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Formalizing Knowledge Creation in Inventive Project Groups

The Malleability of Formal Work Methods[1]

Summary

This paper investigates how participants in cross-functional project groups use a formal work method in their sense making when dealing with the complexity of innovative work, especially in its inventive phase. The empirical basis of the paper is a prospective case study in which three project groups in three different companies are followed as they try to frame and solve their innovation tasks consisting in problems of a relatively general and vague character. The data are analyzed by means of a modified version of the principles of grounded theory. This means that the lessons drawn from the empirical data are guided by a relational sense making perspective in which the formal method used by the participants is seen as a technological artifact. Among the lessons learned by using this frame of reference are that a formal method may be seen as an entity with a meaning depending on the relations it is embedded in; as an enacted cue for interpretation and action; and as a non-human actor. Compared to the tradition of organizational development, these lessons represent an alternative conception of the implementation of a work method and illuminate prevailing notions about the importance of improvisation in innovation.

For many years it has been common wisdom among organizational theorists to claim that organic, or loosely coupled, organizational forms are more effective in innovation while a high degree of formalization, or tight coupling, is more suitable to standard, repetitive work (Mintzberg, 1983; Burns & Stalker, 1961). On the other hand, normative consultants or consultancy oriented researchers have advocated various recipes for innovation, such as Drucker's renowned recipe in his seminal book on "Innovation and Entrepreneurship" (Drucker, 1985). In practice, and in contrast to such recommendations, innovative work, especially in the early phase of concept development, has been observed to be disorganized and privatized, as implied by the term "skunk work". This is usually interpreted as showing that the development of ideas is a matter of a creative individual getting a bright idea (Dansk Industri, 1995). Recently, however, it has been pointed out, for instance by Brown & Eisenhardt (1997), that the proper form of organization for innovative work is not a matter of choosing between no structure or an organic structure versus a tight or highly formalized structure. It has also been emphasized that the creativity of individuals working to create new designs should be 'bounded' as indicated by the concept of disciplined creativity (cf. e.g., Hosking & Morley, 1991).

This paper deals with the issue of how to structure the work process in cross-functional

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project groups in the early phase of the innovation process. The paper develops "grounded lessons" from a case study on how participants use a specific formal method for knowledge work with the declared purpose of coming up with well-founded ideas about qualitatively new product portfolios and new, future business opportunities, that is, with radical innovations. Three groups in three different companies are followed as they try to frame and solve their innovation tasks consisting in problems of a relatively general and vague character. The problem for the group may, for example, be to figure out if and how the company should "go into micro mechanics". Ambiguity and uncertainty characterize the subject matter of the group's work. Moreover, the groups must come to terms with a new way of working that is very unusual to them, and they even have to learn this method while performing their work. Therefore, their situation is also characterized by uncertainty in respect to their work methodology. What is more, launching new types of products within vaguely defined areas may give rise to legal, environmental, and ethical problems. All in all, groups working with radical innovation in that particular way are confronted with an extraordinary high level of uncertainty and ambiguity. The participants' knowledge work may, to a large extent, be seen as coping with complexity and, hence, be conceived of in a sense making perspective (cf. e.g., Weick, 1979; 1995; Daft & Weick, 1984). *In other words, this paper deals with how participants in cross-functional groups make use of a formal work method in their sense making in dealing with the complexity of innovative work, especially in its inventive phase*. The specific empirical research question is; how do the project groups studied handle the new method for doing inventive work, the Cube Method, to be described below?

Theoretical guidelines

In order to create grounded lessons it is necessary to explicate some theoretical guidelines for the analysis of empirical materials. These guidelines are *a way of seeing the empirical materials of the study*. What comes to be seen, the lessons, then depends not only on the empirical data but also on the presented way of seeing.

Guidelines for understanding knowledge creation

Basing this paper on a reformulation of the process of knowledge creation as a process of sense making allows us to emphasize the double aspects of reflection and creation inherent in Weick's concept of sense making. Especially in situations of extreme complexity, knowledge cannot be understood only as a reflection of an existing reality because the act of *making* sense is co-producing what is *sensed* (Weick, 1995, p. 30). Furthermore, there are empirical, pragmatic and fundamental, theoretical reasons for considering sense making as a relational process.

The practice situation of the groups studied, and the rationale for using cross-functional work groups (cf. e.g., Ancona & Caldwell, 1992), is that *together* such *groups of people* have to develop knowledge about the innovation problem presented to them by strategic management. That makes it an appropriate theoretical guideline to conceive of such knowledge work, like knowledge work in groups in general, as a *social affair*. Knowledge cannot be understood as a solitary individual affair, in a brain or a body, because knowledge is "something" that develops between participants. That is "where" it is situated. And due to the different backgrounds of the participants, the sense making process must be understood as a *process of negotiation*. That is why the "where" might be described as an "arena" as Strauss (1993) does. On the

other hand, since knowledge creation has to be relevant to the decision needs of strategic management, it is not possible to consider it as an intersubjective social affair either, that is, as something occurring only between co-present participants. This kind of knowledge creation should somehow be seen in relation to the point of view of strategic management. Thus, once more, the political nature of the sense making process is indicated.

In a more fundamental theoretical respect, sense making may be understood as a relational process in a basically Meadian conception of sense making as a social process (Mead, 1934). Mead's thinking offers a good starting point for overcoming a prevailing dualism in the study of organizational cognition. Much of the existing literature is dominated by a cognitive frame of reference, which deals with organizational cognition and knowledge creation in organizations exclusively as a matter of individual information processing. By contrast, a Meadian point of view offers the possibility of seeing individual thinking as of a social nature while not reducing it to social processes or structures. According to Mead, no special subjective world exists apart from an external world. Mental phenomena are aspects of individual actions that are parts of systems of action, a social process, and a community. It is of special relevance for the problem of sense making that language is not considered as thoughts expressed in an external situation. Meanings develop through reciprocal cooperation between members of groups, communities, or societies by means of symbols and signs.

In relation to sense making and meaning the Meadian point of view implies that the process of sense making unfolds in reciprocal interaction between members of a social field by means of symbols. There is a close connection between organizing and sense making. This point is taken up by Karl E. Weick in his (1979) seminal book on the social psychology of organizing, based on the fundamental principle that organizing *is* a reduction of equivocality (Weick, 1979), and more specifically in his Mann Goulch article (Weick, 1993).

So far we linked sense making to social processes, to what happens between *people* working together. But people working together are dealing with something, a task, an object of their sense making using various tools, and their work practice is formed by and (re)produces a structure. According to common wisdom, tools are means for realizing preconceived goals. Tools seem to play no significant role in creating a human understanding of the world, that is, in sense making. But actor network theory implies such a role seeing artifacts as so-called non-human actors. People are not the only actors involved in sense making because non-human actors (cf. e.g., Latour, 1998; 1991) are understood as subjects taking part, for instance as allies, in negotiation processes in networks. This way of thinking implies that the Cube Method, seen as a technology, has an active role to play in the sense making process more or less equal to the role of humans taking part in the process. Actor network theory makes an important contribution to the position adopted in this paper by underscoring the political perspective on sense making. According to this theory, to promote their way of making sense of a situation in serving their interests, humans may use artifacts such as scientific "findings", models, procedures, and rules. The Meadian conception neglects this political dimension.

Artifacts, tools, technologies etc. may be used for sense making purposes because they not only have an executive function in relation to human purposes. In using them, we also obtain feedback from the objects they are used on. In digging my garden with a spade, I may want to realize an intention of preparing the garden. But, at the same time, by digging I obtain information about the conditions of the soil. We might say that the spade 'decides'

what information I may get. But, the spade does not 'decide' by itself. Its role in sense making is contingent on the specific configuration of human and non-human actors (Suchman, 2001, p. 4).

