Taking Articulation Work Seriously

— an activity theoretical approach

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Abstract: All work needs to be articulated in terms of "Who should
do what, how, when and where", and this becomes more complicat-
ed as more actors are involved. The use of computers in cooperative
work implies new needs for articulations due to the individual's dy-
namic and changing situation in respect to collective and individual
aspects. The *computers* should mediate both categories of activities,
without hampering the alternation between them. In the conceptual-
isation of articulation work, the paper presents a framework that is
aimed at exploring and analysing this complexity of articulation. Ba-
sic principles from activity theory constitute an appropriate ap-
proach in this respect.

1 Introduction

The concept of articulation work was introduced by Anselm Strauss
(Strauss 1985; Strauss, et al. 1985; Strauss 1988; Strauss 1993), as an
analytical framework to understand and explore the interwoven na-
ture of mutually dependent actions of collaborating actors.

This concept is introduced in the research field of CSCW by Schmidt and Bannon (1992), using it to give this research field a focus in terms of understanding societal organised work situations.

The concept of articulation work is promising to CSCW research (Schmidt and Bannon 1992; Schmidt 1994; Fitzpatrick, et al. 1995; Simone, et al. 1995; Divitini and Tuikka 1996). We argue however that there is a potential for further benefit from this concept if also individual aspects, and the tension between collective and individual aspects of action, are more focused.

The boundary between individual and collective activities is dynamic, in the sense that people continuously shift between different work-related actions. Collective activities are punctuated by activities of the individuals and vice versa. Moreover, this basic feature of work constitutes a challenge for computer systems development (and hence design). A computer system (together with other technologies) should mediate actions involved in both categories of activities, without hampering the alternation between them.

The aim of this research is to develop a conceptual framework that addresses the computer systems' integrated role in the interwoven nature of individual and collective activities, and hence allows to explore how the computers influence and are interpreted in this respect.

We are using mainly conceptual analysis in our approach, although some empirical work (Smørdal 1996; Fjuk and Dirckinck-Holmfeld 1997; Fjuk and Sorensen 1997), is used as a basis for our conceptual development. Strauss' (1993) theory on action gives empirically based accounts of an inherent part of any work, the articulation of action and actors in order to create and maintain a total arc of work. However, as will be explored in section 2, there is no clear notion on artefacts and how they influence and are interpreted in work and there is a weakly recognised concept of context for analysis. In section 3 we argue that an integration of activity theory (Leontjev 1983b) and Strauss' theory on action will enrich each other. Activity theory gives conceptual accounts of work and development, and the role of artefacts (like the computer) within social contexts. The contribution from activity theory is an operationalisation of articulated actions in terms of how the work is done. Hence, we argue there is a potential for CSCW research if these two powerful approaches are integrated.

2 Problems in the use of articulation work

2.1 Articulation as a basis for understanding cooperative work

The concept of articulation work was developed by the sociologist Anselm Strauss in order to analyse and understand the interwoven nature of mutually dependent actors in their division of labour (Strauss 1985; Strauss, et al. 1985; Strauss 1988; Strauss 1993). The framework has a strong empirical basis in his many years of study of medical work in hospitals.

Strauss (1993) defines articulation as

> "the coordination of lines of work. This is accomplished by means of the interactional processes of working out and carrying through of work-related arrangements. Articulation varies in degree and duration depending upon the degree to which arrangements are in place and operative." (ibid., p. 87).

Work arrangements, such as projects, involve a course of action which entails a division of work in the meaning of both actors and actions. Thus articulation work is more flexible than the connotations applied by the concept of 'coordination' and connotes far more than scheduling and allocating resources. Articulation work connotes articulation in terms of the actors and meaning (e.g. beliefs, attitudes, perspectives, etc.), tasks, responsibility (obligation, commitment), conceptual structures, time and space. The individual actor has a central position in the concept of articulation work, in the respect that articulation in terms of both actors and actions is present in any work situation. However, when more actors are involved and are in some way mutually interdependent in work, articulation work becomes more obvious and required. The plurality of actions, as well as the relations of actors to actions constitute the totality of work required with respect to the salient dimensions of who (the individual actor) are doing what (action, outcome, objective), where (the context of actions in terms of time and place, cultural - and organisational belongings, etc.) and how (the process of putting the actions into operation). These salient dimensions of work are mutually interdependent, which may indicate that the needs for articulation vary according to the work situation.

