When Harmonizing Can be Harmful – Managing Divergence and Convergence in Coalition Command Work

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Abstract

The theme of the symposium is "Working together", the framework being coalition command. Some of its topics are interoperability, harmonizing technology differences, and the management of multicultural complexities. This paper will discuss the work that is conducted during command and control, *command work*, and what "together" implies and presupposes, eventually the design of IT artefacts. It summarizes an empirical qualitative study on command that has been partially reported during two previous symposiums (1995 and 1996). The study has developed command theory and led to suggestions concerning the design of information systems, how these systems and work constitute a whole. This entity must not be artificially separated by instrumental methods for systems development and change that neglect social aspects of the work, reducing the necessary freedom of action for coalition warriors and partners.
Work is an important study topic because it shall create a common culture, integrate different units, opinions, and shifting opinions. The title of the paper captures what is at stake in command work and especially in coalitions: blunt harmonizing can lead to divergence instead of convergence because social aspects are neglected. On the other hand, convergence can eventually end in reduced variety and failure to handle complex environments.

1. Command Assumptions, Theory and Concepts

1.1 *The Analytic Framework*

> "..the theory must effectively integrate basic and applied research, as well as science and social science, if it is to converge on the true essence of command and control. This will require the rigor that attends quantification yet the human understanding that can be derived only from qualitative methods. " [Foster, 1988, p. 224]

There has been an ongoing search for command theory during several years [ibid.; Levis and Levis, 1994], means for better understanding command work and cooperation and how to design supporting technologies, especially in the form of computer-based information systems. Within Information Systems Research (ISR) domains such as Computer Supported Cooperative Work (CSCW), Organizational Memory (OM) and Collaborative Systems exemplify ongoing work with relations to military command work. Distributed decisionmaking [Sage, 1987] and Distrib-

[1] The National Defence College has supported the whole study. The fieldwork was conducted within the 13. Army division HQ where staff in every possible way demonstrated an open mind and generosity towards the military researcher who tried to catch more than a glimpse of what went on.

uted Cognition are other related directions. My study, initiated in 1995 [see Persson, 1995; 1996] ended in an empirical ethnographic study conducted as fieldwork within tactical army command organizations, which has led to a theory of *command work*, with considerable explanatory and descriptive capacity.

The paper will discuss what command work is, where theory comes from, and presents a model of this kind of work together with conclusions for the design of supporting technologies. Thereby the paper summarizes the final phase of my study. Ultimately, we need consistency between theory and practice, not that either part is out of phase with the other.

In order to reach satisfactory theories and support solutions within Information Systems Design (ISD) it is necessary to form an idea of what the theme for the symposium, "working together" means, both what "work" is (should be) and what "together" implies. This is central, especially within a coalition. There, commitment and trust perhaps have to be achieved rapidly and compensate for the absence of a direct unity of command as for example during the Gulf War (1990–91) and the succession of operations in Bosnia and Kosovo. *Convergence* within an organization—the necessary condition for the establishment of an organization—might easily turn into *divergence* if something goes wrong, when the communication within a unit is interrupted. Each state is a common social phenomenon.

The theoretical concept *dialectic of (management) control* [Nandan, 1997] explains these tendencies. It conceptualizes the ability of subordinates to affect power holders, and is an expression of the relations between *autonomy* and *dependence* which are in-built into the organisational hierarchy, operating at every level, framing both double-sided beneficial power relationships and subordinates' escapes from close supervision. According to this perspective, close managerial supervision is not only impossible, it also further promotes the dialectic of control. The word "harmonizing" is closely related to power. It says that an end-state may be a technically harmonized (standardized) infrastructure, but one imposed during conflicts and during resistance and therefore being less stable. What looks like a satisfactory outcome may instead be a state of "colonization of mind" [Mignolo, 1995] when a foreign technology or culture has been superimposed replacing another one, equally valuable mindset. There are parallels when systems development introduces a foreign element in an organization: new concepts, technologies and processes, a new world view.

Convergence and divergence are not only about reduced or augmented complexity. The well-being and survival of any organization ultimately rests on its ability to demonstrate sufficient variety to handle its environment yet maintain a coherent shape. Enforced convergence (specialization, one-sidedness) and detailed control may reduce this capacity and unfavourably shift the convergence-divergence balance. Few environments are totally stable, offering no surprises and allowing tight detailed central control. Total convergence may be counterproductive: the unit becomes too specialized to be able to act outside a narrow sector of the environment.

1.2 *Theoretical Requirements on Command and Control*

Unfortunately most efforts to theorize about command and control (C2) do not see power and domination as problematic issues, yet the practice of command shows numerous examples of how the dialectic actually has a considerable influence. Consequently idealistic models of command risk to be obsolete and miss essential issues of the social reality involved.

