C2, INFORMATION TECHNOLOGIES AND SUBSIDIARITY: FROM THE ASYMMETRY OF INFORMATION TO THE ASYMMETRY OF KNOWLEDGE

Valérie MÉRINDOL & David W. VERSAILLES
Research Center of the French Air force

INTRODUCTION

The implementation of the information and communication technologies (ICTs) impacts the distribution of responsibility in the command and control (C2) chain. In some cases the introduction of new technologies may favor centralization; in others, they represent the source of new forms of delegation and decentralization. The various levels of the hierarchy may or many not take better decisions because they gain access to detailed data about the tactical situation. The introduction of a new ICT-related system results in diverse impacts and it turns out that the technologies cannot explain as such the new delegation processes.

Command and control systems have become always more complex for the last twenty years. The distinction between strategic, operational and tactical levels has been widely considered as an accurate way to analyze delegation actions because it grounds the relations in the separation between the politics responsibilities and the military ones. The distinction between each level of the hierarchy has become more complex since the end of the cold war. It varies considerably with the context and the composition of the coalition. It also depends on the rules of engagement which define the degree of coercion allowed by governments. The borderlines between the prerogatives associated to the tactical, operational and strategic levels have now blurred. The speed of information flow and the mediatization of conflict both increase the strategic effects of each decision made at the operational and tactic levels. In this context, there is no such thing as a unique model of C2 anymore but, rather, a global trend singularized as much as military interventions require it be adapted.

How is it possible to understand the impact of the ICTs on subsidiarity in military organization? Subsidiarity implies to strike a balance between the unity of political and military responsibilities on the one hand and the optimization of military operations efficiency

Correspondance :

Major Valérie MÉRINDOL - Lieutenant-colonel Dr David W VERSAILLES
Research centre of the French Air Force, CREA
BA 701 – F-13661 SALON AIR

tel (office) : +33-(0) 490 17 83 30 -- fax (office): +33-490 17 81 89
emails : vmerindol@cr-ea.net – dversailles@cr-ea.net

on the other one. The distinction between strategic, operational and tactical levels remains essential; but it is not sufficient to understand the principles of delegation and the impacts of the introduction of new ICTs. Analyzing the impact of the information systems on subsidiarity remains therefore highly difficult and generalizations require the recourse to specific concepts. This contribution addresses on the issue in elaborating on the difference between information and knowledge. Information is related to the messages and data flow. Knowledge is embedded to humane processes related to aptitudes, practice and accumulation of experiences. Information flows may modify individual and collective knowledge or not. The production of knowledge depends on learning processes, on individual and collective capacities. The natures of information and knowledge production and diffusion turn out as very different. This communication focuses on information and knowledge management in order to understand the variety of ICTs impacts on subsidiarity. This development incorporates considerations on the nature of military actions (air, land and naval operations), and also on the issue of their various combinations. This article addresses some critics to the NCW perspective of some alleged ICTs impacts on delegation. One deals with the possibility of increasingly generalizing delegation processes inside the C2 thanks to the introduction of new information systems. This contribution will conclude about information and knowledge management. The diffusion of data conditions the interaction between the tactical level and the C2 chain. Cognitive issues have to be taken into account. The main contribution of this paper lies in the dichotomy between information and knowledge in order to analyze the issue of subsidiarity.

The structure of this contribution reads as follow.
The first part deals with information specifications. The evolution of the access to information induces new ways for the interaction between the tactical levels and the C2 chain. We analyze the processes of information transfers and diffusion inside the hierarchy. The evolution of subsidiarity will be associated to the evolution of information asymmetries between the different hierarchy levels (1.1). This perspective implies that the prescriptive character of the tasks orders may be understood as a direct result of the management of the information asymmetries (1.2).
The second issue deals with knowledge and competences. Understanding the impact of ICTs on subsidiarity turns out as a necessity if one wants to address the problem of asymmetry of knowledge and the construction of competences inside the command chain (2.1). The construction of competences closely depends on individual and collective experience and remains deeply grounded in tactical abilities. Individuals have to fully understand and appraise the current specificities and constraints in association with the execution of action (2.2). Staff officers in charge of C2 decisions have to master a great variety of actions and representations models in order to interact efficiently with all units. Subsidarity deals here with competences asymmetry and seems at the core of the definition of efficiency.