The application of articulation work as framework for analysing work, makes only sense if this interdependency is taken into consideration.

Central to the coordination of lines of work is the interwoven nature of interaction and action:

"Actions are embedded in interactions—past, present and imagined future. Thus, actions also carry meanings and are located within systems of meanings. Actions may generate further meanings, both with regard to further actions and the interactions in which they are embedded." (Strauss 1993, p. 24)

The interactional processes are the strategic means by which the action processes are maintained, strengthened and supported, i.e. to get the whole work done. Examples are negotiations, persuasion, manipulation, threat, etc. The action processes are those which characterise the various forms of work, such as obtaining and maintaining resources; deciding who does what tasks, when, where and how. The various interactional processes are shaping conditions for articulation as the individual actors' perspectives profoundly influence the actions and interactions.

[T]he multiplicity of perspectives ensures a richness of interactional flow, because representativeness varies from interaction to interaction and within the interaction itself. Multiplicity also guarantees that courses of action, except perhaps quite brief ones, will have elements of surprise, will produce their own contingencies quite aside from the external ones" (Strauss 1993, p. 252)

Both internal factors, embedded in the work arrangements, and external ones—such as technological, cultural, organisational, physiological, economical—are parts of actions as they influence and may change the course of actions. Star (1991) points to the unanticipated contingencies and breakdowns as central for articulation work, in order to "get things back 'on track' again in the face of the unexpected" (ibid., p. 272).

In agreement with this, Strauss (1993) distinguishes between two levels of actions; the routine and the problematic:

"Problematic interactions involve 'thought', or when more than one interactant is involved then also 'discussion'. An important aspect of problematic action can also be 'debate'—disagreement over issues or resolutions" (ibid., p. 43).

However, most interactions are routinesed:

"Actions and counteractions are expectable; often repeated; governed or guided by rules, regulations, standardised procedures, agreements, or understandings." (ibid., p. 43).

Moreover, the dynamic interplay between problematic and routine action is the basic of an interactionist theory of action. Complicated and complex actions cannot take place without the routine

actions, and the usually taken for granted skills and abilities. And routines may be changed, and turn over to complicated actions caused by contingencies.

In agreement with the two major levels of action—the planned and situated articulating work—is the explicit and implicit articulating work. When people are assigned to coordinate certain aspects of cooperative functioning, they are doing explicit articulation work (Strauss 1988). In contrast, the more invisible but invaluable work—for instance a considerable part of clerical work—is termed implicit articulation (ibid.). The explicit articulation is thus connected to the planning and decisions regarding the salient dimensions of work—who, what, when, how—while implicit articulation is invaluable when carrying out activities in situated circumstances, in order to handle contingencies.

2.2 How articulation work have been applied in CSCW research

Although collective, each activity in cooperative work is conducted through the actions of individuals, directed toward a work-related objective or another individual. The individual does not function in isolation, and her/his activities cannot be understood or explained without taking into account the social setting, the collective within which s/he is functioning. Even less can we understand the collective without considering its individual members. This is the mutual interdependence which Berger and Luckmann (1966) characterise as 'dialectical'.

Following this basic assumption on work—as the tension between individual and collective aspects—the CSCW research field has almost exclusively focused on the collective side of this dialectical relation. Moreover, the focus has been on the product of a collective activity rather than on the process itself (Heeren 1995).

This constitutes a gap to the original interpretation of articulation work in which the individual actor and her/his action have a central position.