> We pride ourselves on our rationality, while avoiding reality. If we are to function effectively as diplomats and soldiers, we need to turn a dispassionate eye on mankind. We need to study the behavior of the individual and the mass, and to do it without stricture. We cherish the fiction that technology will be the answer to all of our dilemmas, but our enemies know that flesh and blood form the irresistible answer to our technologies. [Peters, 1999b, p. 35]

Builder et al. [1999] stated that a deeper theory of C2 is required, complaining that contemporary C2 theories are about organizations and communications, often taking the form of charts and diagrams. Commanders become the occupiers of boxes through which messages flow. Such theories do not explain what C2 does and does not do, can and cannot do. They do not explain the qualities of the ideas or how these ideas are expressed within the system. Builder et al. searched a theory about C2 concerned not only with the organizational and technical aspects of information processing, but also the quality of ideas, how they are expressed and how the qualities of people contribute to or detract from C2, not only how activities should be organized and 'wired' together. The new theory should encompass both high-level creative and the direct-order and control aspects. They stated that theory should be prescriptive and explanatory. The basic requirements are that the C2 system shall transmit the command concept formulated by the commander and his vision of the prospective operation that informs the making of command decisions during the subsequent operation. Unfortunately these researchers claimed the cognitive processes of the commander being the essence of command [p. xiii]. We must leave the invisible, centralized and mystical world and instead turn to what is visible, where work is.

Likewise, it is necessary to avoid blunt beliefs in more technology as remedy, or that technology differences are the only worth engaging in. The concept of "technological frames" [Orlikowski and Gash, 1994] is another way to express how technology is interpreted and valued differently within an organization. We must therefore ask ourselves on what foundation theory and practice are built, on ideal but incomplete assumptions or on other grounds, and how conclusions about good/bad technology and practices are reached.

> Narrow definitions are for the frightened and the mediocre. And the best definitions are intuitive. Language serves only to communicate a shadow of the ideal; words reduce and constrain. At most, definitions of concepts should be regarded as intellectual shorthand. Like doctrine, such definitions should offer starting points - they must not be used as shackles. [Peters, 1999a, p. 167]

An example of a taken for granted but hardly justified belief is what Scaife and Rogers [1996] called the "resemblance fallacy" meaning the strong common sense positive notion of resembling representations when the real world is modelled. There is some evidence that the connection between the object world and how it is represented is far more complex than resemblance. Instead what is important to study is how people interact with graphical representations, and the relations between internal (mental, cognitive) and external representations

2. What is command work?

Van Creveld [1985] stated that what is management in business, is better labelled *command* when studying the military, and a way to avoid more cryptic terms, abbreviations etc. The term I use, *command work*, is the military analogy to what is called managerial work elsewhere [discussed by Lind and Arvidsson, eds., 1998]. Command work is characterized by or contains the following:
- the interplay of both formal, informal and cultural conditions;
- communicative activities, where situated and experience-based knowledge is important;
- cannot be summarized in abstract and general principles;
- it is normally conducted under severe time constraints and demands;
- reactive mechanisms and reflective actions are more important than formal decision analyses and strategic planning; and
- it is about to focussing attention and reducing uncertainty in order to create stable conditions for actions in war.

Command work is consciously designed, supported by secure communication and robust IT. Control technologies are mainly developed and implemented within the framework of the (scientific) ideal rational bureaucratic peacetime management, and command work is conceived there in order to fit very different contexts. Much command work is *invisible work* (also because we lack concepts for it) and hard to infer from. This situation means that to making visible, to using concepts, research methods, command practices that allow discovery of work, are prerequisite. What pays in research as well as in the military practice is to apply a relevant framework — paradigm — instead of continued use of abstract concepts and systems models that leave the social aside, virtually invisible.

One of my first analytical gains was to establish a theoretical idea of what command work is, inspired by cybernetics and the Viable System Model/VSM [Beer, 1981]. According to this model and early modern management and systems science [Emery, ed., 1969] command work is a two-way transformation process, continuously managing the boundaries of the organization, capable to demonstrating sufficient variety [Beer, 1981]. The primary mission for management is to handle the organization's boundary conditions where different levels of exchange decide the survival of the organization. Without commitment the extra energy and efforts are not likely to materialize; control has to accompanied by consent [Emery, 1969]. This *boundary management* regulates the degree of integration and autonomy between the organization and its environment [Morgan, 1986].

> The boundaries … can be managed only by managing the co-variation of internal and external processes. In so far as a manager has to co-ordinate or otherwise resolve internal variances then he is distracted from his task. [Emery, 1969, p. 9]

In the *boundary zone* between an organization and its environment (Figure 1), whether it concerns a large rational bureaucracy or a small team, certain *boundary phenomena* appear.