I – DELEGATION, C2 AND ASYMMETRIES OF INFORMATION

1.1 - ICTS' IMPACTS ON COMMAND AND CONTROL

The delegation of authority depends on the transfer of and on the access to information inside the structure of the organization. The forms of command and control are related to quality and speed in the distribution / access to information. At any time, the introduction of information systems modifies its distribution and implies new forms of command and control (Cummings, 2003). Military organizations are often reluctant to introduce new information and communication systems because they are aware of the risk of loss of autonomy. For example,

in two articles published in *the Army and Navy Journal* in 1908, the hierarchy of the US Army and US Navy underlined the disadvantage of radio in military operations. The risk was analyzed in relation with the excessive centralization of decisions in the chain of command (Schoeder, 2001; Fitzinaud, 1998). In this case, the autonomy associated to each level of command and control resulted from difficulties to communicate inside the hierarchy. Less information implies an increasing autonomy at each level in charge of command and control. The same logic holds today. Autonomy creates information asymmetry inside the chain of command and reduces the possibility for the staffs to interfere in tactical actions. Symmetrically, when communication remains limited, decision centralization implies a risk of excessive inertia in the conduct of action.

The first lecture of the impact of ICTs on subsidiarity is related to information management. Delegation depends on the constraints affecting information processing and on its diffusion in the organization. ICTs modify the management of information and reduce the asymmetry between the different levels of the hierarchy as regard their access to information. More information provides the possibility to increase the centralization of command and control. Specific levels of the hierarchy may be tempted by the opportunities of directly interfering in the course of action through micromanagement (Vego, 2004). The 1991 operations in Kosovo exemplify this option. The possibility of exchanging via videoconference and text chat created new opportunities for strategic, operational and tactical levels to interact. History will remember that General Wesley Clark, SACEUR, interfered every day in the planning process and in the conduct of Air operations (White, 2002; Howe, 2004). His behavior induced tensions with Lt-General Michael Short who was in charge of NATO *Allied force*'s Air operations. Targeting mistakes have occurred and some decisions were made too late. Micromanagement seems to represent an inevitable practice in hierarchical structures (Gode Sanchez, 2005) because the distribution of authority is conditioned by the distribution of information. The temptation to control more of the subordinates' activities grows. These behaviors are frequent and they show off the organizational culture is characterized by the principle of autonomy of action. For instance, Schoeder (2001) points out that one of the consequences of new ICTs for the organization of the Marines corps tend to introduce new forms of C2 centralization when the Marines are characterized by a sharply different culture.

This situation where ICTs lead to more centralization may be balanced by others where new decisions opportunities have opened a range for increased delegation. ICTs offer new possibilities to access tactical information at each level of the hierarchy (David, 2004). For example, the digitization of the battle space affects (real time) the diffusion of the common operational picture (COP) at each level of the hierarchy. Each level may develop better decisions because it now accesses to all relevant data. Decentralization results from new practices and processes inside the organization; it is clearly associated to a better diffusion of information (Mérindol, 2005). One who devotes attention to military operations under the specific scope of ICTs understands that issues mainly refer to their impact on subsidiarity. All technologies introduced in the process impact the repartition of the information and the potential of each hierarchy level to process it. New opportunities to centralize or decentralize C2 occur in this framework and the delegation of authority will depends on the ability to assimilate, to stock and to translate data into coherent and useful elements for C2. It depends on the context, on the organizational culture, and on the personality of the officers in charge. The principles of delegation always represent a deliberate choice of organization aiming at maximizing the success of the mission.

The NCW doctrine focuses on the impact of ICTs on the reduction of asymmetry of information and on the possibility to decentralize decisions. According to the doctrine, alternative model of subsidiarity may not improve military action as much as it will/can. The lower the officers are constraints by informational loads, the more efficient they deal with opportunities in military action (Lambert & Scholz, 2005). The NCW doctrine implies a direct relation between the new possibilities of information transmission, the decentralization of decisions and *shared awareness*. In order to maximize the efficiency of Defense organizations, the NCW doctrine introduces the concept of *self-synchronization* as a new principle in military interventions (White, 2002; Hatter, 2000). This concept is defined as a specific aptitude of the military able to synchronize their actions thanks to well informed tactical units. Self-synchronization supposes the military to coordinate themselves at the right time for the right action without any specific intervention of the hierarchy. This reference is not easy to deal with. Specifically, the conceptual reference proposed by self-synchronization seems to be inappropriate for Air operations. This NCW doctrine suggests here forms of C2 which turns out to be extremely different from (and somehow inconsistent with) the US Air force doctrine. Davis (2004) considers NCW to be incompatible with the conduct of Air operations. How is it possible to explain this situation? The main reason is related with the fact that the nature of the military missions has not been taken into account. This is the topic to be inquired now in order to assess the impact of ICTs on subsidiarity and to check the advantages associated to the reduction of asymmetry of information.