In the meaning of articulation work, the collective side of work is centred around the three major interpretations: Coordination mechanism (Divitini and Tuikka 1996), management of work flow (Schmidt and Bannon 1992), construction and management of common information space (Schmidt and Bannon 1992). Moreover, CSCW has been aimed at representing concrete or abstract products or outcomes of the actions (such as memos, letters, minutes, etc.), and

not explicitly on the actions done on the representations and the processes of putting them into operations. Although problematic actions amongst collaborative actors—such as negotiations on the present objects, common problem solving, etc.—are emphasised in order to make the work flow possible (Schmidt and Bannon 1992), the what-dimension of articulation dominates at the cost of the other causally interdependent dimensions.

The what-dimensions are from a theoretical point of view similar in any artefact-mediated activity. However, how the actors are putting the actions into operation is dependent on the functional conditions embedded in the mediating artefact and the general collaborative nature of the computer systems. Let us for a moment use simple and asynchronous text-based e-mail systems as an example. These applications are well known for being obstacles for problematic and collective actions involved in negotiations and consensus seeking. The lack of immediate feedback (Eklundh 1986), the written communication style and the dominating non-verbal situations (Feenberg 1989; Sorensen 1994), make complicated actions, in which multiple actors are involved, both time-consuming and problematic to fulfil especially when deadlines are near. Problems of putting the actions into operations and break-downs caused by the applied computer system, may cause extra work for the collaborative actors as the actions might become even more demanding for the individual (Fjuk and Dirckinck-Holmfeld 1997). On the other hand, the computers may reduce some parts of explicit articulation as the cooperative actors implicit may be able to get insight of the others' action through a shared database.

The illustrated problems are not necessarily a consequence of (in this case) the text-based and asynchronous nature of the computer system, but of the where-dimension in its own right. In work situations in which the actors are sharing both time and space, the different lines of work are often tacitly or implicitly carried out. A joint physical presence makes unconsciously coordination and adjustment possible.

This indicates that the practice of computer-mediated cooperative work is a complicated phenomenon influenced by several mutually dependent dimensions. In applying articulation work seriously, the mutual relationship between who, what, how and where need to be explored in an analysis of work. The how (and in many cases where) dimensions are related to the properties and conditions of the

computer system and can be viewed as external factors. Following Strauss' interpretation, the artefact is thus an indivisible part of action as it influences and changes the course of action. In such a view, the computer system has to be viewed as incorporated into the total arc of work—as an incorporated element of the wholeness—influencing and changing the salient dimensions of lines of work and a creating a requirement for new articulation needs (Nurminen, et al. 1994; Fjuk, et al. 1995).

We agree with Schmidt and Bannon (1992) that CSCW is basically a design oriented research field. Consequently, a theory on work should address the dynamics in work which creates and drives development, both in terms of humans, work organisation and artefacts (like computer systems). We feel that the theory of articulation work comes short in this respect, because it is developed in order to analyse current work arrangements. The next section will explore how we integrate the theory of articulation work with activity theory in order to address development and design.

3 An activity theoretical perspective on articulation work

Articulation of work connotes far more than scheduling and allocation of resources. It connotes the relation between actors and between actors and different levels of action, and the unforeseen contingencies caused by these relations and external factors such as technology and economy.

Although Strauss (1993) recognised external factors as parts of action, the concept does not in any strong sense explain how these factors influence the actions, and what impact this may have on development of technology. In order to take articulation work seriously, we need an approach that more thoroughly and explicitly take this into consideration.

This section integrates basic notions of activity theory, which we find promising as an approach to address the concerns mentioned above, with Strauss' theory on articulation work.

Activity theory originated as a psychological theory giving a notion of context to human actions in the world, in the sense that an activity orients a subject in an objective world. Central to this interaction is a motive, which is fulfilled by means of the activity and

thus explains why an activity exist. The conditions the society gives to the motives and goals for activity are stressed by Leontjev (1983b), whose work are commonly accepted as in the core of activity theory.