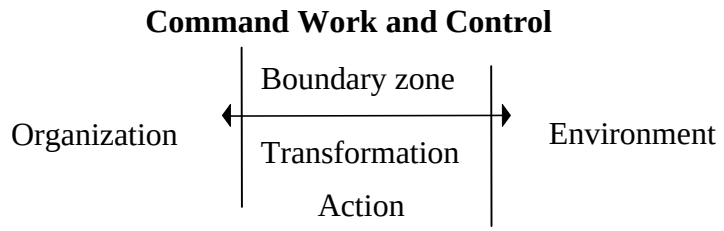

Figure 1. The organization, its boundary zone and environment.

The same idea is applicable in command work. The organization faces a dynamic, in war even a hostile environment, which needs to be made controllable through social action. The military in fact has a dynamic boundary zone all the time, not only in war, where contradictions must be reconciled. There is a parallel to information system development when social action is transformed and (more or less) formalized into organized action. There is a boundary zone separating and insulating the formally organized and the not yet organized part of social action. A few more words about the VSM and boundary management are necessary. A Viable System consists of autonomous subunits (subsystems) which become viable because they can exhibit the necessary variety for handling evolving situations, having the capacity for self-repair, self-awareness, recursion and maintenance of identity [Skyttner, 1996]. Such a system is able to adapt, to respond to unexpected and previously unknown events [SYNCHO, 1992, http://www.syncho.com/ 17 February 2000].

Boundary conditions cannot be predefined or managed with the help of rules and rigid programs along established channels for cooperation and communication or according to the (military) Standard/Standing Operating Procedure (SOP). The two-way transformation process is first when the environment is interpreted and defined (its complexity being reduced) and then when the distinctions support organized actions with sufficient variety (detailed design). If the way the organization works does not allow useful distinctions— a *social construction of reality* [Berger and Luckman, 1966], including commanders and their cognitive processes (how can these be externalized and opened up?)— then operators experience problems initiating actions. Another way to express this is to say that an organization that does not admit rich communication, support innovation and expression of ideas, risk to be left with inadequate practical distinctions. Divergence appears.

3. Where does theory come from?

Theories are not the products of magic or gifts from God. Their purpose may be explanation, prediction, or prescription/persuasion. The practice of the scientist is a social enterprise and not mechanical engineering even if reliability and precision are deep concerns. “Scientific” means different things and the argument “scientific” can be more or less justified, sometimes even used as a tool for its own sake. Personal and social judgements are involved in data manipulation, the choice of tools and models, the selection of evidence and in the construction of an argument [Majone in Miser and Quade, 1985]. Theory (according to common scientific method) is derived

from ‘penetrating tools’: experiments or from logical deduction, the use of mathematics, guesses (intuition), bold conjectures, empirical evidence from observations and interviews, in short from quantitative and qualitative methods. Historically, scientific management has been developed from very pragmatic old methods and practices, only afterwards given the label “scientific”. Within accounting history the examples are abundant of how very old (read the Bible!) pragmatic social practice has become rule and law and eventually science, because it has strength and works [Nandan, 1997]. What has had a considerable strength as an instrument for social control became the tools to produce scientific results: quantification, measurement, mathematics, logic.

The paradox which Majone formulated was that when systems analysts’ and scientists’ work become difficult to validate, as when trying to establish best practice and find scientific support for it (in military matters and command work), the harder it becomes to stick to scientific standards borrowed from the natural sciences. Analysis of experiences in war is not easier. Historical events are difficult to study and analyse socially afterwards.

The *sociology of the military*, from WWII to more elaborated theories, was first an urgent matter coming second after solutions to the problem to find ways to create large armies [Caforio, 1998]. Caforio meant that the sociology of the military has overcome a purely empirical phase aimed at satisfying immediate and contingent public needs, still pursuing empirical research, but now combining it with a theoretical elaboration. But still the quite limited development surprises. The basic problem is the reluctance or unwillingness of the military establishment to allow investigation “by penetrating tools of social investigation”. [ibid., p xxiii]. Other examples show that practice precedes theory. Systems Theory became the answer when “system” had become part of the practice within control. To conclude, empirical evidence is desirable but hard to find when studying military matters, which explains the strong tendency to using simulations and models. Belief systems, while waiting for the final proof, can have various components. ‘Intuition’ is another term for rationales, ‘divine inspiration’ another.

History shows that theory increasingly grows from practice, that politics is part of this practice, and that we have to accept uncertainty. My work is empirical, qualitative, offers opportunities for interpretation and critical questions about the military practice but is at the same time open for inspection, possible to relate to other theories, for example Systems Theory and cybernetics. But let us take a look at the result from the study, a conceptualization and a model of command work made visible, and one model of a theory of practice.