1.2 – ICTs' IMPACT ON MILIEU SPECIFICITY

The levels of autonomy of decisions depend on the nature of military action. The level of prescription remains essential in order to understand the forms of subsidiarity (Mérindol, 2005). Prescribing actions supposes that the hierarchy has to detail the principles of each and every mission at the tactical level. Boukhouta & al (2004) point out that military officers act always within prescribed limits. The character of the prescription is visible through rules of engagement and via the transmission of commandment intent. Each level which is part of the command chain acts in accordance with the prerogatives and prescription introduced by the hierarchy. There actually remains some impossibility to delineate and prescribe all aspects of the missions. Paradoxically enough, the NCW doctrine does not say anything about the level of prescription associated to military missions. It is open to any kind of situation, whatever their prescriptive level. The NCW doctrine invokes the possibility of decentralization and spaces of self-synchronization as if it were to always apply spontaneously in an efficient way. The so-called 'uncertainty of war' which echoes the usual aspects of radical uncertainty as it is known in the methodology of the social sciences (Versailles, 1998) does not lead to specific conclusions: the doctrine calls upon ICTs and the decentralization and self synchronization principles as omnipotent solutions suited to conduct military operations in the information age (Mérindol, 2005).

In specific cases, the hierarchy defines not only the mission's goals but also the modalities of action. Orders are detailed. Air operations illustrate this situation. The conduct of Air operations implies to codify all known parameters. Air operations are planed 48 hours in advance and programmed for the next 24 hours. A recurring process of execution, programming and planning occurs, where all three staff activities overlap and complement in a continuous production of task orders: the information flow does not stop during the operations (Gomez, 2003). Air tasking orders transmitted to the pilots are very precise. In this context, his autonomy is reduced. Command intent must have been made explicitly precise and detailed. Pilot's initiative deals only with events which cannot be planned. Staff officers

exemplify this situation with a mission sharing a bombing action between two planes. The first pilot could fire the target(s) assigned to him without any problem but it was possible for the second one. The distance between both planes was too narrow and the pilot of the second plane has not been able to visualize his target(s) anymore because of the fog induced by the first bombing action. He then decided to deliver his weapons on another target close to the one assigned to him, in paying attention to the prevailing RoEs and to the risk of collateral damages. This case illustrates that some autonomy exists at the level of the pilot, yet it is remains strictly limited to some tactical prerogatives.

In specific cases, the hierarchy cannot prescribe detailed tasks in the orders. Orders are related to the mission's goals only. They are limited to generic principles of action because the hierarchy does not want to prescribe the action or can not detail the "how to do". The impossibility to prescribe actions results from uncertainty in military operations. In such cases, the decision has to be delegated near to the tactical commanders. The autonomy remains necessary to action, even if decision may have strategic impacts. The "fog" of the war and the characteristics of the battlefield reduce the possibility of C2 centralization in military missions. For example, in land operations, Reilly (1997) points out that the company commanders have to make numerous decisions about logistics engagements, redefinition of priorities, and the cut of hierarchy contacts... The tactical action's paralysis occurs when excessive centralization has been made. The same specificities exist for naval operations. In specific operations, autonomy of commanding officers is related to less detailed orders than in prescriptive action. The hierarchy is not going to detail the "how to act". It remains limited to the definition of the main goals. Command intent constitutes a set of guide principles (Boerchert, 1998; Hatter, 2000), and allows centralization or decentralization of actions depending on the contexts. The respect of each level of hierarchy prerogatives is considered as fundamental.

The prescription character of action explains the range of application of the OODA loop. In non prescriptive action, the OODA loop is only applied to specific phases of military actions. Conversely, in prescriptive action, the OODA loop does not have any interruption. The situation facilitates the centralization of C2 which is justified to perform military operations. The flexibility of military operations is not grounded directly in the increase of delegation but in specific uses of information flows in the centralization process. The OODA loop relates to information management (Allardice, 1998). The improvement of quality and speed of information exchanges inside the OODA loop is important to understand the C2 centralization. The flexibility of Air operations, for instance, is grounded in the improvement of information management and automatization process which both allow to the increase centralization of decisions.