Activity theory addresses individual human beings (Kaptelinin 1996b) and to the individual-psychological level of human activity and consciousness. However, the subject's mutual interaction with a social world is important:

"Only through a relation with other people does man relate to nature itself, which means that labour appears from the very beginning as a process mediated by tools (in the broad sense) and at the same time mediated socially" (Leontjev, 1981 #154, cited in Engeström 1987, p. 68)

The subject does not relate to the objective world directly, but through artefacts like concepts, heuristics, and tools. One of the claims of activity theory is that the nature of any artefact can be understood only within the context of human activity – by identifying the ways people use this artefact, the needs it serves, and the history of its development (Kaptelinin 1996a). Thus, by applying activity theory as an approach we want to enrich the individual aspects of articulation work, as well as the importance of incorporating the artefacts in the total arc of work. In this respect, we will also get a broader notion of context of work than the original framework of articulation work has offered.

Leontjev's interpretation of activity, as composed of actions and operation, is in agreement with Strauss' levels of articulation. An activity constitutes a hierarchical structure with inner dynamics, transformations and its own development. (Leontjev 1983b). The driving force behind activity, action and operation is different, as can be seen in Figure 1:

Figure 1.   The internal side of an activity, along with corresponding driving forces (ibid.).
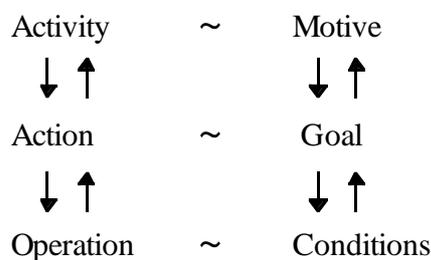
An activity is realised through goal-oriented processes, termed actions. An action can realise different activities as the given action may fulfil different motives. Before an action is performed, it is planned by a conscious subject. Actions are realised through operations, that face conditions in the objective world. Operations are typically initiated unconsciously—often even the collection of operations which accomplish the action is selected without explicit decision. The 'automatic' choice and routinesed performance are possible only for a knowledgeable and experienced subject. The development may be described in terms of habitualisation and institutionalisation (Berger and Luckmann 1966). But once acquired, this ability appears as a competence for situated action. Development of cognition is thus a process moving actions to operations, and operations into actions (e.g. instances of breakdowns). As the degree of routinisation increases, the action is moving towards operation.

Leontjev's model of human activity is used to give structure to the remainder of this section, and are interpreted in terms of two levels of articulation. There is an increasing need for articulation as the work situation becomes more complex, thus we present individual activity first, and then collective activity. We conclude the section by presenting the most complicated form of societal organised work, that is when the involved subjects take part in indivisible collective actions. There is an increasing need for articulation as the relationships between the salient dimensions (who, where, when, what and how) become more complex, e.g. if more actors are involved and with an increasing interdependence between them. The dialectical relationship between individual and collective activities indicates that the borders between these two major aspects of work are not to be regarded as static. Rather, the struggle between the aspects is the driving force for development and progression of the societal organised work. In Table 2, we outline the need for articulation in the three categories that we have identified.

Figure 2. The increasing need for articulation

Individual activity	Collective action
Articulation in terms of creating and maintaining the available tools, methods, and machines. Articulation in terms of contingencies and breakdowns due to external factors and tools.	Articulation needs identified to the left, but with increased complexity due to indivisible action.
	Articulation in terms of temporary merge of activity, motivating the same action.
Collective activity	Higher demands for articulation relative to time and place.
Articulation needs identified above, but with increased complexity due to the collective setting.	
Articulation in terms of shaping, planning, and maintaining the social arrangement and the division of labour.	
Articulation on terms of internalisation of rules and social relations.	
Articulation due to breakdown in the division of labour and interpersonal conflicts.	

3.1 Individual activity

An activity theoretical perspective on articulation
Most of the articulation needs in this category are found at all the other levels, even if some of them are modified to meet the particular characteristics of the category. These needs are fundamental, because it is obvious that also a subject has to articulate her/his work. Articulation of the cooperation is meaningful only as far as the tasks to be performed are defined and understood by the subject. When a subject is faced with a new task, many questions must be answered before an adequate performance may be expected. We find it justified to call this articulation work of the individual.