4. The Ethnography

4.1 *Purpose, Process and Result in Brief*

> We are about to enter a new century constrained by the last century's narrow and inadequate definitions of warfare. Countries and cultures make war; the military is merely the bluntest of humanity's broadening range of warmaking instruments. [Peters, 1999a, p. 167]

My overriding research question was why efforts to implement modern information technology are so slow, costly, and why the contribution from the output as regards higher control efficiency is so uncertain. In order to reach behind the common concepts and discover what command is

about I designed my work as an ethnography [Creswell, 1998]. Its purpose was to create a cultural portrait, what *actors do, say and use*. With this portrait the idea was to reach principles for the design of information systems. I entered into fieldwork during a succession of domestic tactical command post exercises involving one division and a few brigade HQs in the first half of 1998. These exercises were occasions for full-scale tests of a new communication system and a new information system infrastructure. The fieldwork was conducted mainly in the division HQ. The data are audio-recordings, photographies, documents and fieldnotes, also from interviews after the exercises. Data could be transformed into cases and analysed.

There are different opinions on what "culture" means and is. *Sociality theory* (a capacity for complex social behaviour) implies that *people do things together*, using "cultural" means [Carrithers, 1992]. Actors are not starting with a common culture, possibly with some communication "protocols". Much work is about the creation of cultural means, because it is difficult to supply a ready culture from above. Working together thus means first the establishment of a common culture, then the operational activities. Cultural 'repair work' is a recurrent topic in work in order to keep it together as a central system within the total C2 system.

Command work is pragmatic and opportunistic, conducted by experts in the modern military command structure who transform the operational environment, and control it through controlling actions. In that respect autonomy, a prerequisite to meet evolving events—frictions—and power become core issues, interchangeable goals and means for flexible social control, in cybernetic terms variety. Key concepts are social value, function and visibility. Actors must be visible in the command work, and make the work visible. Consequently, when designing control tools, computer artefacts and information systems, the design challenge is to reconcile dynamic and pragmatic demands for power, autonomy and control with demands for stability. Such an organization becomes a viable system, one that can survive, because there is no conflict between its mind and physical resources. In operational terms, this means having *freedom of action*. The prerequisite to achieve this is one perspective on knowledge and information and that information systems match the needs growing from within the work because work builds the organization.

Knowledge and power, expertise and authority, represented by experts and formal leaders have to be brought together if the work is to be efficient. Knowledge from research and information technology will both be rejected, if considered irrelevant. I have called this applying a *rationality of practice*. We can conclude that command work is not ordinary managerial work (section 2). The analysis led me to conclude that it is a kind of *design work*, dynamic, hard to define and to control. Command work is knowledge-intensive; it designs and produces symbols. Therefore it is very flexible and involves interpretation and negotiation of both its content and products. The most important symbol is the Army, which must be visible and credible, built from real components.

4.2 *A Model of Command Work*

In the course of the study, it became obvious that theoretical constructs like power, autonomy, and rationality could explain cases and actions. Huguet et al. [1996] pointed at the need for *autonomy*, and how autonomy defects in an organization lead to either decisions *on constraints*

or decisions *under constraints* (acceptable defects). When faced by new situations in the work, staff organized control actions as individual or cooperative efforts in order to achieve either *more autonomy to build power* or to *exploit existing power*, ultimately to better control the environment.

The pragmatic 'command *design work*', aimed at functionality, integration of different kinds of rationality, and satisfactory autonomy within a certain context. My model of command work (Figure 2) recognizes and explains how people skilfully apply various rationalities in order to invent satisfactory solutions to everyday problems, including development of such self-help systems.

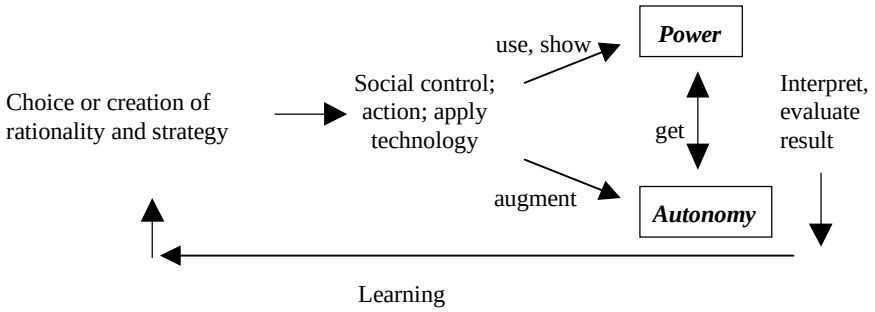

Figure 2. The pragmatic command work principles

Technologies have several roles during control actions. Part of the choice of strategy was how to use technology within and between subgroups. There was a tension between imposed and traditional technologies, and between informal and formal, often technically structured mechanisms. Accounting practices and techniques (budget procedures, audit practices) belong to such instruments, but recurrently face opposition from other communities of practice.

In theoretical terms, what was at hand in the heterogeneous organization and work groups (and most groups *are* heterogeneous like in a coalition), was that different competing rationalities were applied, indicated by change of strategies and reinterpretations of previous actions. Actors had different goals and followed a diversity of rationales in what looked like a harmonic joint effort. Even the formal bureaucracy was consciously used or circumvented in order to reach the desired result. Ongoing evaluation guided continued action. This model certainly looks like "boxed actors" [Builder et al., 1999] but is a way to describe the social aspect of command work, how mind(s) cooperate with matter, although in this context flesh and blood.

