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Managing Intersubjectivity in Distributed Collaboration[1]

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ABSTRACT

A situated approach is employed to in order to study distributed collaborative learning. We present a case study of how one group of students collaborate through a groupware system called TeamWave Workplace. In addtion, we provide an illustration of a case involving a particularly interesting form of use concerning this topic. The main aim of the article is to gain insights into some of the problems students' encounter in distributed communication, especially in regard to how participants establish a shared context for their activities. A particularly important issue in this regard is related to how the system is used in order to manage intersubjectivity. The system offer both opportunities and obstructions as regards communication, depending on how the participants use it for what purposes.

Keywords: *Computer Supported Collaborative Learning, Learning and Social Intreraction, Distributed Communication, Intersubjectivity*

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1. Introduction

The present study represents an attempt to investigate the use of technological tools for collaboration and problem solving in a distributed environment. A situated approach to cognition and communication (Gee & Green, 1998; Suchman, 1987) is employed in order to examine how a shared context for action is established on a moment by moment basis in interaction. The main aim of the study is to gain insights into the opportunities and problems that participants' encounter when they are engaged in distributed collaboration. This is pursued through an analysis of one case, where, by

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using a system called Team Wave Workplace, groups of students were engaged in solving a particular instructional task. In addtion, we provide an illustration of a case involving a particularly interesting form of use in regard to this topic.

Put simply, in the cognitivist tradition the main aim in research on instructional technologies has been to assess how technological tools afford or contrain the development of reasoning, conceptual understanding and problem solving, or communicative processes that are considered important in regard to the development of reasoning (see, for example, Koschmann, 1996). In general, such a view entails that technology, cognition and human action are treated as separable ontological entities.

On the other hand, in socio-cultural and situated approaches, approaches which have informed the development of the research area termed *computer supported collaborative learning* (CSCL), instructional technologies are conceived as mediational means in human practices (see Koschmann, 1996). In accordance with such a view, there is a need to examine how technologies actually are being used as part of collaborative learning activities. In order to examine how computers work as mediational means in distributed collaboration on a moment by moment basis, we draw on ideas developed in *ethnomethodology and conversation analysis*.

2. The study of technologically mediated social interaction

Two recent and promising attempts to analyse the relationship between interaction and computerised tools are pursued by Baker, Hansen, Joiner & Traum (1999) and Dillenbourg & Traum (1999, see also Dillenbourg, 1999). They emphasize the importance of shared knowledge in distributed environments. As an analytical tool they draw on psycholinguistics, particularly Clark's (1996) notion of *grounding.* According to Clark (1996) grounding is the process through which shared knowledge is established in interaction. This process is dependent on the participant's prior beliefs, their previous knowledge, and the material artifacts that are available in any communicative encounter. The main assumption in the studies by Baker et al. (1999) and Dillenbourg & Traum (1999), is that different technological tools provide different constraints and affordances for the grounding process. Moreover, analytically they try to demonstrate how tools affect grounding.

In regard to analytical practice, the focus on grounding implies a concern with whether an emergent understanding is sufficiently grounded or not. Therefore, analytical categories that enable distinctions to be made between different degrees of shared understanding are often employed. For example, Dillenbourg and Traum

(1999) make use of four communication functions (access, perception, understanding, and agreement) as a way of identifying degrees of shared understanding in virtual environments. Moreover, technologies are assessed in regard to how they support or contstrain the grounding process.

According to such a view, communication is conceived as a process of coordinating knowledge that the participants already possess. However, the efforts involved in arriving at a shared interpretation might require a reorganization of the knowledge that an individual brings to the situation. Nevertheless, social interaction is mainly the site where participants' mental states are articulated and coordinated. However, the main problem with such an analytical practice from a situated perspective, is that it implies a disregard for the participants' interpretative work (Ludvigsen & Mørch, 2003). Moreover, the management of intersubjectivity is treated as independent of the situation in which it occurs, the activity in which participants are engaged and the goals that they are trying to achieve. In and through our analysis, we will attempt to demonstrate how these issues are closely intertwined.