The Cube Method

The Cube Method is designed to improve the knowledge creating work in the early inventive phase of the innovation process. The presentation of the Cube Method is sketched below and spelled out in detail in the Ph.D. dissertation of the constructor of the model, Henrik Herlau, associate professor at the Copenhagen Business School (cf. Herlau, 1995; Darsø, 2000). The author of this paper had no role in the development of the method, nor did he take an active role in trying to implement it.

The Cube Method may be seen as a technology for doing knowledge work. This is in accordance with the constructor's exposition of the method. He does not simply see it as a set of tools, but also as a theory of what constitutes the inventive phase of the innovation process and of how this process should be dealt with. In other words, the Cube Method is *techné*, that is, useful skills and knowledge ("know how") applied to systematic knowledge development in the inventive phase of the innovation process. But the Cube Method is also a *logos* for inventive work, that is, systematized and formalized knowledge about how to make inventions, focusing on the inventive phase, as well as a theory of what invention and innovation is. So, like any other complex work method, the Cube Method is to be understood as a technology in a modernist understanding of technology, i.e., as a series of elements, artifacts, procedures and a theory which are tightly coupled (cf. e.g. Hatch, 1997, p. 128).

The theory of the Cube Method

The theory inscribed in the artifacts of the method and seen as a guideline for activities distinguishes between the inventive phase called the preject phase, in which objectives and goals are searched, and the project phase of the innovation in which an innovation, e.g. a new prototype, is created. The Cube Method deals with the inventive phase of the innovation process. It is claimed to create a way of organizing knowledge work in this phase that places it between a network form of doing innovation and the traditional form of project work. In the traditional form of project work, people work within a retrospective perspective and in a convergent way focusing their efforts instrumentally on reaching an already formulated goal. Moreover, here knowledge work means working with explicit knowledge following explicit rules. This mode of working characterizes the formal organization. By contrast, the network mode of working is characterized by accidental contacts and is oriented towards the here-and-now situation. Spontaneity and implicit knowledge dominate. The network mode of working represents divergent thinking in which goal seeking and problem framing prevail rather than goal realizing and problem solving. The network form is associated with the informal organization. It is intended with the Cube Method to create a bridge between formal and informal ways of organizing innovation work accepting certain aspects of both ways of organizing while rejecting others. Key characteristics of the Cube mode are divergent thinking, systematization, explicit knowledge, strategic consciousness, and transparency by following explicit rules. With the Cube Method, by using a divergent way of working people have to search areas of strategic interest systematically in order to create explicitly formulated and stored knowledge as a basis for deciding which problems or goals should be pursued in the following project phase of the innovation process. Due to the complexity of the situation, the work should be done in a very transparent way, and two members of the groups should lead the

group work, one focusing on task leadership, the other on processes. Both group leaders are ordinary members of the groups serving as temporary leaders.

Procedures and objects of the Cube Method

The cross-functional project group is claimed to be the proper organizational form for the intersection of formal and informal organizing. Its format is plenum work in which a problem is presented and discussed and conclusions drawn about which tasks individuals or small groups are to deal with until the next plenum meeting.

The Cube Method contains a very large toolbox of procedures, rules and artifacts to be used to structure the group work in the plenum sessions. In some of the early versions of the Cube Method, the constructor of the method compared the group process with the playing of dice. He deliberately chose the name Cube Method to refer to a dice with six sides. The numbers on the sides of the dice refer to fields of discussion, called arenas, which the group should deal with in their knowledge generating process. Arena 1 consists of open questions and refers to the situations and issues which the members of the groups do not know anything in particular about but where knowledge may be obtained by asking open questions about 'why' and 'how'. Arena 2 is information in journals, books and electronic devices, such as the Internet, i.e. information external to the groups. Arena 3 refers to the project groups themselves, i.e. their members and their knowledge. Arena 4 refers to the network contacts of the group members. Arena 5 deals with the management of time and resources, and arena 6 is about keeping track of accumulated common knowledge in the process.

So, in way, the group process is like playing with a dice since, by throwing the dice, different numbers will come up telling that the group members have to deal with a certain arena. But unlike the playing of dice, the 'Cube game' does not consist in a random moving from one arena to the other. The playing of the game of creating knowledge is governed by certain rules:

The project leader selects two persons to be group leader by turns for a given meeting. They are charged with securing an encompassing working through of the different arenas and with the responsibility for keeping track of the process by taking the minutes of the meetings, which will be stored in the IT-system of the Cube Method. A main reason for this rotating leadership is to make people accept that the process has to be directed.

The two group leaders deal with two different sets of arenas. The so-called green leader is responsible for directing the discussion in arena 1, 2 and 3, and the so-called red group leader is responsible for directing the discussion in arena 4, 5 and 6. The constructor of the Cube Method conceives the method as a dynamic agenda. It must be respected as a traditional agenda in order to focus the attention of group members and to prevent people from jumping from one topic to another. Shifts from one arena to another should be made explicitly.

The two group leaders should follow some guidelines for discussion. Among the most of important of these are that members should be very explicit about what the believe they know, should feel safe to reveal what they do not know, should give evidence for what they believe they know, and everybody should have a fair chance of contributing. The groups should tolerate the uncertainty inherent in exploring different fields in a divergent way searching for goals instead of searching for means to solve preconceived goals. It is an important imperative to suspend a premature jumping to conclusions about what the innovation goals and concepts should be.

Altogether, the Arena model is a means to regulate group discussion in such a way as to secure that areas of potential new information

and knowledge are dealt with systematically. It is emphasized that one should keep track of what is known as well as of what is not known and, hence, should be pursued by raising questions in relation to potential knowledge in the group and external networks.

Another technique for directing the work is the template of the Cube IT. This is a data base program for systematically registering the process from the very beginning. It registers information about the background of the given project; the point of departure of the process in the form of information about the strategic management's presentation of the task for the group; minutes of the meeting (made by the red and the green leader); the social codex of the group; information from external sources; the strategy and the delegated tasks from one meeting to the next. The structure of the IT template prescribes the work process very closely step by step. At the same time it must function as a memory of the group and the company.

Low tech tools are also used. Thus, the use of a knowledge tree serves as a way of picturing accumulated knowledge and of keeping track of the process by focusing attention on how to search for ways of obtaining information and develop knowledge systematically.

Thus, the Cube Method consists of many tools and rules for developing knowledge. But it is not just an instrument of problem definition and solution. It is also a way of regulating the interaction between members. These tools are an example of group ware claimed to be typical of organizational forms emphasizing collective endeavors in solving novel problems (Blackler, Crump & McDonald, 1998, p. 73). At the same time as being tools directed towards the object of the work, they, in fact, prescribe a formal structure for the interaction between the participants. Norms of equality and rationality and rules for how to locate, explicate and store explicit knowledge tested in an open group discussion are claimed to be distinguishing features of the Cube Method.

The Cube Method may be seen as part of a long tradition going back to Frederick Taylor's attempt to abolish spontaneous work group behavior by prescribing presumably effective ways of conducting work. The constructor seeks to reduce informal, spontaneous behavior. In the discourse of the constructor, the informal is subsumed into the formal by prescribing ways of participation as well as excluded through reification by using artifacts, especially the Cube IT system.

As we shall see later in the section on improvisation, innovation does not imply a contradiction between the informal and the formal. In improvisation informal participation is increased at the same time as the formal retains an important role.

Method

The empirical grounding for this paper consists in data collected from a development project called "Management of Innovation" (Herlau, Prahl & Nordlund, in prep.). This project was initiated by the Danish Confederation of Industry (DI) in early 1997. DI viewed its task as supporting the efforts of companies to improve their capacity to develop knowledge intensive innovation. Some of the consultants in the organization believed that the Cube Method was worth a try. A project organization was established consisting of the constructor of the method and his assistant as well as consultants from DI. The author of this paper was asked to join the project group because DI wanted to have a neutral outside observer in the project so that the experiences with the method could be evaluated scientifically as they put it.