Recent examples illustrate this theory. During the operation in Kosovo 1999 an incident occurred when in June a Russian force suddenly marched towards the Pristina airport. There is one unofficial mass media version of what happened. I will use this to illustrate some conclusions; the story is credible and fits the theory, hopefully enough to show what rationality means and how technology is used. The first story (reporting from Senate hearings in Washington three months afterwards) in the International Herald Tribune [September 11-12, 1999] said that a command dispute grew when the British general in charge did not carry out an order from the NATO supreme commander. The order was to send a force to seize the airport ahead of the Russians.

The dispute got political overtones about credibility within NATO and trust between Americans and Europeans, about insubordination. One argument from the supreme commander seemed to have been that no 'second-guessing' was to evolve in the chain of command.

Three days after [September 14], this general's explanations were printed: an explanation to the refusal was that the hesitant general was using an option named a "red card" meaning that an officer asks his national commander for permission to disobey an order from a superior foreign officer. His true reasons were the total agenda and the options not to violate other agreements within the coalition, which led him to consultations with his senior national authorities. An agreement was then reached with the American side of the command chain. There had actually been a high-level consensus on what had first been interpreted as disobedience. Another media detail during this event is worth mentioning. The order was first given to a U.S.-led force to get to Pristina ahead of the Russians but NATO's supreme commander was told that they lacked the regulation quantity of ammunition for the mission [September 11-12 issue]. A third explanation was that the refused action depended on U.S. senior military's concern about possible casualties.

A theoretical reflection is this. Clearly, the British general had and achieved more power and autonomy, while the NATO supreme commander's resources were not sufficient. The Russians got the airport first because of superior power and autonomy (thanks to speed, a rapid advance), and possibly the U.S.-led operation was delayed because of reported *lack of technology* which became a possible resource: supported an argument to get out of the operation. Thus, when we look at failures to adapt 'perfect systems', sometimes implicit but not desirable detail-controllers, it may be worthwhile to investigate issues such as autonomy and power, how rationalities interplay, and how various social actors are "rationality brokers".

Whether the use in September of the mass media as a technology fits into the model is out of the scope of this paper, but some actor may have gained from the articles.

4.3 *Command and Design Work, a Composite Model*

A relevant model of work reduces the risk for command failures and bad information system design. Conventions about what real work is may lead to negligence toward important but less glorious parts of it. My ethnographic approach made work visible, and produced a model of command work.

Clearly, issues of *autonomy* and *power* are central in command work, achieved with the help of *technology* (also the mass media). We have seen, too, that technologies both cause troubles and are dear resources for battle capacity, communication and survival, given *knowledge* about how to use them. The following model illustrates the relationships between categories at play in the social world (Figure 3). Control capacity, power, and autonomy presuppose technology, organization and knowledge. These central components both constitute and form the culture, what people do, say and use and imply certain values:

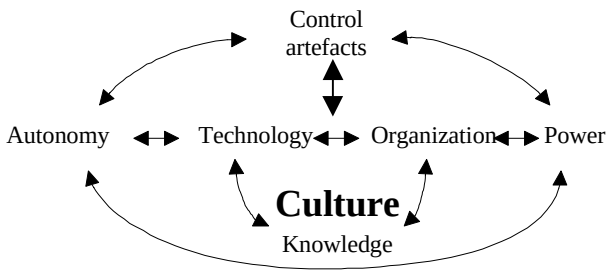

Figure 3. Interrelationships between categories in the social world

The model illustrates the "core" of artefacts, organization and technology, underpinned by knowledge, how it supports control capacity which is the product of interrelated constructs: autonomy, power and control artefacts. Once recognized, power also defines organization and knowledge, directs technology, influencing culture. The model says that technology is a prerequisite for control and organization and is socially interpreted. In addition, technology may be the mould for culture: what is it *possible* to say and do? Because knowledge has to be externalized when used socially, it is dependent on available technology for representations. Control capacity is interrelated to autonomy and power, and supported by the knowledge, organization and technology belonging to the *dominant culture*. Those belonging to this culture within a coalition need a sensibility about this dominance and its effects

4.4 *A New Perspective, Command Work as Design Work, Generating Boundary Objects*

The idea to see command work as *design work*, not routine *office work*, came from Grinter's [1999] study about how design architects worked with product design in a telecom industry. Architects' work takes them across large parts of the company. They have to find ways to manage dual contexts – the customers and the development organization. This "web of social forces" do not "create additional work that needs to be taken care of in order to produce the technical design, *they are what product architecture is about* (emphasis added). It is the articulation work necessary to bring about the opportunity to design technically a new product or feature enhancement [p. 16]." In design work, architects reconcile these social forces so to make the products both technically possible and organizationally feasible.