In terms of activity theory, this situation fits directly to the framework presented by Leontjev (1983b). The three levels with their psychological background may be used as such to describe the work of individuals. Other important aspects are the object-centred notion of activity and the tool mediation principle.

We distinguish between two levels of articulation: Articulation of actions within an activity and articulation of operations within an action.

Articulation of action within activity: The actual arc of work/ project must be articulated. Thus this articulation will inherit many aspects from the activity it is realising, which is likely to add the co-

herence between the single actions which belong to one activity. Articulation is dominantly deliberate planning in the lines of project planning. In the terms of Strauss (1993), this articulation is explicit.

Articulation of operation within action: The choice and performance of operations are often well habitualised and less conscious. It is, however, fruitful to regard this seamless flow of work as the outcome of articulation. Before the choices we can imagine a brief moment of articulation (this coincides well with Strauss' (1993) implicit articulation), which even a tiny breakdown brings to the surface. We can even evaluate the performance; the goal(s) of the actual action gives the criteria to such evaluation.

The two last categories also correspond to the distinction between plans and situated actions discussed by Suchman (1987). The surplus value given by the activity theory puts both of them in a context: plans within an activity and situated actions within an action. Situated action is then situated both by its context and initiation.

The need to articulate both actions within activities and operations within actions follows also from the experience that the borderline between action and operation is dynamic. Breakdowns turn operations into actions whereas learning has the opposite effect. In a breakdown the covert articulation becomes overt and vice versa in the learning. These transformations must also be steered by means of articulation.

Another new aspect inspired by the activity theory is the internal initiation of tasks, e.g. of various tasks of maintenance type. Not all tasks arrive from outside like on the assembly line. The articulation of these tasks takes place mainly in the same way than of other tasks. The most important new feature is that the specification task and its need are entirely locally determined. The adequate triggering of such an internal task, on the other hand, presupposes that the responsible actor keeps herself well informed about the state at her/his work domain (area of responsibility). The importance of this orientedness is best visible in time-critical work situations like process control or navigation. The situatedness does not come only from the environment, it is also created through the subject's own actions.

Individuals only seldom work in isolated work settings. Often most tasks arrive from and are delivered to the organisational context. Also the borderline towards other activities must be maintained. This requires that the boundary is articulated repeatedly and

continuously. This is collaboration and it will be discussed more thoroughly in the next section. It is, however, important to notice this interface to the interplay between individual and collective aspects.

Incorporating computers

According to activity theory the computer is not qualified as an actor, because it does not have motives or purposes. It is only qualified for operations. Human actors can perform actions (within some activity) by means of computers (as tools). The information system often also constitutes the object of work. Both aspects are present in many work situations, e.g. writing a text document by means of a text processing program. Software may be seen as objectified work. Because it cannot be situationally changed, the modules, which correspond to operations, are the smallest building blocks. We expect that the tools for decomposing modules at a breakdown and (re)composing them at learning and routinisation will be popular features in future systems development.

On the other hand, data in systems may represent (m)any things, also actions and activities. Work flow programs and collective calendars give examples of this. This property makes computer systems attractive for articulation work.

Both of the two articulation levels identified above are interesting. Computer systems are likely to create needs for articulation and at the same time be used to satisfy them.

Articulation of action within activity: Computer systems may be used as means of articulation in various ways. Calendars and to-do-lists help keeping track of tasks under work and their priorities even in individual activity. Blueprints and work plans give structure to the actions. If the object of work is in the system, it may be designed so that it encapsulates important articulation information about the state of the object, the intended task chain, the next task to be performed, deadlines for future tasks, etc. Such features have been implemented in e.g. work-flow systems when they allow interruptions in the task chains. At the operation level of articulation many hints and cues in the computer interface may be used for giving desired support.