Research strategy

Because the project was primarily conceived of as a development project, it was not possible to plan and implement a very controlled and well-ordered design and data collection. The author's primary way of collecting data was to hang out and follow what happened in the

project groups working with innovation. In that situation a research strategy emerged with similarity to what Schein (1987) called the clinical research method. This method deals with how consultants may do research while they try to help organizations improving. In that situation the problems of the client to a very large extent influences how the processes unfold and the kind of data that might be collected. This was also so in our study. As Schein pointed out, this type of research strategy is not suitable to test hypotheses or generate theses inductively from a detached theoretical standpoint. Its force is to offer an opportunity to develop theoretical ideas and theoretical deliberations about processes normally not accessible for researchers due to their sensitive character.

Design

Methodologically speaking, the study is a modified case study design as described by Yin (1994) because it was not possible to guide the selection of cases by strategic, theoretical considerations in order to secure important, theoretical variations. This is, in part, due to the fact that it was difficult to find companies that could participate because we wanted to include companies just about to start an innovation process of a type they were not used to handle. Only three companies did take part in the project. The selected case companies, however, did turn out to represent theoretically interesting categories such as high-tech and low-tech companies. The two high-tech companies, here called Transmit and Measurement, have a long history of doing technological innovations. The third company, Electric, had a short history of doing innovation. It had been protected until recently by barriers of import but was now faced with the dilemma of outsourcing or of making innovations allowing prices matching the salaries of Danish workers. In spite of these differences, all three companies faced the same situation, namely to engage in radical innovation, i.e. innovations based on qualitatively new product or business concepts, for which they had little or no prior experience.

As pointed out above, the research project is a kind of clinical research project because it was the interest of the participating companies to improve their innovation processes rather than to collect research data. The research data are, therefore, to a large extent a spin-off of developmental processes. The project group divided so that one researcher adopted the role of a distant ethnographic researcher (the author of this paper) and the other two (one of whom is the constructor of the Cube Method) adopted the role of (researcher) consultants.

Data collection

The three case companies were studied for two years in 1997 and 1998. The empirical materials consist of documents describing innovation methods, strategy, organization structure etc., discussions and interviews with managers and members of the project group, and observations of group discussions. This paper is primarily based on data from the group observations.

Three project groups in three different companies were observed from beginning to end of their work on the task of developing an innovation concept. The author observed 22 meetings, normally of 2 to 3 hours. One meeting lasted for half a day and another for one and a half-day.

This close following of the events as they took place makes the study a prospective study since group processes are observed while they take place in real time. That gives us an opportunity to see how complex negotiating processes unfold which is of crucial importance for the relational process orientation of this paper. The data collection is supported by no guiding hypotheses and yet not unsystematic. On the contrary, it is systematic in the same sense as the field work of anthropologists collecting data systematically on what happens around them (cf. e.g. Judd, Smith & Kidder, 1991).

One consequence of the method used is that we only have little information about what took place between the meetings. This is a serious drawback since we have the impression that much of the politics took place outside the meetings.

Data analysis

The collected data are first sorted out according to an ecological model of group processes in organizations (cf. e.g., Hackman, 1987; Sundstrom, DeMeuse & Futrell, 1990; West & Anderson, 1996) in order to get an overview over the materials. This model summarizes much group research focusing on the interrelations between group processes, on the interface between groups and the organization, and on features of the organization.

The materials thus sorted out are analyzed using a modified version of grounded theory (Glasser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1990). Many types of data are gathered pertaining to group processes and other organizational issues. As to the data on group processes, the method of grounded theory analysis is modified in two respects. Firstly, the analysis is guided by the relational sense making frame of reference described above. Secondly, the coding strategy is not to code microscopically, but – inspired by Harré & Secord (1972) and Harré (1972) – to code interaction episodes, "for we never experience nor form judgment about objects and events in isolation, but only in connection with a contextual whole" (Dewey, 1938, p. 67). The materials from discussions in the cross-functional project groups have, therefore, been analyzed to identify separate sequences of interactions, constituting meaningful parts of the group process, as "units" to be coded.

The analyses and interpretations of the empirical materials focused on different themes. In Döpping & Prahl (1999) and Prahl (2001) parts of the materials were used to elucidate the importance of organizational identity as a boundary object. In this paper the empirical materials are approached so as to say something about formalizing.

Conclusion

In many ways there is a weak empirical basis for this. The number of cases is small, their selection has not been guided by strategic theoretical considerations, and the whole process was guided by consultancy concerns rather than theoretical and methodological concerns. But, in dealing with issues of vital strategic interests, this is perhaps what one should expect.

Empirical results

Our empirical study generated many data. In the following only data of immediate relevance to the issues of this paper will be presented – and that in a selective and illustrative way.

The implementation of the intervention

The consultants' efforts to implement the Cube Method varied from one case company to another, probably reflecting specific organizational circumstances, e.g. the compatibility of former work habits and organizational culture to the Cube way of thinking.

The data show that introducing the Cube way of thinking and its procedures was a quite complicated affair. Thus, the consultants used several ways of communicating and promoting the knowledge about the method and its procedures. They also employed various roles and forms of consultancy to support the process during the project.

Many forms of teaching were employed ranging from traditional one-way teaching over demonstration of and instruction in the procedures to supporting learning-in-practice.

As to forms of consultancy the consultants acted in ways compatible with process consultation and expert forms of coaching in relation to the specific use of Cube procedures and broader organizational issues.

Finally, the consultants, especially the constructor of the method, acted as a personal and professional sparring partner. He gave personal advice based on his experiences with other groups working with the Cube method. He also gave professional advice on technical matters due to his background as an engineer.

So, it was not easy for the consultants to have the participants learn and use the procedures of the method in a way that the consultants considered to be correct. This 'problem' will be interpreted below in a way that transcends the mode of thinking about implementation in the literature on "organizational development".

The attitude towards and understanding of the Cube Method

The participants' attitudes towards the Cube Method vary a lot. Variations in attitudes and understandings are what is most characteristic of the participants.

At the beginning, the attitudes towards trying out the Cube method are mostly favorable though some people are not quite certain what is going to be tried out. The reasons for a favorable attitude differ. Some participants, especially managers, see the Cube Method as an opportunity to get help to develop a more systematized and documented innovation process. Others see the use of the method as a means to get an opportunity to work with interesting and challenging technical projects. A few participants, however, are reluctant towards the method preferring to work with short-term product modifications. The chief consultant, who constructed the Cube Method, is eager to demonstrate the value of his method. During the course of the project there are at times conflicts between people from different departments, and at times between the chief consultant and the project groups, on issues about the proper use of the method.

Dissimilarity also characterizes the attitudes and understandings at the end of the project. On the one hand, the Cube Method is seen as a good instrument for innovation work because it supports the process in a systematic way and seems to produce interesting product ideas. On the other hand, some participants think that the use of the method is very time consuming. It is also said that the use of the method entails a lack of structure to the innovation process. They miss a recipe for which innovation issues to deal with through a sequence of time with fixed deadlines. A third critique is that the management of the process is too tight. Finally, even far into the course of the project a few participants are uncertain as to what the method is all about and what the essential differences are between the traditional project model and the Cube model. In Electric the following remark is heard, "What's the difference between preject and project? Maybe, I should have asked this question somewhat earlier?"

So, it is variable and varied what the Cube Method means to the participants. This finding will serve as an important point-of-departure for the theoretical discussion below.

The participants' understandings of the task of the group

The Cube Method deals with radical innovation, which means that the projects group should work with far-reaching product and business opportunities rather than with specific product ideas to be realized in the nearest future. In Measurement the strategic management presents the object of the project group as, "Should Measurement go into micro mechanics in the future?" Accordingly, at the beginning of the process the groups understand that they have to work with a task far beyond what is usual in groups of product development. Uncertainty and ambiguity characterize this situation. As the project leader in Transmit puts it, "In this project we are dealing with a situation where no customer has yet arrived due to the time horizon of the project. The

problem is to figure out which situation the customer will be in. We are moving on thin ice, in unknown terrain."