Now over to what makes the study worth concluding from. Architects' technologies allow them to share their work with all parties involved. The organization has supported their collaborative activities by "institutionalizing the role of architect" [ibid., p. 17]. They are expected by their corporation to use informal networks and to be organizational diplomats. Grinter saw them as *boundary objects*, in fact they also *produce* boundary objects with the help of technologies which allow them to span multiple groups seamlessly. Boundary objects, said Star [1989], are

> objects that are both plastic enough to adapt to local needs and constraints of several parties employing them, yet robust enough to maintain a common identity across sites. [p. 46].

Appreciated technologies consequently were electronic mail, telephone, the web, and viewgraph products, just like in the command work. To *work together* clearly means to *make work visible*, according to the requirements in the environment. Staff invented and used a large variety of

technologies when confronted by constraints, most aiming at *visibility of work processes* and *communication*. If not this had been possible, work had hardly been possible to carry between organizations, forward to other persons within the own organization, or negotiate over. There are striking similarities between the architects and the military "command workers" as "boundary objects" that certainly are institutionalized, provided authority, and have to coordinate a variety of efforts. Work was created, above a certain most elementary level, it did not exist as ready programs and routines to follow.

5. Technology, Command and Work

5.1 *Design Frameworks*

Bucciarelli [1988] discussed design (in its general sense) and formulated a design theory. He saw the potential contributions from ethnography:

> If one intends to develop computer tools, management information systems, decision support systems, expert, knowledge-based systems, to assist participants in design, then they themselves ought to be designed to accomodate the different perspectives of users within the firm. The importance of exchange across object worlds in designing ought to be taken into account. This points to the desirability, and problem, of net-working participants' work through computer representations. At the same time the notion of different object worlds points to the need for flexibility in the tool. It ought to be able to accomodate the peculiarities of the furniture of an individual user's own object world. In short, toolmakers ought to recognize that knowledge is context dependent. Through ethnographic study we can understand the use of tools. [ibid., p. 168]

Current technical change imposes paradoxes and new control requirements in accordance with Beniger's [1986] conclusion that every new technology leads to control crises which are resolved by new control layers. Echevarria II [1997] discussed the Revolution in Military Affairs (RMA) and came up to a paradox. Digitization is transforming command and control, digital systems rendering battle command nonhierarchical. He assumed that situational awareness would soon become automatic and the transmission of the commander's intent instantaneous. The details represented by the new technology are minute: "a flood of real or near-real time information puts greater demands on intelligence gatherers and decisionmakers alike, forcing them to rely more on their intuition and Clausewitzian *coup d'oeil* than ever before" [p. 30]. If Echevarria was right the technical artefacts do more harm than good. Without them, only intuition is left, with them, only intuition will do.

From these thoughts the step is short to what Whitaker and Kuperman [1996] discussed. They described two approaches for development of command and control mechanisms, each attending to one aspect of the command activities and efforts. One approach was to use IT to enable one's own military system to operate more efficiently and more effectively than it did before. Own systems features are the targets for change - criteria for improvement being based on own-system performance. The other was the concern with exploiting IT to enable one's own military system to obtain advantageous leverage over an adversary's military system. The balance of own-system features vs. relevant adversary-system features is the target for change. This may encompass actively degrading the adversary's IT capabilities. This approach is connoted to the VSM and cybernetics, achievement of balance and self-regulation, homeostasis, and adaptivity.

There is an idea of a system of systems (SOS) metaphor within the command organization. In order to be the perfectly controllable and controlling agency, strict discipline, standardization, tight integration, and much hard-wiring is needed. Pickering and King [1995] who studied interorganizational computer-mediated communication pointed at another paradox.

> …coordination advantages held by integrated and hierarchical production will diminish and the advantages of flexibility and responsiveness inherent in market modes of coordination will rise. Eventually, we can expect to see a shift from hierarchical to market coordination in many sectors…[p. 484].

Another future's vision is the autonomous *cyber warrior* [Gumahad II, 1997] who receives a maximum information about the environment. This development means challenges to the military commanders who need another control layer, because organization members behaving as individuals undermine unit integrity and threaten mission success. Greater discipline is required to preserve command unity and control.

Behind many visions is a belief that the symbols carry the knowledge and that the better representation the more automatic is the conveyed knowledge [the 'resemblance fallacy'; Scaife and Rogers, 1996]. Although there is a widespread insight that *interpretation* is prerequisite for "information" [Gumahad II], which implies a conception of information as close to knowledge, there are other claims that information (knowledge) is a commodity, possible to disseminate automatically [Roszak, 1986]. These opposing perspectives have to be reconciled in design.

5.2 *Design and Tools for "Rationality Brokers" and "Boundary Objects"*

The emerging theory for work and design (Figure 1) was based upon work, central social factors and their relations. Artefacts and tools have to be usable across rationalities, follow work. Their meaning and relevance cannot be given once and for all. The temptation to add more powerful features that rely on formal information should be replaced by design as incremental formalization, especially if informally represented information is sufficient [Shipman III and Marshall, 1999]. Theory or not, to give work priority, and to accept both informal and pragmatic solutions–in–the–world probably will be beneficial, given that there is institutional support for such enterprises. If not, the power that grows from work may be interpreted as a threat and be met by institutional countermeasures.