ICTs implementation has many impacts on the selection of information. They facilitate the integration of known parameters in military planning and programming. They allow for the regular adaptation of task order and plans to the context. The more information system performs, the more phases in OODA loop may be centralized in the C2 chain. In Air operations, the informational flow is essentially vertical. As Woodcost (2005) underlines, the Air commander remains the unique authority. All information bypass by him and the opportunities for the strategic level to interfere in operations increase with the improvement of ICTs use. The flexibility of Air operations relates to the increase of speed and to the efficiency of time management of the OODA loop. From the perspective of information management, the introduction of ICTs induces more centralization of C2 than before. The synchronization of prescriptive action is not grounded on the *self synchronization* defined in

the NCW doctrine. It depends on the codification of tactical parameters and on the automation of information via ICTs. *Shared awareness* is important but its content does not deal with the aspects mentioned in the NCW doctrine. It is reduced here to an immediate understanding of the battlefield (characteristics of the enemy's forces, geographic characteristics) and to the understanding of rules of engagement. The main problem of coordination in prescribing actions does not relate to a problem of *shared awareness* but to a problem of sharing *situational awareness* among militaries.

The impact of ICTs on non prescribed actions is very different. Coordination and synchronization of military actions are not grounded on codification and automatization of processes and information as it may be the case when dealing with the processes associated with the production of goods and services in private companies. As in civilian production activities, coordination and synchronization require that routines, values, automatism, mental models of action are shared among the hierarchy (Paparone and Crupi, 2002). But it goes a bit further. Coordination requires not only to share out *situational awareness* as the common perception of a specific environment, but also to increase *shared awareness* which relates to the interpretation of the reality [situations] in the general framework of decision processes. Shared awareness mainly depends on learning processes and on transmission of knowledge. In such cases, *self synchronization* seems a concept to be adapted in order to improve the flexibility of military organization. The delegation and the autonomy of tactical level remain important. The reduction of asymmetry increases the opportunities to delegate inside the chain of command (subsidiarity). Miller (2001) underlines the particularities of application of NCW concepts to naval operations. The implementation of ICTs modifies the distribution of information inside the C2. In naval operations, each officer in charge of command responsibilities will benefit from the flows of data and from the multiplication of exchanges with the hierarchy thanks to ICTs use, going for beyond the description of the positions on the battlefield. Virtual collaborations increase the exchange inside the hierarchy and contribute to the implementation of the military strategy. ICTs' use may introduce more delegation. The model of subsidiarity as defined by the NCW doctrine seems to be well suited to a double top-down and bottom-up process between the officers in charge of command at the various levels dealing with the tactical and operational levels. Miller (2001) explains the global action plan at the operational level emerges from this collaborative interactions allowed by ICTs. However, the consequences of the implementation of ICTs on subsidiarity are not automatically associated to the decentralization of decision. The risk of centralization exists because ICTs introduce a kind of "virtual presence" for specific actors who may interfere in local decisions as they are precisely in charge of non-local decisions during the same command process. ICTs therefore offer a new range of possibilities to precise command intent. In the end, upper levels of command do not provide anymore a framework for local action to develop on an autonomous basis: their intervention is associated to prescriptions for local action and reveals tendencies to micromanage military operations.

The risk of the implementation of ICTs deals with the rise of prescriptive behaviors by the hierarchy. The delegation model suggested by the NCW doctrine is well adapted to actions which may be prescribed on a sound basis but many organizational adaptations are necessary to reach such a situation. They imply specific military training and suppose that the working processes be adapted. Understanding the impact of ICTs on subsidiarity implies obviously to take into account the asymmetry of information but it is clearly not enough. Action also refers to interpretation schemes and their convergence does not rely on information flows only. It becomes necessary to develop about the knowledge processes specificities in the C2 chain. The development relates to the skills embedded in individual and collective experience.

II. DELEGATION, C2 AND ASYMMETRIES OF KNOWLEDGE

2.1 ICTS AND THE MANAGEMENT OF C2 COMPETENCIES

Understanding the whole problem associated to ICTs impacts on subsidiarity requires an account of the interaction between information flows and knowledge assessments. Competencies become the core concept to be developed and focused on. Their evolution remains necessary in order to improve ICTs' use and to develop new functionalities of information systems.