The participants' understandings of their point-of-departure were very much discussed. All groups discussed to what extent they could exclude working with more specific product concepts. Another issue was which degree of autonomy the group possessed. A third issue was how to frame more precisely the assignment given by the strategic management.

In the course of the project, the groups at times worked with strategic issues and at other times with specific product ideas. There were also attempts to bridge the tension between working with specific product ideas and strategic issues. At times, the members strongly disagreed on these matters. But, as the deadline of the project came closer, the groups increasingly used their time to work in a more traditional product development way. Time pressure, and so-called signals from the strategic management, seemed to play a significant role in this respect.

So, equivocality and uncertainty mark the work situation. The understanding of the innovation task is not a stable entity with a fixed meaning for all. Furthermore, the understanding of the task often moves in the direction of traditional product modification tasks due to the experience of signals from strategic management and to influence from some of the other participants preferring to work with such tasks. In this situation the group does not work with tasks which the Cube Method was developed to deal with. In the discussion below, this finding will be used to discuss the systemic interplay between tasks and methods understood as forms of organizing.

The participants' use of the Cube method

One of the most general observations is that the groups in all three companies at times use specific Cube techniques and procedures. In all three case companies the technique for leading meetings by means of green and red leadership roles is appealing. It is something the group participants want to try out. But the data show that it was difficult to practice the green leadership role, probably because it deviates more from the common understanding of how a leadership role is to be practiced. Leaders seem not to be conceived as people who act in a divergent cognitive mode asking questions! Especially the formal project leaders of the groups failed to live up to the Cube Method's prescription for acting in an exploratory, divergent way in attempting to practice the "green" role.

Another general observation is that there was pronounced differences between the case companies as to how often and how well they practiced the Cube techniques and procedures. They were practiced most in Electric, the company in which the consultants, as a result of their experiences with the two other companies, used very much time to implement the Cube Method.

The statement that all of the companies at times practiced the Cube procedures and techniques must be qualified. Often they did not do this by themselves but in cooperation with the consultants guiding the application of the procedures. Furthermore, the data show that sometimes the participants work with the tools and techniques in a way intended by the Cube Model, but often they do not. Sometimes they talk about the invention in the Cube way, but at the same time use methods, e.g. the brainstorm method, which conflict with the idea of a systematic creation of knowledge. On the other hand, sometimes they use specific methods, e.g. the SWOT analysis that does not exist in the Cube tool box, in a way that is in accordance with the Cube thinking. In one of the case companies, Transmit, the chief consultant together with the project management tried out a familiar meeting technique to express the Cube Method. In this case company the Cube Method was made part of a model for discus-

sion in large groups, namely the annual general meeting method. Here the work alternated between small groups and plenum discussions. The small groups worked on different kinds of future user situations inspired by the Cube Method. Following that, the results of the work were discussed in plenum on the basis of a pre-established agenda format.

An analysis of *how* the groups work with the Cube Method shows that the groups oscillate on a series of dimensions. Only a few of these oscillations will be reviewed here.

Firstly, the groups oscillate between working in the demanded divergent way and the traditional convergent project way. At times, as tensions amount among the participants, the group may go back to the well-known project model. The project leader in Transmit indicates this by saying, "We are not used to work in such a nerve-wrecking way. We don't feel safe. So we go back to the well known." Time pressures and expectations from top management seem to push towards traditional methods of project work.

Secondly, the group process oscillates between being governed by the members themselves or by the formal project leader. According to the norms of the Cube Method, the groups must be headed in a way that furthers transparency and equality. The data show that it is difficult for the project leader to find a proper role. In Electric he plays a rather traditional group leader role. In Transmit he oscillates between behaving in even an autocratic fashion and a laissez-faire fashion. In Measurement for very long periods the formal project leader abdicates from a role as leader altogether.

Thirdly, the process oscillates between a cognitive work process, in which ideas of how to locate relevant information, questions and tasks are discussed, and a political bargaining process. The Cube Method insists that the work process should pass as a disinterested process of developing and creating knowledge. But there are many instances of political processes. The groups discuss how they can manage the strategic management in order to be able to work with interesting projects. Project leaders try to find acceptable political compromises between the interests of the different actors. Between meetings project leaders may negotiate with dominating members of the groups and present compromises as new problem framings. Couched in other terms, the groups oscillated between working in a problem solving way and problem bargaining way.

So, these findings show that the Cube Method is a changeable phenomenon. But they also show that the modernist idea of a tight coupling between the elements of a method may be questionable – a finding which will be elaborated in the following discussion.

The structuring of the work process

As mentioned above, the Cube Method is to be seen as a method for organizing. According to the Cube Method, we should have seen meetings in which the presentation of a problem was followed by a systematic, disciplined, thematically focused and transparent discussion explicating knowledge and leading to a rationally founded conclusion which might give rise to new tasks.

The data analysis of the episodes of the group work process distinguishes between three degrees of structure. The most structured episodes come close to the formal structure of the Cube Method. The partly structured episodes deviate from the well-structured. They may be sequences characterized by mixing up or skipping issues of the agenda and/or taking no minutes. They may also be sequences ending without a conclusion and/or decision about what to do next or sequences ending with a conclusion that does not follow from what was investigated but is imposed by the project manager. The episodes that deviate the most from the formal structure of the Cube Method are the so-called anarchic episodes, strongly marked

by a lack of structure and order. These episodes are characterized by tendencies of dissolution. People may sit in small subgroups talking to each other, making fun, or there may be confusion as to the delegation of tasks, and some people may leave before the meeting ended because it went on beyond its time limit.

The analysis of the episodes shows that a substantial number of episodes are partly structured. For Transmit and Measurement the majority of episodes are partly structured, for Electric the distribution is fifty-fifty. Even anarchic episodes are seen in a substantial number of cases.

There are indications in the data materials that the structure of the episodes is influenced by the implementation efforts of the consultant, by difficulties in playing the role of green leader and by conflicts among the participants.

So, the Cube Method, conceived as a way of organizing, is difficult to realize in this study. The discussion section of this paper considers alternative ways of interpreting this finding.

Grounded lessons and theoretical discussions

Now it is time to discuss the grounded lessons from the empirical materials. Since this is a limited case study, these lessons should be understood as hypotheses for further studies. The empirical study should only be seen as generating ideas.

There seems to be more grounded lessons to learn from the empirical materials when they are seen in a relational sense making perspective. First of all, the results of intervening in the work of the project groups with a formal work method are ambiguous. That is documented by the participants' diverse understandings of the method, the variability and changes of the content of the method during the process, the conflicts and compromises, and so forth. A complex negotiation process turns the definition of the work and the understanding of the work methods into a changeable, many-sided construction. In the following, we attempt to disentangle this complex negotiation process.

Formal work methods as changeable elements in a social system

First of all, the empirical data show that the meaning of the work method is highly changeable. That is illustrated by the occurrence of a reciprocal relation between the construction of the innovation task and the conception of the work method in use. When the task is moving in the direction of becoming a short-term product modification task, the use of the work method or the understanding of it is moving in the direction of a traditional model of project work or of seeing it as an irrelevant method that may be discarded. It is, therefore, useful to adopt a systemic conception of how a formal method is understood and used.