In command design work, other principles than formal design methods are relevant, according to the current dominant *rationality of practice*. There is a widespread belief (accounting) that work can be engineered and that technology is a remedy for most deficiencies. "Rationality brokers" (design architects, commanders) have sufficient power and autonomy to be able to achieve changes and enforce solutions, or know how to get it, and hardly care about "theory" and "rationality". Negotiation and re-interpretation of meaning are likely to be part of their work.

Leadership easily becomes a technology and a panacea for a variety of symptoms. This belief is underpinned by management science, and most attempts to augment efficiency through better leadership are accompanied by rationalization, development of sophisticated control mechanisms, and formalization of tasks. This then leads to problems when trying to apply modern sup-

port technology designed from computer artefacts because integration and formalization, recognized by other research, often is rejected and the leadership threatened by the technology. This phenomenon is recognized in the grounded theory I have generated as the social response to reduced autonomy [Persson, 1997]. Within the military research community this tendency has been criticized [Sorenson, 1989]. Self-help systems are treated as anomalies, diverting resources from the organization's ambitions to create a system of systems capable of integrating an organization. Sorenson also complained over the inability of the industry to deliver what people in the forces wanted. We have a few contradictions here. Sorenson complained about the negligence towards the organization's needs but suggested extensive user involvement in systems development. Richardson [1991] who studied feedback theory, and Whitaker/ Kuperman [1996] who analysed military command provided explanations to this situation. Combining their discussions and analyses the following picture appears.

6. Discussion

The military seemingly has failed to integrate two opposing perspectives on feedback and control in the organization and its activities. These are the *servomechanics thread* and the *cybernetics thread* [Richardson]. The first underlines internal stability and is focused at internal reliable control. The second prioritizes the management of the variety in the environment, applying self-reference and autonomy to handle the influences from the external variety. Whitaker and Kuperman [1996] went a few steps further. They said that the unresolved duality between the IT-enabled internal control structure and the externally (likewise IT-oriented) efforts to inflict damage on an enemy had led to a confusion. This confusion had been labelled *information warfare*.

> Success in one can facilitate success in the other, but there is no necessity that they entail each other. As a result, projects to accomplish the one do not necessarily entail accomplishing the other. The confusion deriving from these conflicting foci has been exacerbated by their all being lumped together under the rubric of *information warfare (IW)* [Whitaker and Kuperman, p. 2]

The central message is this: The military is, traditionally, very focused at internal stability and capacity because if this is not there, not much training can be conducted and the image of the military would appear less trustworthy. However in the modern organization the complexity is monumental and much efforts must be allocated to sustain the internal stability. The organization, like a coalition, becomes fragile and this in turn promotes more "system of systems thinking" and a professionalization of the force, but not one that puts requisite variety first, rather to suppress variety. Finally little attention is free to scan and analyse the environment. The resulting confusion is the challenge for the command work.

This locked position is especially harmful in a coalition where different contingents may enter, carrying with them opposite views of what command work is about and what ideals and theories shall guide the common work. Crucial in work but abstract are the concepts of *information* and *knowledge*, and how IT is used. There are two opposing perspectives: information and knowledge as a resource and as what people carry in their work as the output from interpretation of a situation and of data. When internal order and stability is given priority and a resource perspective colours "information", it is a small step to design and implement centralized information systems that require much "information systems work", and design information-heavy

infrastructures. Such technologies may be less relevant for the common infrastructure in coalitions.

There is a debate about the possibilities to create a SOS and the achievement of 'information superiority' [Krygiel, 1999], a (vision of a) powerful and seamless sensor-to-shooter information (data) flow. It is evident that the new weapon technologies transform what war once was. The result from the Kosovo operation (1999) is debatable at least, not easy to interpret. Either military-technical reasons reduce the alternatives to conduct war (reduced variety), or political considerations attenuate the capacity and then discredit armed formations which become forced to carry out attacks from high altitude and/or with less than relevant weapons, leading to failures, politically and military. Krygiel stated that different command systems are required for different missions. The 1990s have shown the span of possible missions, each having its own traits and not only technical ones. The title of her book, *Behind the Wizard's Curtain*, marks what is essential "but not at the center and front of the stage" [p. 29]: the orchestration of people, processes and information systems. Krygiel meant that the SOS-concept underestimates the complexity involved (for example from legacy systems). One of the recommendations is to look carefully at those factors behind the curtain, the social factors, and to investigate case stories.