The position of decision-makers is related to abilities to decide and take initiatives aiming at conducting missions. In a contribution about knowledge management in civil organizations, Child (2000) analyses top-managers competences. He considers that decision-makers have to master *strategic knowledge* assets which are required to head teams, mobilize all energies and reach common goals. The competences of a decision maker are built on individual and collective experiences and practices. They refer to behaviors and to personals skills such as leadership, intuition, etc. The definition of the prerogatives associated to command and control clearly depends on the efficiency of the implementation of *strategic knowledge* assets at each level of the hierarchy. Subsidiarity is based on the distribution of these assets towards the lower levels of the hierarchy and the construction of competences inside the C2 chain relates to the opportunities to re-incorporate them into new decision processes. Fact is that *strategic knowledge* is very difficult to transfer. It is embedded in minds, experiences, behaviors and social interactions. The main problem arises with the irremediably tacit character of *strategic knowledge*. The possibility to develop new (joint) operations via ICTs uses implies new problems of coordination and grounds in knowledge articulation. The consistency of mental schemes inside the C2 chain turns out as a strict necessity required to coordinate various military actions. Increasing *shared awareness* implies that numerous difficulties associated to learning processes are solved thanks to the construction of a common basis for interpretation. Strategic knowledge precisely represents this framework.

Sharing knowledge mechanism remains different from transferring information. It depends on individual and collective competences and abilities; it requires the multiplication of interactions. ICTs contribute to increase interactions inside the C2 chain. For example, Air C2 needs less and less to be collocated, which has an impact on the appraisal of vulnerability for Air operation Centers (AOC) (Woodcost, 2005). ICTs' new interactions offer a range of exchanges and of communications varieties but the knowledge transfer associated to virtual collaborations and "face to face" interactions do not ground in the same mechanisms. All media affect the context of communication in some way. Regulating interactions and understanding conversations via ICTs supposes specific transaction costs issues. Wainfain & al (2005) point out the importance to work out complex solutions in order to make sure that people know each other personally before entering into virtual collaboration and using it efficiently. Socialization facilitates common understanding. Shared awareness is associated to the mechanisms of acquisition and transfers of knowledge. It deals with complex learning processes and results in sharing experiences and reference models for action. This is the reason why the AOC may be set up anywhere where organizational features may improve its efficiency. It may be set up aboard a ship if this efficiency would result from Air and Naval C2 collocation based on increased "face to face" opportunities. In such cases, collocation only is not a reason for success because common experiences and reciprocal acculturation are required to guarantee the quality of common understanding between hierarchies.

The implementation of ICTs does not reduce the problem of asymmetry of knowledge inside the chain of command. A large focus on the technical aspects related to ICTs may even increase the risk to minimize the role of competences required to think about subsidiarity. The NCW doctrine provides an illustration of this phenomenon. The omnipresence of the reflection associated to ICTs implementation ignores most part of the organizational aspects. In reality, the dispersion of information does not cover the same aspects as the minimization of knowledge distribution in C2 is concerned with. Information may be present and not processed in the relevant way; it might even be misinterpreted because of wrong reference patterns. The NCW doctrine supposes that more information may automatically result in better decisions (Allardice, 1998). It is all not so simple.

The first problem relates to time-processing delays inside decision-making. ICTs compress delays thanks to the increase of information flows speed. However, decision requires an incompressible time dedicated to thinking. Spedero (2004) illustrates this point. *Time sensitive targets* (TST) often describe strategic and moving targets. The shooting decision remains centralized in the chain of command according to the strategic value of targets. The incompressible delay before shooting as it is materialized by the OODA loop turns out to represent the counterpart of the incompressible decision and evaluation processes assessing the effect of the operation. Whatever the level in the preparation of decisions, the assessments associated to decision are independent from the technical efficiency of the OODA loop (information flows) and from the automation in the treatment of information. Time processing may even not be compared. When it deals with the technical aspects of the OODA loop information transfers, time passes by at the speed consequent to the technical solutions introduced in the C2 chain. When it deals with decision processes, time depends on brains and connections between the individuals' brains which need to interact. Compressing delays cannot rely on the same procedures and on the same preparation, even if it always deals with preparation, programming and training.