As mentioned above, the Cube Method is meant to be a method for organizing work by facilitating participants' efforts to structure a highly complex situation. By using the Cube Method, participants are supposed to be able to work systematically to create knowledge, that is, to solve the puzzle of not knowing what should be known. This situation represents an extreme version of a Weickian relation between organizing and reduction of equivocality. Accordingly, the consultants seek to accomplish that the participants use the Cube Method as "a consensually validated grammar for reducing equivocality by means of sensibly interlocked behaviors" (1979, p. 3). We can see what this means in Weick's model of organizing:

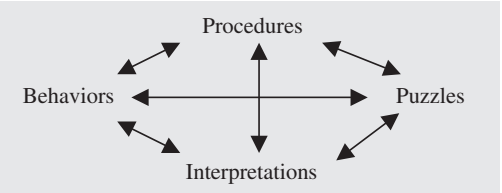

Fig. 1 (Weick, 1979, p. 4)

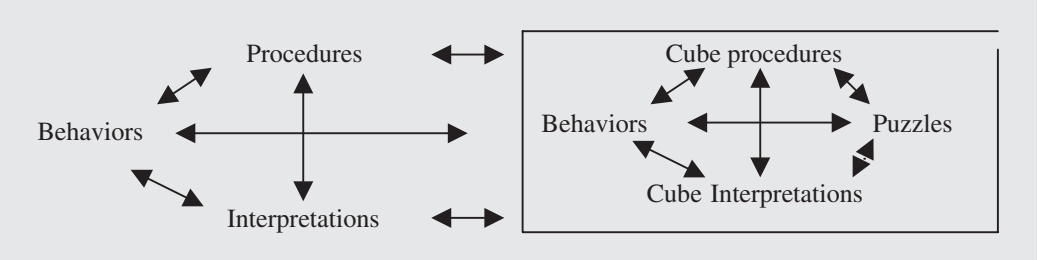

Fig. 2

Our notion of a work method as a technology fits well with Weick's notion that "organizing is like a grammar" (1979, p. 3), if we disregard for the moment that technology also includes material artifacts. As a grammar, the Cube Model refers to what is called procedures and interpretations in figure 1. The model describes a series of interdependencies, which imply that a work method with a given name does not have a fixed meaning. The conceptual implication of the many interdependent relations between the method, the behaviors and the puzzle is that a formal method is not constituted by a fixed meaning, for instance, the one inscribed by its constructor. Relations are important here, not entities. What matters for the interpretations and uses of the method, is the set of interdependent social relations "it" is embedded in.

But we must complicate the model of organizing further to match our empirical findings more fully. In the situation we studied, the participants do not only deal with one set of puzzles, the innovation task. They must deal with two sets of puzzles since they also face the challenge of learning and using the Cube Method. Fundamentally, their problem is how to realize figure 1, so to speak. *Organizing is the puzzle*. This means that, as they try to solve the innovation puzzle, they must replace whatever procedures and interpretations they used before. The consultants demand that the participants build an organization in which the adopted procedures and interpretations are those of the Cube Method. In fact, through instruction, training, coaching, trial-and-error, and so forth they seek to establish an organization in which the model in the rectangle in figure 2 is the puzzle:

This doubling of Weick's model makes us see that two systems with two conflicting ways of organizing are creating very complex ways of organizing. We must even add to this picture that the groups are operating under time pressure in a confusing situation. As shown in Weick's study (1993) of the behavior of fire jumpers at the catastrophic fire in Mann Goulch valley, severe stress situations may lead to a breakdown of a well-established and appropriate role structure (i.e., their method of working together in coping with fire). In our study, the appropriate ways of coping with the puzzles are not well learned but have to be learned while the participants struggle to cope with the innovation puzzle. That is why, as mentioned earlier, we in fact see tendencies towards anomie, a disintegration of the structure of the social group process. Because of that, at times the methods do not make sense and hence cannot be used to reduce equivocality, i.e. to handle the complex task of invention, and this may lead to even higher levels of confusion. A way of avoiding this is to discard the Cube Method and re-use old work habits. That may be the reasons why the participants oscillate between traditional, convergent methods and new, divergent ways

of working and between well-structured episodes and episodes of anarchy. The lessons to be learned from this may be that the application of a formal method is not a matter of implementing a method with a fixed meaning, as its constructor believed. Especially in radical innovation projects characterized by high levels of equivocality, formal methods lose their claimed unequivocality. This changeable character of new formal methods may be understood within the sense making perspective when we realize that more than one social system is operating simultaneously.

On the face of it, the model of organizing used above has a traditional realist flavor by showing causal relations between entities. It mediates a picture where primarily the social relations which the elements are related to determine their meaning or effect. This implies that it should be possible to decipher meanings as thing-like entities *determined* by nets of relations. However, looking more closely at how Weick conceives the process of reduction of equivocality, we see that in organizing their work the actors are actively *constructing* the objects of their actions. A formal work method, as the Cube Method, is not 'given' to the participants. It is a set of enacted cues for interpretation and action.

Formal work methods as enacted cues for interpretation and action

The data on how the participants understand the Cube Method make it clear that they do not select for attention what the chief consultant would like them to. The meaning participants ascribe to the work method is a result of their pre-conceived notions of what they will see as much as of the inputs 'given' during the process, such as the consultants' presentation of the method, the instruments used, and the IT of the method. Hence, making sense of the work method must be seen in relation to the participants' repositories of ideas, concepts and knowledge about how they are to work with the inventive phase of the innovation.

This lesson may be generalized by means of Weick's evolutionary metaphor of organizing. The Cube Method is a case of high equivocality since it is new and, at some points in time, contradictory to their usual ways of doing project work. According to Weick, the reduction of equivocality may be described by the following formula:

The participants are confronted with unusual changes in their work situation. They join a project group together with people they do not know, they are confronted with a consultant who seems to have important but strange ideas about what they should do, and signals from top management are confusing. They are, in other words, confronted with what could be called a 'mess' in the model of 'ecological changes'. By noticing what is happening and by taking actions, e.g., by trying to do what they believe the consultant and the project group leader tell them to, they single out or configure parts of the mess as cues for sense making. What they are making sense of informs and is informed by their retention of what they believe to be taking place. How they

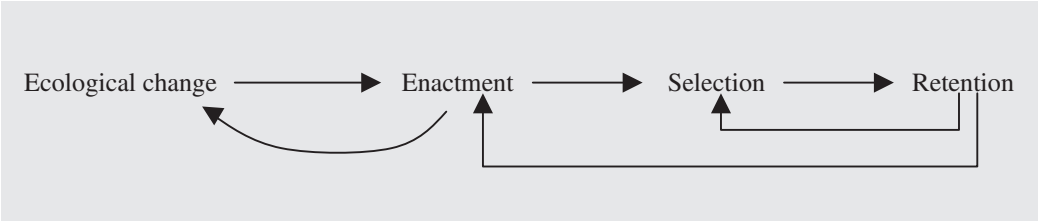

Fig. 3 (adapted from Weick, 1979, p. 132.)

make sense of what is enacted also influences and is influenced by their retention.

The importance of retention is illuminated in several ways in our empirical study. As mentioned earlier, at times a drift occurs towards using the Cube Method in accordance with the traditional model of project work. This tells us two things: First, the cognitive map of the traditional model of project work influences what is selected for attention from the 'mess'. Second, the causal maps of the model of project work are then imposed on the cues they attend to.

Our data also mediate the lesson that retention cannot remain the same as the process continues. The balance changes between the importance of inputs and retention due to the consultants' massive attempts at influencing the process. At times, it will be difficult to see what is happening as an expression of the old project model. At least some participants come to believe in the Cube Method and they will come to see what they are doing as Cube behavior. This occurs at times in our study. But sometimes it occurs in a way that – to an outside observer – involves a discrepancy between what is done and what is interpreted retrospectively.

As mentioned above, at times participants do not succeed in making sense of what is happening. This may be seen as a symptom of the heterogeneous and conflicting character of retention. For one thing, as the process continues, participants assimilate aspects of the new method deviating more or less from their preconceptions which, therefore, come under pressure. Secondly, cross-functional project groups may represent different and sometimes conflicting outlooks (cf. Döpping & Prahl, 1999; Prahl, 2001). A further lesson, therefore, may be that we should expect a loose coupling between interpretations and procedures and tendencies towards confusion in cross-functional groups working with a new formal method in highly complex innovation situations.