The ethnography that has produced data for this paper demonstrates one fruitful approach which does not aspire to do more than this: to look behind the curtain. Its case stories illustrate what concerns command workers, what has to be handled before harmonization is initiated, and to some extent the effects of blunt harmonization. One aspect of convergence–divergence evolved from the analysis, the necessity to see that power and knowledge converged in the work. However this requirement may be realized best in a decentralized organization.

When information and knowledge are products of humans' interpretation, it is evident that what is information and relevant input in the work varies from time to time and between individuals. I have mentioned accounting. There will be continued collisions within the work because of the contradictions between accounting practices as symbolizing (rationalizing) social action and its demands for being precise and objective truth. We will see continued efforts to circumvent such rules and laws. Flexibility and re-design are most important capacities and local solutions are most efficient, because they explicitly support what actors do and need in the work. In a coalition, this quality may be the winning concept, because if people cannot use their expertise, the organization will fall apart of its own weight. There is some evidence that what is a useful information system (technology) is open for interpretation.

7. Continued Work, Information Systems and Leadership

First, there is a consistency in my study between the conception of work as design, the design and use of IT, organization theory and information system theory. The central concepts of autonomy, rationality, and power have to be studied more, together with technology-as-action. Bucciarelli's [1988] study showed three kinds of discourse involved in design, constraining, naming and deciding: establishing the freedom of action, giving labels and names that allow action, and then decisions about what to do. This perspective on design as social action means that design work is

difficult to formalize, and consequently that IS *engineering* based upon mathematics is less suitable within large parts of it. Instead other strategies must be applied. Perhaps re-definition of goals, problems, and time-frames, everything else kept constant, is the success recipe? From other sources, research has produced insights about design failures which indicate that premature formalization is rejected [Shipman III and Marshall, 1999].

The theory which my study has developed promises to be a relevant guide for action because it is built from the practice, supported by empirical evidence of the unpredictability of the human nature, sometimes only amplified by control efforts. Research in the intersection between accounting and command will probably reveal more about fruitful (and counterproductive) social control practices. Another boundary in the work, worth studying, is the role and effect of law and legal matters on command work. Power is closely related to law but legal issues are normally absent in the abstract charts with their boxes and messages.

The common ideal of a system of systems may be irrelevant in coalitions because of the differences among participants as regards the lowest common denominator when it comes to technical capacity and social value. Another reason is that the multiple complexity of keeping both the internal command structure together and fighting a war may split the attention of the warriors; it is very difficult to do both. The modern battlefield or peace-keeping environment requires flexibility, it is highly unpredictable, and the flow of events may be impossible to forecast. Accounts from war how radio equipment is turned off during battle to avoid superiors' intervention [Pagonis and Cruikshank, 1992] underlines this.

Turning to information systems, there are a few guiding ISD principles for computer artefacts for command work. The primary concern is to facilitate communication and sensemaking, from the use of interfaces that provide overview of the capacities, that allows easy linkage of people, and admit informal communication. The second is about visibility. Because much work is invisible, either done in remote places, consisting of mental processes, or simply cannot be described in the absence of suitable concepts, efforts must be initiated again and again in order to augment its visibility, because what cannot be seen cannot be controlled. Scales Jr. [1998] underlined the use of liaison officers in the classical style, being the human links between forces from various nations. Lastly, a concrete example. Spreadsheet techniques allow overview, admitting people to build their own representations (computer applications) where they can visibilize work, study relations between objects, and make comparisons as the foundation for control actions.

I have deliberately avoided to discuss leadership but will make a few remarks on this topic, so central in the mindset of warriors. The theory model (Figure 2) describes leaders' behaviour as well. Because "leadership" tends to be moulded into a kind of technology in the search for still more reliable social control methods (along with cognitive engineering) it is used for augmented or maintained autonomy and power, stabilizing a chain of command. When similar actions are used by subordinates who rely on their interpretation of a situation it is called subordination (at worst) or negotiation (at best). The institutionalized dialectic of control has got the label "mission tactics" or "directive command" which satisfies commanders and followers: both parties get

satisfactory power and autonomy. Still, this “autonomy game” which commanders and (not yet) commanders are involved in must not be just a technology, but involve deeper social layers.

> Technology offers no panacea for conducting coalition operations, regardless of who the members are. [Scales, 1998, p. 7].

Instead trust builds coalitions. Complicating factors are that in coalitions there may be a cultural assymetry, culture being what people do, say and use, including values in order to socialize. Management by walking around exemplifies such efforts. The manager sees and is seen. Information systems which intervene will be avoided and circumvented even if they have a potential to be allies. This last issue signals what command research should be involved in. From my study it is evident that qualitative methods have made the difference and illustrated crucial issues. Another approach is likely to have left the cases without notice, maybe even defined what happened as anomalies. Such an outcome had contributed little to the knowledge of what command work is about, namely how people actively create their own reality and when satisfied, together can overcome most obstacles in their way. This includes handling the divergence-convergence issues, orchestrating what is behind the Wizard’s curtain and reducing him to less mythical proportions.

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