2.1 A situated approach to the study of collaboration in distributed environments

In ethnomethodology, a theory which forms an important backdrop to many recent studies of situated action and cognition, social action is conceived as accountable action. This means that people display and orientation to and design their actions in relation to what is considered as 'normal' and 'rational' in different cultural contexts (Heritage, 1984). Moreover, the orderliness of social life is perceived as continually produced and re-produced in and through situated actions. This does not mean that actions are idiosyncratic and coincidental. On the contrary, the ways that people make sense of their world and one another, are founded on shared procedures that enable them to co-ordinate actions with others and participate in meaningful communication. As such, intersubjectivity is not the result of the participants' ability to coordinate their already excisting cultural knowledge. On the contrary, it is a practical concern for interlocutors.

Important ethnomethodological concepts that are invoked in order to account for these aspects of social action are *indexicality* and *reflexivity* (see Potter, 1996, pp. 43-49). Put simply indexicality implies that the meaning of actions is dependent on the context where it occurs. Thus, the sense that particular actions have for participants, is bound to the local circumstances of their production (Suchman, 1987). The concept reflexivity refers to how situations are the product of the participants organized

activities, and that actions reflexively orient to this normative ordering. As such, social reality is dynamically produced, maintained, or altered as both a process and a product of ordinary human practical action (Heritage, 1984).

In order to study how people are able to make sense of one another in social interaction, we need to employ methods that enable us to study how meaning is produced on a moment–by–moment basis. Conversation analysis (CA) is one method that enables such a locus of inquiry.

In many ways CA is a practical application of ethnomethodological principles to the study of talk. Two complementary ways of describing CA is, firstly, as the systematic study of how talk performs social actions. Secondly, it can be conceived as the study of the practical management of intersubjectivity (Edwards, 1997, p. 117). Heritage, paraphrasing Garfinkel, defines intersubjectivity in the following way.

> ...the intersubjective intelligibility of actions ultimately rests on a symmetry between the production of actions on the one hand and their recognition on the other... this symmetry of method is both assumed and achieved by the actors in settings of ordinary social activity (Heritage, 1984:179).

This depiction includes much of what CA-researchers understand as a fundamental and pervasive feature of all talk — it's sequential organisation.

3. Collaborative construction of mutual understanding

The sequential organisation of interaction provides participants' with a set of resources for managing intersubjectivity (Schegloff, 1991). An intersubjective understanding is something which is continually shaped and reshaped throughout the course of the interaction. However, to make sense of any action is not an easy task, neither for interlocutors nor analysts. This is because any action can convey multiple meanings at the same time. Thus, to establish a relevant context for making sense of some action is a practical problem for the participants involved. However, this is not to say that participants are not without their resources for inferring the meaning of some action, for example features to do with the delivery of an utterance such as intonation and so forth. Moreover, participants can draw inferences on the basis of how their utterances are taken up and responded to. However, for the analyst, it is an important resource to examine how utterances are taken up and responded to, because one possible interpretation of a previous utterance, so to speak, is displayed in the next turn.

Through this and other related practices, participants continually construct and display their interpretations as well as negotiate each other's position and status in the interaction (Schegloff, 1991). However, even if participants manage intersubjectivity through talk, this does provide evidence for what participants 'actually' think or understand. On the contrary, any utterance represents one possible interpretation.

Thus, the analytical focus is on what participants, for all practical purposes, display and treat as shared in relation to their task at hand (see Edwards, 1997). Language provides a set of resources that enable participants to show each other which parts of their shared knowledge are relevant for making the inferences necessary for some locally contingent purpose. The fact that people understand each other and are able to achieve the necessary alignment to solve some common problem, is therefore due to practical work by the participants and in our view, it is problematic to attribute them to any unobservable common ground. Anyhow, as we will attempt to show, to approach computer mediated interaction as a practical activity has certain advantages, in that we do not have to appeal to something beyond talk in order to explain the same talk. The latter view makes it difficult to describe the relation between the mental entity and what people say (Suchman, 1987).