Weick (1979, chapter 5) claims that a residual equivocality remains after individual attempts at superimposing conceptions on what is happening. Reduction of equivocality is, hence, "both a social and a solitary process" (p. 142). This means that a negotiation process is going on. In Weick's examples this negotiation leads to an increasing overlap between the maps individuals retain and, in turn, to a way of dealing with equivocality as a consensually validated grammar. "Having consensually made the enacted environment more sensible, the members then store their revised and presumably more homogeneous cause maps for imposition on future similar circumstances" (ibid., p.143). But cross-functional groups may be characterized by more instability than the picture Weick draws of how, for instance, a jazz orchestra evolves common schemes of interpretation. It may be difficult to apply his conception of organizing as a consensually validated grammar in dealing with temporary, cross-functional project groups. Such groups may be only minimally organized, and formal methods, or at least new culturally unfamiliar procedures, may not gain a role similar to the role of the theory of chords in jazz. They may rather at times contribute to a destabilization. This critique has to do with that Weick's theory is a process theory focusing on the *how* and not on the *what* at the micro-level of social psychological analysis.

A further point may be difficult to understand from Weick's perspective, namely, the common tendency to assimilate the Cube model to the traditional model of project work or to replace the one by the other. This has to do with that his model is a primarily individual psychological model. Participants are seen as arriving at the arena of sense making with different schemes of interpretation and each as trying to solve the puzzles of equivocality by superimposing and modifying schemes of interpretation. Because they cannot completely reduce equivocality individually, they have to

accommodate to each other's schemes of interpretation. Only in this way is the process seen as more than merely a cognitive process. But this understanding of social process is not in accordance with the understanding presented in the beginning of this paper. Here we claimed that dealing with equivocality should be seen as part of a social or societal process giving meaning to individual acts of reduction of equivocality. We, therefore, should look for a common grounding of the sense making process. And as far as the tendency to use the project model is concerned, this common grounding may be the widespread conception of instrumental rationality in Western societies as described, for instance, by Schön (1983) and March (1991).

A further lesson does not follow directly from the sense making perspective but fits with it all the same. It may be drawn from our data on the dissolution of the work method into procedures and interpretations not fitting with each other. In the introductory section, the work method as a technology was conceived as a set of objects, procedures, and interpretations. But, as shown earlier, the data suggest that the coupling between these elements should not be conceived as a tight coupling. This fits with Suchman's (1987) observation that people spontaneously construct interpretations of technologies as they interact with them. People may combine the elements of objects and procedures by means of a theory in ways the constructor did not intend. Or they may express a theory of a method by means of other procedures or objects than the constructor intended.

So far we have seen the sense making process as a social and cognitive process. The political dimension was, thereby, insufficiently exploited. That is unfortunate. In our study different participants pursue different projects. Their conceptions of the character of the innovative work are an issue of conflict. Should they work on a long-range innovation or on a short-term innovation? Is it possible to combine these two forms of innovation? All the actors, including the strategic management and the chief consultant, were at times in conflict over these issues. Hence, the reduction of equivocality cannot be understood only as a process of negotiating a reduction of equivocality by establishing an overlap or common schemes of interpretation. It is also a process of negotiation understood as a bargaining process between the participants as political actors. Consequently, the definition of the work and the understanding of the work methods become a changeable multi-voiced construction through a complex process of negotiation. For example, the project leader creates a synthesis between what he perceives to be the points of view of strategic management and different opinions in the groups – and this synthesis changes over time with time pressures, new signals from the top, feedback from the consultants, failures of progress, etc. The lack of political analysis in Weick's sense making perspective may be due to its systemic bias. In the following we shall compensate for this by looking at the actor network perspective.

Formal work methods as non-human actors

As an artifact the Cube Method is a non-human actor in the actor network perspective. As such it should play an active role in the process because agency is understood as not locatable in either humans or non-humans but as a relational effect generated in different configurations of human and non-human materials (Suchman, 2001, p. 4). In the following we shall use a few, well-known actor network case studies to stimulate the discussion of the political perspective combined with an attempt to understand work methods as technologies.

Suchman's formula allows non-humans to play an active role because activities are seen as distributed among humans and non-humans in various ways. Latour (1988) illustrated this point by using the concept of delegation in his

article on the sociology of the door closer. A door closer performs activities humans otherwise would have to perform – and less costly – making the transition from the outside to the inside of a building more expedient. This is, indeed, what the Cube Method intends. It must make work more efficient. Especially its IT software must systematize and restore information fixing the process unequivocally. Just as in the case of the door closer, a division of labor between the human and non-human actors is to be achieved. It succeeds in the case of the door closer. A small push, the door opens and then slowly closes again. But the Cube Method does not function that well. Or we may say that the communication between the actors and the technology is at times poor and at other times better. Such a problematic situation has been noticed for several years in the literature on human-machine interaction. Concerning artificial intelligence this problem of communication has been formulated as "how two entities (or objects or nodes) with two different and irreconcilable epistemologies [can] operate?" (Star, 1989).

Considering the Cube Method, we may hypothesize that we are to some extent dealing with such two irreconcilable epistemologies creating 'communication problems'. This is due to the assumptions taken for granted in the method about innovation being a matter of identifying and developing explicit, encoded knowledge (Blackler, 1995). Still, as pointed out among others by Nonaka (1991), innovation work not only consists in working with explicit knowledge but also with implicit knowledge by means of metaphors and analogies. The requirements of the Cube Method, however, almost ban the use of metaphors and implicit knowledge to synthesize meaning although that is so important for the inventive phase of the innovation process. Thus, we may expect the Cube Method to act as a barrier at times when it is necessary for the group to work with metaphors and analogies. At other times it may be useful to work with explicit knowledge, for instance, when the group has to summarize its findings and present its results to strategic management. In the latter situation, the group should be able to articulate its knowledge in an explicit form, generalizable across the boundary between them and the group of strategic management. Hence, it is a grounded lesson from our study that a formal method for innovative work may be useful in some phases of the work but not in others.

In order to see the political aspects more clearly, let us look at what happens from the point of view of the chief consultant. His predominant interest is to demonstrate that it is worth following his method and his theoretical understanding of the inventive phase of the innovation process. As shown earlier, he and the other consultant use many methods to make the participants follow the prescriptions of the Cube Method, such as training, coaching, teaching, and persuasion. We may compare him to the hotel owner in Latour's (1991) hypothetical story about how to make the guests hand in the keys when leaving the hotel. The hotel owner's problem is that guests often take the keys with them when leaving the hotel with the risk of losing them. To begin with, the hotel owner politely asks the guests to hand in their keys though mostly in vain. Then he makes big posters telling the guests to hand in the keys before leaving the hotel, almost also in vain though not as much. Finally, he attaches heavy pieces of metal to the keys and thereby succeeds in having more keys left in the hotel.

In general terms, this story tells us that a manager may add voice to his understanding of a situation and promote his interests by using a series of actors, among these non-human actors, as allies. In our story, the chief consultant basically tries to achieve the same result in the same way. The association of the Cube Method with the reputation of science, the image of the Copenhagen Business School and the

strategic management's acceptance that the method is worthwhile trying are elements in the consultant's network which he more or less explicitly enrolls as allies to increase his voice. Nonetheless, sometimes participants behave as expected, at other times not. Why is he not able to discipline the participants as the hotel manager in Latour's case?