Articulation of operation within action: Those work tasks which are performed by means of the computer systems need a particular articulation. The subject must have adequate knowledge and skill in using computer systems and s/he has to master the professional sub-

stance of the work tasks. The subject cannot perform the tasks well unless s/he can integrate these two domains of knowledge. This integration actually is articulation of operations within action: "When I push this button, this work task will be performed". This type of articulation appears at the individual level of action, even if it is important for the actor to be aware also about the shared and collective features of the artefact. This articulation takes place in a dynamic environment with changing needs and continuous learning.

3.2 Collective activity

Engeström (1987) presents an alternative model compared to Leontjev's model of activity (the individual and the object), with three interacting entities (the individual, the object and the community) in order to analyse the social phenomenon of human activity. The objective of the model is to take the social context of human activity, by including rules of communication and division of labour. The model is illustrated in Figure 3. The upper triangle of the model illustrates Leontjev's basic interpretation of human activity. The two others represent the collective aspects of human activity.

In the model, human activity is interpreted as a dynamic interrelation between the three aspects. The extended model of human activity shows that an individual is not isolated but is a part of a community, and the activity is affected by the individual's participation within this community.

Figure 3. The aspects of collective activity
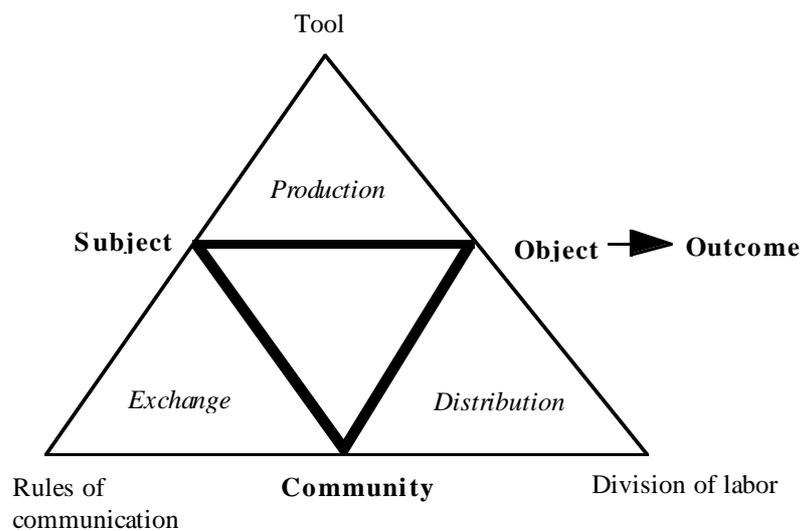
The individual's action toward the object of the activity is affected by three factors: The tools applied (signs, language, instruments), the community s/he belongs to in terms of the embedded rules of that community (laws, practice and tradition, etc.) and the division of labour in that community (roles, communication and coordination procedures, etc.).

The subject's relationship to the community is mediated by rules and the community's available tools. The community's relationship to the object of the activity is mediated by the division of labour. The division of labour is necessary to organise and coordinate the activities of the individual in order for a community to achieve a common superior objective. Distribution consists of the role each of the individual in the community plays, the power each wields, and the tasks each of the individual is held responsible for.

Leontjev's (1983a) original structure of activity and its strength is only briefly illuminated in Engeström (1987). The structure is embedded in each corner of the triangle, which means that an activity itself not only is mediated by, but also develops rules, instruments and division of labour. However, Engeström does not explore the concrete actions within the three aspects of human activity, and thus how these actions are influenced by and influence the rules, tools and division of labour. As we will see below, this abstraction of the model makes the model less sufficient to explore how the computers mediate the human actions of cooperative work, and how they influence the actions. Hence, we have integrated the two levels of articulation (presented in the previous section) with the aspects exchange and distribution. This gives an interpretation of the dynamics between the two levels of articulation in collective activities.