The second problem deals with the risk of the increasing interference of the hierarchy inside local decisions. Upper staff levels officers feel that they *can* decide instead of their subordinates because of the improvement of information and communication system give them such a practical ability (Sardiello, 2004). The hierarchy may feel that it understands via virtual interactions the local situation as well as subordinates on the battlefield do. These situations remain very dangerous. First, lots of personal attitudes and feelings (such as fear…) cannot be virtually exchanged. The limits of ICTs are here associated with the nature of the data transferred. Personal feelings may be exchanged yet they cannot provide a basis for sound interpretation if people do not know well each other before. Increasing knowledge exchanges via ICTs does therefore not imply automatically an improvement of coordination and of *shared awareness*. The risk also relates to underestimating the specific knowledge necessary to the decision process. Tactical decisions require *technical knowledge* associated to the practice of technology and weapons systems in the conduct of military action. It is conceivable that the hierarchy may minimize the obsolescence of its own technical competence. Staff decision-making closely depends on individual and collective experiences related to tactical abilities. As careers evolve and develop, the accumulation of experience allows for higher level responsibilities but, at the same time, the ability to endorse intermediate functions decreases because individual do not master the technical competencies required by the operational life at the relevant level anymore. Technical changes and the evolution of weapon doctrines imitate the ability of the top level hierarchy to take over specific activities. Woodcost (2005) points out that Air C2 involves perishable skills that

atrophy in the absence of training or in the introduction of new technology. The subsidiarity implies to take into account what each body and each brain know best at specific moments of the career.

The third problem relates to the risk of mislay competences in C2. ICTs affect the quantity and quality of interactions. It may even be thought of ICTs as to increase both the interactions quality and quantity. The situation implies new behaviors at each level of the hierarchy in the chain of command and, progressively, the construction of *strategic knowledge* is modified. ICTs gradually allow unbroken interactions between strategic, operational and tactical levels (Sardiello, 2004). Individuals very soon realize that they have become dependent from the organization of labor rooted in the interaction based on ICTs. Usually ICTs implementation starts with a joint reference to the ICTs and traditional coordination modes. After some time both organizational practices cannot be exercised at the same time anymore, and the preservation of non-ICTs techniques becomes an issue. What is it to happen is suddenly networks and communications fall down? Such risks always existed, yet the systemic risk associated to the potential collapse does reach now huge levels of concerns. Here again, the first reaction most often deal with practical and technical aspects. The problem to be raised here deals with the individual competencies associated to the techniques. Military officers (both at the staff level and in the tactical missions) progressively lose the competencies associated to non-NCW doctrines, which is not only normal but also turns out as a necessity. At each level of commandment decreases the ability to make decisions without referring back to the hierarchy which is on the other side of the ICTs network (Cumming 2003). When the connection is broken, the vulnerability of forces rises because the ability to take initiatives is reduced or, even in some cases, lost. We come here very close to a problem of training both for the tactical and staff activities. The issue is puzzling, because it is highly disputable whether both competencies may be installed in the very same brains without setting up at the same time psychiatric diseases. Sound technologies management requires maintaining both types of units and competencies on the short run, but sooner of later the generalization of ICTs will induce a major change with the transfer to the other side of an organizational break-through innovation. This radical transformation may induce new sets of vulnerability at the level of the humane knowledge and competencies.

2.2 ICTS AND THE EMERGENCE OF JOINT COMPETENCIES

Knowledge is told to represent (and result from) an embodied practice (Amin & Cohendet, 2004). The problem does not deal only with the coordination of individual practice(s) as it has already been presented in this contribution with the conciliation and coordination of various competencies in order to fulfil specific missions. In reality, Amin & Cohendet adapt a traditional view of knowledge and learning theory (Boland 2004, Versailles, 1998) and focus on the way new competencies are introduced in the complexity of coordination. Knowledge embodies a complete set of (provisory true) answers to the problems raised by the operational life. Each individual refers to theories and real-life experiences. His competencies elaborate on the interaction between case situations and tasks: the efficiency of the solution is appraised in comparing the initial goals to the results. Success (for the theory, for the attempt) occurs every time the results match the initial goals. The broad logic described here does not change when coordinating numerous people in order to solve a complex problem. It just enlarges into the problem of articulating the various individuals' knowledge sets and trajectories, which is not an easy theoretical problem as such. In reality things are quite easy when dealing with military missions, because all people involved in the activities are mobilized towards the same common goal: they coordinate on the basis of their specific competencies and all converge

towards the same objectives. The various contributions rely on their various knowledge and learning trajectories, which complement each other in order to achieve at the complete set required by the current mission. As Amin & Cohendet argue, articulating spaces of knowing echoes the division of labor.