A clue to an answer may be found in Susan Star's social science study of scientific work. The work of cross-functional groups, especially in the inventive phase of radical innovation projects, is similar to her description of scientific work as a very heterogeneous work in which different points of view are constantly adduced and reconciled (1989, p. 45). As when scientists work together in project groups, people from different functional units cooperate without good models of each other's work. They have different assumptions about their work, goals, time horizons, and so forth (Döpping & Prahl, 1999; Prahl, 2001). The development of boundary objects is one reason why the heterogeneous work can be done. By boundary objects Star (Star, 1989; Star & Griesemer, 1989) means objects which are sufficiently plastic to adapt to local needs and constraints of several parties employing them, yet sufficiently robust to maintain common identities across sites. Boundary objects are considered more vaguely when used across boundaries, for instance, when people from different fields are speaking with each other, than when they are used in individual sites.

In the case study by Star & Griesmer (1989) on how a zoologist succeeds in establishing a natural research museum in California, we see how boundary objects may be developed so that they make different groups cooperate in a way that fits the interest of a manager. Briefly put, the zoologist succeeds in creating objects that may promote his interest and understanding of what should be achieved and how to achieve it and, at the same time, express the interests of the different groups involved in the project. Of special interest to us is that he succeeds in having different groups follow standard forms for doing their work. According to Star, he succeeds because the methods are not so complicated that they interfere with the jobs of the group while operating on their own. Furthermore, the methods may be used as a 'lingua franca', that is, they may be used as a common ground in clear, precise tasks without requiring the parties to share a common, theoretical understanding.

Reconsidering our case study in the light of Star's study, we see that we are dealing with a series of more or less conflicting networks. Firstly, we have the different networks, which the different participants of the project groups were involved in, that is, the different functional departments, managers and non-managers. Secondly, we have the network(s) of the consultants facing the more or less recalcitrant network(s) of the cross-functional project group. The participants in these groups are seeking to turn their version of the Cube Method into a boundary object, which the interests of others may be translated into. In this way the Cube Method becomes a political football between the parties – a very surrealist one because by being played around, or rather performed, its content changes! Thus, in the context of cross-functional project groups a formal work method may be performed in overlapping networks in which participants use it to give them more voice. The general and relatively vague nature of boundary objects may promote this.

But may a formal method be thoroughly malleable? In accordance with our theoretical guidelines, a series of different meanings are inscribed in formal methods. These different meanings exist in so far as they are (re)constructed in practice in different networks which actors may enroll in trying to establish obligatory passage points. When an attempt is made to translate the different meanings of a non-human actor, in this case

the meaning of the method, to make it fit the translator's interests, that involves an attempt to invoke a whole network as an ally. In other words, although the nature of the formal method changes as it is performed in the interaction between conflicting networks, culture – in the sense of 'recursive social language practices' – is an important constraint.

Implications and conclusion

A way of seeing may conflict with other ways of seeing or elaborate them. Below we shall first briefly see how the presented way of seeing conflicts with mainstream thinking on methods and technology as expressions of theoretical conceptions about methods. Then we shall discuss how these lessons may contribute to ideas about the relation between improvisation and innovation.

Work methods as expressions of theoretical ideas

Our way of seeing and our grounded lessons conflict with the underlying scheme of thinking in the literature and practice on organizational change and development where a specific method of change or development is usually considered as a given logos that may be realized in practice in various ways according to local circumstances. The subtitle, 'Behavioral science intervention for organizational improvement', of French & Bell's widespread textbook 'Organizational Development' (1995) may illustrate this precedence of a theoretically conceived identity of methods. Here intervention is seen as an application of behavioral science, and the methods of organizational development should, hence, be understood as theoretical entities. This is seen clearly in Schein's well-known definition of process consultancy emphasizing the importance of process consultancy as a 'philosophy' in relation to its procedures and practices (Schein, 1988, p. 3).

In this mainstream conception of the relation between theory (i.e., the method as a logos) and practice (the specific procedures used), the observed variability in using the Cube Method may be understood in two ways. Part of the variability may be understood as a variation of the method. The *same* method is expressed in different ways of handling the innovation problem. The reason why people do not use the prescription strictly all the time may then be explained as an adjustment to local circumstances. In fact, participants then do follow the "spirit" of the method. On the other hand, part of the variation may be understood as a manifestation of a change in method. Different factors, such as time pressure and feedback from strategic management, may cause participants to change method or readopt old methods.

Thus, there are ways to preserve the notion of a formal method as a (theoretically defined) entity with a fixed meaning. This paper tried to show that one should see a formal work method as a technology consisting of a collection of elements which, at times, may be quite loosely coupled rather than see it as a tightly coupled set of elements conceived by its constructor. As participants interact in conflicting networks, they perform a method in complicated ways. The method *is* the conflicting and changing ways they perform and not something that its constructor has the sole privilege to define – not to mention, to enforce on others.

Work methods as resources for improvisation

In general terms, one of the most fundamental lessons to be learned from this study is that project groups do not, strictly speaking, follow formal prescriptions in doing inventive work. This conclusion also applies to work groups in many other work settings. When working together to solve daily problems while performing their jobs, people deviate from formal procedures, manuals, etc (cf. Orr, 1996; Brown

& Duguid, 1996; Suchman, 1987). Thus, inventiveness and innovation are integral aspects of work performances. In this fundamental sense innovation work is similar to work in general. But, it also has some peculiar features. Firstly, the innovation situation, especially in radical innovation projects, is a situation of very high complexity compared to ordinary work situations. Therefore, it cannot as easily as simpler jobs be represented formally in guiding models. Secondly, since participants in cross-functional groups represent different functional units in the organization and different educational backgrounds, they are likely to use different work methods and understandings of the innovation problem.

In order to understand innovation, the concept of improvisation was drawn into the theoretical debate. And because jazz music is "about inventiveness as an expected mode of thought and behavior" in conditions of high uncertainty (Bastien & Hostager, 1988, p. 522f), people playing jazz have been used as a metaphor for people working together on innovation. In playing jazz as well as in doing innovative work, people improvise which means that they deviate – and *have to* deviate – from existing procedures and knowledge (Moorman & Minor, 1998, p. 761). Still, this does not imply that they act in a random manner. Jazz musicians, as well as our project groups, are able to coordinate their behavior though we saw episodes of anarchy at times. As for jazz musicians, they are said to act with reference to a musical structure and social practices constraining the turbulence of the jazz process. "Paradoxically, these structures enable collective musical innovation by constraining the range of musical and behavioral choices available to the players" (Bastien & Hostager, 1988, p. 586). For improvisation to result in coordinated behavior there has to be a common referent, which may be used – and changed – while working on innovation problems.

In our study we saw that the Cube Method was only sporadically able to serve as such a common referent. But this does not negate the importance of such a referent because, unlike jazz musicians succeeding in their endeavor, in many episodes participants in the project groups do not master the same set of rules, that is, the Cube rules. In some few episodes, especially the episodes in which the Cube rules are assimilated to a well-known form for regulating discussion among groups, the so-called annual general meeting model, participants deviate in an organized, creative way from a set of agreed-upon procedures. Then deviations from the rules of the meeting are sometimes made purposefully while at other times they go unnoticed by the participants. It is worth noticing that it is in such episodes that the group seems to come up with interesting innovation concepts. A grounded lesson may therefore be: When project groups explore complex problem situations leading towards new innovation concepts, improvisation as a way of making sense is grounded in common, well-learned rules for working together in a coordinated way.

Conclusion

Our study has a seemingly paradoxical implication for understanding the usefulness of formal methods for knowledge creation. The widespread search for *best practices* in management and consultant circles may be said to be a search for formal methods conceived of as unequivocally defined, specific standard procedures. Such a search may produce counterproductive results (cf. Orr, 1996; Brown & Duguid, 1996). On the contrary, its potential for malleability is what may make a formal method useful.

The malleability of a formal method for knowledge creation in complex situations of innovation may be due to it being a technology consisting of a loosely coupled set of concepts, activities and objects, with a loose coupling to sense making in competing actor networks.

Granting Weick (1996) the last word: As a technology a formal method for knowledge creation in the complex setting of inventive work in a radical innovation project is "an equivoc"!