An activity theoretical perspective on articulation
In agreement with the aspects exchange and distribution, the two levels of articulation are concerning how the subject influences and is influenced by the social rules and the division of labour. However, the articulation needs are increased compared to those identified in the previous section as a consequence of taking the social organisation of work into account:

Articulation of action within activity: As an active subject of a societal organised work arrangement (a community), the subject has to internalise the explicit rules of communication and division of labour to her/his understanding, and further to her/his actions. In addition

to the subject's articulation needs, this involves articulation in terms of obligation and commitment to the other subjects and to the objective of the community. This in turn involves articulating actions such as: informing the others, obtaining information due to the problem and objective of the work arrangement, and internalising the other subject's perspectives to current cognitive structures and existing beliefs. These actions may be put into operation in a conscious way following the explicit rules and division of labour.

Articulation of operation within action: The explicit actions often turn into more problematic ones in the societal organisation of work—caused by the salient dimensions of articulation. Disagreement over issues or resolutions, misunderstandings and various external factors may create a need for making implicit actions more explicit, but also influence and change the rules and the division of labour.

In turn, the new rules and division of labour, become conscious and explicit, and illustrate the dynamics between the levels of articulation.

Incorporating computers
Fjuk et al (1995) suggest that the ideal role of computers is to fulfil the mediation of production, exchange and distribution — not in terms of separate aspects, but in terms of the situated nature and relationship between them. This incorporated role of the artefact means that the computer should have the position of mediating the fluent meshing of individual and collective activities of work. Schmidt (1994) illustrates this nicely by composement of an e-mail message:

"(...) the user should not be required to shift to a special editor and leave the world processor normally used for composing letter, writing report, etc. The same applies to CSCW facilities supporting cooperative authoring, conferencing, etc. " (ibid., p. 68)

The computer has a certain impact on the levels of articulation, as it should mediate the dynamics between the collective aspects (mutually with the individual aspect presented in the previous section):

Articulation of action within activity: The computer should mediate the explicit organisation of division of labour in terms of organisational units, projects and the functional roles. A creation and maintenance of the division of labour include access rights, available tools for the explicit role, and indication of the boundary toward oth-

er roles. This means that the computer should be tailored the various roles of work, having the total arc of it mind, so that the selection of a tool in one role does not hamper the work of others. Different communication channels should also take the distribution of labour into account. The computer may mediate the rules of communication, either explicit as in an e-mail or message system, or implicit as in writing and reading in a database (e.g. a shared calendar), and thus be used as a means of articulation both in terms of interpersonal relations and the information objects of the division of labour.

Articulation of operation within action: The explicit rules of the communication channels and the different implemented representations of the division of labour, imply certain conditions to how the actions are put into operation and thus the course of action. In some actions—especially the problematic ones—the artefact may not fulfil its role sufficient as mediator and imply rigid and complicated collaborative settings. Implicit actions may thus turn into more explicit ones—or other artefacts may be needed—in order to get the work done.

3.3 Collective action

This category is not thoroughly developed within activity theory. However, it is as important as the others when it comes to understand and analyse the complexity of cooperative work. Even if further research has to be done, we believe that activity theory has a potential for addressing collective action. Development of collective actions may have certain importance to incorporation of computers in the total arc of work, since the category may be viewed as the most complicated of the three. The category differs from the two previous ones as some actions are collaboratively put into operation in order to get a qualitative good outcome in respect of the individual and her/his activity. Examples are actions involving negotiations, consensus seeking, common problem solving, etc. According to Leontjev (1978), actions are usually polymotivated; two or more activities can temporarily merge, motivating the same action, if the goal of one action is a prerequisite for reaching the motives for all the activities simultaneously (Kaptelinin 1996b). Thus, the subjects may have different (even conflicting) motives of the collective action. Another view, also presented by Leontjev (1983b), implies that the subjects share the same motive. The concept of collective subject has been introduced to account collaboration amongst individuals, deal-

ing with a joint activity. The collective subject can then be considered as a 'total subject' of the joint activity, and "the interrelations with the individual subjects can be comprehended through a psychological analysis of the joint activity" (Leontjew, 1980 #157, cited in Engeström 1987, p. 70). However, the inner relations (amongst subjects, and between subjects and the collective arrangement) as characterising a collective action are not modelled in a structural way.