It is important to our topic to deal with the possibility of managing the radical transformation of ICTs' introduction in the repartition of actions associated to military missions. It is then necessary to explain not only why we have come to the current situation but also to address how we can come to an efficient use of ICTs. It represents an autonomous problem, which subdivides into two aspects: the first one relates to the condition prevailing during the learning stages of the process, and the second one to the compatibility of the results of the learning process. Dealing with the military and its interventions, the "space of knowing" closely relate the milieu where individuals live, behave and work, which is of crucial importance because it represents their "learning space". This last section will develop that the construction of individual knowledge closely depends on the "learning space" whereas the construction of coordination grounds in a learning process made of interaction and mutual consistency. Learning trajectories are "sticky" or, in other words, context-dependant and milieu committed. Here the military reference to ICTs raises an interesting issue because the problems to be addressed in each milieu do not deal with the same tactical constraints and to the same spaces for knowing. Decision and action schemes depend both on the space where knowledge and learning occurred. Paparone (2002) underlines the impossibility to transpose a schema of action from a specific context to another. For example, the application of the OODA loop is determined by the tempo of action and by the character of prescription (Mérindol, 2005). The great variety of specificities and constraints associated to land and to air operations explains why the outline of action cannot be transposed directly from an activity to the other one. Strategic knowledge is associated to the specificity of military missions, to the technical knowledge required for mission management and to the associated organizational processes. The character of prescription, routines and speed of execution are different to air operations and naval operations. Such knowledge is partially unconscious, internalized in individual and in collective behaviors. Subsidiarity relates to and follows the variety of decision schemes associated to the nature and context of action.

The construction of *knowledge* is contextualized. In this perspective, the impact of ICTs on subsidiarity is related to the possibility to elaborate new sets of knowledge and, therefore, new contexts. Exchanging and articulating *knowledge* depend on the contexts where it grew up. Bechky (2003) analyses the transfer of knowledge between communities in civil organizations. He concludes on the impossibility to directly transfer knowledge from a specific context to another one. As soon as a community communicates to another one, new knowledge diffusion implies a process of adaptation and the appraisal of efficiency of knowledge to the reality to be grasped. In this perspective, the diffusion of ICTs implies new forms of transfer of knowledge (Lundvall & al, 2002) because new attitudes, new practices are set up in the every-day life of the agents. Opportunities to increase military coordination offered by these technologies introduce new problems because concepts essential for the organization of the missions such as centralization and control now endorse new contents. A close appreciation of subsidiarity under the perspective of ICTs implies in reality the combination of two different processes. The first one relates to a common perception of the main C2 principles. The second process explains how the variety and complexity of military applications implies new forms of joint (inter-services) articulation and a specific analysis on the compatibility of decision processes.

Coordination makes it at least compulsory that the main important reference patterns be coordinated, even though the whole learning processes does not cover exactly the same steps and determinants. It turns out that the joint use of ICTs at the level of large organizations reveal most often coordination paths for which activities did not evolve along the same lines. It is then important that the various aspects for which coordination has to occur follow the same interpretation lines. If the main patterns shaping the whole analyze represent discrepant options for the sub-groups searching for coordination, then the convergence between the subgroups will hardly occur. On the other side, if a common authority is able to let consistent solutions emerge at the overall level, then coordination might occur. In the realm of military operations, it might be already enough to then organize the joint meeting required to train and convince that joint operations are possible. In that case forms of codification and a kind of standardization of knowledge are developed around the main important reference patterns on a separate basis, but the individuals are trained together in order to make joint commitments and missions possible. Dealing with command and control in military operations such as close air support, the combination of aerial facilities and of the Special Forces during the operations in Afghanistan might illustrate the point. It is important to bear in mind that most of these missions are targeting objectives of higher strategic importance which are accordingly appraised and investigated. Once the political and military decisions have been made (at the highest level of decision) and have led to tasking orders, missions barely represent a coordination issue in the framework of the common OODA loop. For each contributor, ICTs do not represent a specific added value but for the reduction (and minimization) of coordination costs. Aerial intervention has to occur on the basis of rather limited number of planes and in delivering precise ammunitions. At the origin of the OODA loop initiation, Special Forces need to identify the targets with a high level of precision. It is then required that they keep all necessary contacts to guide and coordinate the intervention(s) toward the target. At this level, the introduction of ICTs can conciliate the various cultures and routines developed in the milieu each groups knows best, and at the same time opens a new space for coordination (Danskine 2000). The original organization in each subgroup is not affected by the joint operation and joint training merely develops new competencies in the framework of existing knowledge trajectories. Learning processes are much more affected by the organization set up during the 2003 operations in Irak (Harrison 2005). Fire decisions were totally centralized and problems arose because of the routines of the various services, here in the previous case the ones associated to the Air force and to the Special Forces. The general articulation of the rules of engagement does not refer to the same references when dealing with combat jets engaged in close air support and with Special Forces. The engagement decision had been made possible for the Special Forces on the basis of counter-fire operations (trajectory identification opening the possibility for counter-battery fires) whereas the pilots had to visualize the targets first. In this precise framework, RoEs materialize and codify different rules of conduct for each milieu (Spedero 2004). If one wants to coordinate the aerial forces engaged in CAS missions and the Special Forces on a larger basis, another codification must emerge, which does not necessarily imply that actions schemes and routines specific to each milieu must be ruled out and merely replaced by new ones. A common perception of the RoEs and converging appreciations of the milieu are enough to provide the various actors with coordination.