References

Ancona, D. G. & Caldwell, D. (1992). "Cross-Functional Teams: Blessing or Curse for New Product Development?" In Kochan, T. A. & Useem, M. (Eds.) *Transforming Organizations*. Oxford: Oxford University Press, 154-168.

Bastien, D. T. & Hostager, T. J. (1988). "Jazz as a Process of Organizational Innovation." *Communication Research*, 15 (5): 582-602.

Blackler, F. (1995). "Knowledge, Knowledge Work and Organizations: An Overview and Interpretation." *Organization Studies*. 16(6): 1021-1046.

Blackler, F. & Crump, N. & McDonald, S. (1998). "Knowledge, Organizations and Competition." In von Krogh, G,. Roos, J. & Kleine, D. (Eds.) *Understanding, Managing and Measuring Knowledge*. London: Sage Publications, 67-86.

Brown, J. S. & Duguid, P. (1996). "Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation." In Cohen, M. D. & Sproull, L. S. *Organizational Learning*. Thousand Oaks: Sage Publications, 58-82.

Brown, S. L. & Eisenhardt, K. M. (1997). "The Art of Continuous Change: Linking Complexity Theory and Time-paced Evolution in Relentlessly Shifting Organizations." *Administrative Science Quarterly*, 42: 1-34.

Burns, T. & Stalker, G. M. (1961). *The management of Innovation*. London: Tavistock.

Daft, R. L. & Weick, K. E. (1984). "Toward a Model of Organizations as Interpretation Systems." *Academy of Management Review*. 9(2): 284-295.

Darsø, L. (2000). *Innovation in the Making*. København: ATV Ph.d. serie 4, 2000.

Dansk Industri (1995). *Industriel Projektledelse*. [Industrial Project Management]. København: Dansk Industri.

Dewey, J. (1938). *Logic: The Theory of Inquiry*. New York: Holt, Rhinehart and Winston.

Drucker, P. (1985). *Innovation and Entrepreneurship*. Oxford: Butterworth Heinemann.

Döpping, J. & Prahl, A. (1999). "Re-Thinking in Collectives: Between Groupthink and Garbage Can." Paper Presented at the 6th Workshop on Managerial and Organizational Cognition. University of Essex, Colchester, UK, June 1-3, 1999.

French, W. & Bell, C. H. Jr. (1995). *Organizational Development. Behavioral Science Interventions for Organizational Improvement*. Englewood Cliffs, N.J.: Prentice Hall International, Inc.

Glaser, B. & Strauss, A. (1967). *The Discovery of Grounded Theory*. Chicago: Aldine.

Hackman, J. R. (1987). "The design of work teams." In Lorsch, J.W. (Ed.). *Handbook of Organizational Behavior,* 407-424.

Harré, R. (1972). "The Analysis of Episodes." In Israel, J. & Tajfel, H. (Eds.) *The Context of Social Psychology: A Critical Assessment*. London: Academic Press.

Harré, R. & Secord, P. F. (1972). *The Explanation of Social Behavior*. Oxford: Basil Blackwell.

Hatch, M. J. (1997). *Organization Theory. Modern, Symbolic and Postmodern Perspectives*. New York: Oxford University Press.

Herlau, H. (1995). *Kubus® – Uddannelse – Teambuilding – Innovation – Ledelse*. [The Cube – Education – Teambuilding – Management]. HHK, Det Økonomiske Fakultet, Samfundslitteratur, Ph.d. serie 11, 1995.

Herlau, H., Prahl, A. & Nordlund, T. (in prep.). "Ledelse af innovation. Kubus, en metode til systematisk videnskudvikling." [Management of Innovation. The Cube Method, a method for systematic development of knowledge].

Hosking, D.-I. & Morley, I. E. (1991). *A Social Psychology of Organizing. People, Processes and Contexts*. New York: Harvester Wheatsheaf.

Judd, C. M., Smith, E. R. & Kidder, L. H. (1991). *Research Methods in Social Relations. Sixth Edition*. Fort Worth: Holt, Rinehart and Winston, Inc.

Latour, B. (1988). In Johnson, J. (1988) "Mixing Humans and Nonhumans Together." The So-

ciology of a Door-Closer. *Social Problems*. 35(3): 298-310.

Latour, B. (1991). "Technology is society made durable." In Law, J. (Ed.) *A Sociology of Monsters. Essays on Power, Technology and Domination*. Sociological Review Monograph. N. 38: 103-131.

March, J. G. (1991). "Social Science and the Myth of Rationality." Speech held at the School of Social Sciences, University of California, May 1991.

Mead, G. H. (1934). *Mind, Self, and Society*. Chicago: The University of Chicago Press.

Mintzberg, H. (1983). *Structure in Fives: Designing Effective Organizations*. Englewood Cliffs, New Jersey: Prentice-Hall International Editions.

Moorman, C. & Miner, A. S. (1998). Organizational Improvisation and Organizational Memory. *Academy of management Review*, 23(4): 698-732.

Nonaka, J. (1991). "The Knowledge-Creating Company." *Harvard Business Review*. November –December: 96-104.

Orr, J. E. (1996). *Talking About Machines. An Ethnography of a Modern Job*. Ithaca, NY: Cornell University Press.

Prahl, A. (2001). "The relevance of the concept of work network for understanding the ordering of work activities." In Jern, S. & Olsson, E. (Eds.) *Studies of Groups and Change*. Proceedings from a conference on group and social psychology, Lund University, May 2000, 183-196.

Schein, E. H. (1987). *The Clinical Perspective in Field Work*. Newbury Park: Sage Publications.

Schein, E. H. (1988). *Process Consultation. Vol. I. Its Role in Organizational Development. Second Edition*. Reading, Mass.: Addison-Wesley Publishing Company.

Schön, D. (1983). *The Reflective Practitioner*. New York: Basic Books.

Star, S. L. (1989). "The Structure of Ill-structured Solutions: Boundary Objects and Heterogeneous Distributed Problem Solving." In Gasser, L. & Huhns, M. N. (Eds.) *Distributed Artificial Intelligence. Vol. III*. London: Pitman, pp. 37-54.

Star, S. L. & Griesemer, J. R. (1989). "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39." *Social Studies of Science*. 19: 387-420.

Strauss, A. L. (1987). *Qualitative Analysis for Social Scientists*. New York: Cambridge University Press.

Strauss, A. L. (1993). *Continual Permutations of Action*. New York: Aldine de Gruyter.

Strauss, A. L. & Corbin, J. (1990). *Basics of Qualitative Research*. Newbury Park: Sage Publications.

Suchman, L. (1987). *Plans and Situated Actions: The Problem of Human Machine Communication*. New York: Cambridge University Press.

Suchman, L. (2001). "Human/Machine Reconsidered." Department of Sociology. Lancaster University. http://www.comp.lancs.ac.uk/sociology/soc0401s.htlm

Sundstrom, E., DeMeuse, K.P. & Futrell, D. (1990). "Work Teams. Applications and Effectiveness." *American Psychologist*, 45 (2): 120-133.

Weick, K. E. (1979). *The Social Psychology of Organizing. Second Edition*. New York: Random House.

Weick, K. E. (1993). "The Collapse of Sensemaking in Organizations: The Mann Goulch Disaster." *Administrative Science Quarterly*. 38: 628-652.

Weick, K. E. (1995). *Sensemaking in Organizations*. Thousand Oaks: Sage Publications.

Weick, K. E. (1996). "Technology as Equivoc: Sensemaking in New Technologies." In Shafritz, J. M. & Ott, J. S. (Eds.) *Classics of Organization Theory. Fourth Edition*. Forth Worth: Harcourt Brace College Publishers.

West, M. A. & Anderson, N. R. (1996). "Innovation in Top Management Teams." *Journal of Applied Psychology*. 81(6): 680-693.