Because of the indivisible nature of collective action, time and place have a certain signification for the course of action, and influence the articulation needs. One example of such a situation is a community aimed at reflecting upon a problematic situation based on involved subjects' multiple perspectives. Typical collective actions in such—brainstorming, confrontation and negotiation of perspectives, consensus seeking—may be put into operation without the interactants co-presence in respect to time and place. However, the more 'distance'—of both mental and geographical nature—the actions and operations are sources for more planning and more explicit coordination (Fjuk and Dirckinck-Holmfeld 1997).

An activity theoretical perspective on articulation
The additional articulation needs are typically related to the salient dimensions of articulation which questioning the factors of 'distance':

Articulation of action within activity: In the indivisible and societal organisation of action, the active subject has to contribute with perspectives, knowledge and thoughts. Through the subject's knowledge and existing beliefs, s/he makes a contribution to the societal development and thus indirectly to her/his own development of cognition (Vygotsky 1978).

Articulation of operation within action: The dynamic and spontaneous nature of such collective actions, are seldom put into operations without breakdowns in respect of inter-personal conflicts. This may be caused by external factors, but also by the subjects' internalisation of others' perspective to own conceptual structure. These contingencies become more obvious and visible when 'distance' is present. 'Mental distance', such as a weak common conceptual structure, and geographical distance, require more explicit articulation of usually implicit articulation.

Incorporating computers

The complicated phenomenon of collective action, may be even more so when computer artefacts have a certain role in the mediation. This may create new articulation needs compared to those described in the category of collective activity.

Articulation of action within activity: Articulation of collective action involves a temporal merge of activities, to ensure that the action realises activities of several subjects at the same time. This can be done using the computer as means for communication in negotiations and discussions. This means that the computer should ideally mediate each of the subject's operations to the other subjects, and to the actions taken place.

Articulation of operation within action: The computer artefact has certain impacts on how these actions are put into operation. And differences in time and space have impacts on the course of actions. E-mail are well known for being obstacles in such complicated processes. Multi-media applications have been suggested as mediators for complicated actions in order to adjust signals of understanding and misunderstanding, questions or interruptions (Kraut, et al. 1992).

4   Conclusions

In this paper we have integrated two powerful approaches: Activity theory (Leontjev 1983b; Engeström 1987) and articulation work (Strauss 1993). The synthesis has not lost anything of the promises embedded in each of them. But when this synthesis is applied on the use and development of computer artefacts, it turned out to have more potential than just the sum of the two approaches.

Activity theory is used as an approach to address the computers' integrated role in the individual's dynamic and changing situation of performing individual and collective actions. The core of the developed framework is two levels of articulation derived from one basic principle in activity theory: The hierarchical but dynamic structure of activity, action and operation. The conscious and motive oriented activity is realised through actions. These actions are in turn realised through operations that are determined by the conditions of the applied artefacts. The activity concept generates a domain of responsibility within which the subject him/herself without external

triggering initiates and articulates actions and operations. The levels correspond to explicit and implicit articulation found in Strauss' (1993) theory on action.

The levels expand our understanding of individual work-related activities at the individual level. But they seem to be even more interesting when the concepts are applied to collective action, since the articulation needs are increasing when several actors are involved. Unfortunately, activity theory does not provide us with a well defined concept of collective action, which would be necessary for more thorough analysis. There is thus much research to be done in this area. However, the conceptual framework includes the two developed levels of articulation in order to explore the increasing needs of articulation, and to illuminate the computer's integrated role in this respect. As a sophisticated technology, the use of computers itself imply articulation in terms of the two levels. The individual must know what operations of their actions can or must be performed by means of the computer and how this is done. On the other hand, computers can be used as means of articulation in individual and collective issues in various ways, but also create new articulation needs. The framework introduced in this paper can be used for exploring such applications.

Further research will use the conceptual framework to analyse different cooperative situations in which computers are incorporated: Focus on the new articulation needs required in collaborative situations in which the individuals are geographically dispersed (Fjuk 1997), and modelling computer systems incorporated in work (Smørdal 1997).

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