The other case mentioned above faces problems which cannot be overcome thanks to standardization and codification. The necessity for new forms of (joint) articulation has been mentioned in order to make coordination emerge, and the compatibility of decision processes exist. As compared to the previous situation, routines and actions schemes attached to the same milieu are not together consistent. The analysis reveals that the various positions are

rooted in specific tacit knowledge framesets, which lead to diverging interpretations of the same reality (whatever its level of complexity). Sharing the same interpretative schemes requires then a convergence starting from the deepest elements explaining tacit knowledge. In the most frequent situation, reconciliation only occurs if some actors accept to walk (at least a part) of the way towards the others: the process leads to explicit parts of the previously tacit knowledge characterizing the various actors in order to share it and make it the ground for common interpretation schemes. A common learning process installs and complements the each of the previous knowledge sets. The main danger is associated to the potentially of abandoning or of forgetting the basics of the respective identities in the same time new learning processes and new knowledge sets are jointly shared by the actors. The case of joint aerial operations mobilizing the Air force and the Navy has been often evocated: the introduction of joint ICTs allow for a mobilization of all available planes required to engage the various targets and threats to the benefit of the command in charge, whatever it may currently emanate from the Air Force or the Navy. This situation would remain clearly transparent in other countries where joint activities have now become normal because of a smaller military format. Hatter (1999) explains that specific coordination problems emerge. According to him, knowledge framesets are not exactly covering the same elements; different routines and working modes have been elaborated for a milieu and for missions which remain, basically, the same even though the jet planes are not totally equivalent. This asymmetry leads to different rules of engagement and to diverging interpretation of the same tactical situations which are not in relation with the situation itself, but rather show off as a consequence of the routines developed during the learning and training processes. How much might cost such a new convergence for the institution and for the individuals? This question remains wide open. It does not only affect the efficiency of the missions but also the whole identity construction in each service. Here we touch the difficulty of introducing a joint culture, which represents in reality the very kernel of the NCW revolution.

3. CONCLUSION

This communication has stressed the importance of the dichotomy between information and knowledge at the moment to inquire C2 organization and subsidiarity effects. The NCW doctrine provides now the US services with new organizational structures (“joint”) and with new coordination patterns between the officers in charge of tactical and operational levels. Even though the NCW doctrine invokes self-synchronization and decentralization as two prevailing principles, it reveals in reality that an interpretation of ICTs which remain limited to information transfers. It seems that the doctrine could benefit from considerations associated to the ways knowledge is transferred and diffused among the people, and from the introduction of cognitive models into the argumentation on subsidiarity.

C2 competences require taking into account a great variety of situations and action schemes, all of them impacting directly the potentiality of working out an efficient coordination. One who focuses on the exercise of responsibilities at all levels of the military hierarchy thanks to knowledge-related assessments will automatically realize that the whole cursus must itself be perceived as a mere training course: officers need to realize as soon as possible the true domain of their prerogatives in checking carefully the levels of delegation they are consented in each situation. If this solution is associated to joint training and joint operational interactions from the earliest stages in the exercise of responsibilities, common and mutual understanding will also arise. A common learning process will install and complement the interpretation specific to each milieu and culture. The main important question will then deal with the preservation of the efficiency of each actor in a framework where individuals might be led to abandon or forget the basics of their own identity and professional efficiency.

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