How these rather theoretical issues can be reformulated into a more workable set of analytical procedures, is the topic of the next section.

4. Analytical procedures

Even though doing CA is very much a practical skill that cannot be formulated as a set of procedures, certain analytical commitments and guidelines are considered important (Hutchby & Woofitt, 1998; Pomerantz & Fehr, 1997).

First, one should be cautious with letting the analysis be dominated by researcher stipulated categories. This is because the focus is on participants' concerns, on what they treat and display as relevant to the task at hand.

Second, a detailed examination of the sequential unfolding of talk is required. This is because any answer to an utterance makes visible one possible interpretation of the same utterance. The task for the analyst then is to make visible how an utterance is taken up and responded to, because this provides important information in regard to the participants' concerns.

The third issue is related to the understanding of rules and the relationship between rules and actions. Rules are treated as situationally invoked and closely related to specific activities. Thus, the task for the analyst it to identify which rules and norms that

participants are displaying an orientation to and ground the analytical inferences in what people say and do.

5. Data and transcription

The data that we have analysed was recorded using a screen cam, something which means that all of the activities happening on the computer screen were captured. We have transcribed the interaction as it happens sequentially. However, since the activity under scrutiny involves the use of multiple tools, this proved to be a difficult task. We have chosen to use a format that explicates all the text that is being written by the participants—Post-It entries indicated in **bold**, Chat entries in plain text —with additional descriptions of relevant actions in square brackets. This might decrease readability, but it is relevant for the analysis. Note that the indication of pauses is not necessarily accurate in real time, due to different machine capacities and configurations.

Due to the specific nature of the activity under scrutiny, it is necessary to introduce the collaborative activity as well as the groupware system in some detail in order to provide a certain context for the analysis.

6. Research setting

Project DoCTA (Design and use of Collaborative Telelearning Artefacts) aims to bring a theoretical perspective to the design of ICT technologies that supports the socio-cultural aspects of human interaction *and* to evaluate its use. In the first phase (June 1998 - December 1999) we focused on the design and use of technological artefacts to support collaborative telelearning aimed at teacher training (Wasson, Guribye & Mørch, 2000). Various scenarios utilising the Internet were used to engage the students in collaborative learning activities. The data used in this particular article was taken from a particular scenario called VisArt (Wasson, 1999).

6.1 VisArt and TeamWaveWorkplace

The VisArt scenario involved students taking courses at three educational institutions (University of Bergen, Nord-Trøndelag College, Stord/Haugesund College) in Norway. Teams comprised of 3 students, 1 student from each institute, collaborated to design a learning activity. There were no opportunities for the teams to meet face-to-face.

TeamWaveWorkplace[2] (TW) was used as the main information and communication technology. The VisArt activity took place during February and March 1999. One week of training in using the TW tool for collaboration proceeded three weeks of design activity. In the design activity, the teams designed TW rooms for learning about some topic they agreed upon.

TW is based on the metaphor of shared networked places. Virtual team rooms provide a permanent shared space where teams can conduct meetings, store documents, share URL links and co-ordinate and communicate with one another. Each team can build a set of different rooms and each room can be customised by the team to suit their specific needs by using any of the 19 tools provided. The tools include: Address Book, Brainstormer, Calendar, Chat, Concept Map, Database, Doorway, File Holder, File Viewer, Image Whiteboard, Meeting Roster, Message Board, Personalised Message, Post-It, ToDoList, URLRef, Vote, Web Browse, and the on-line help. Figure 1 shows a TW room with user-defined configuration of some of the tools. The three team members are in the room as indicated by the icons along the top of TW—the happy face, the text data, and the picture, respectively.

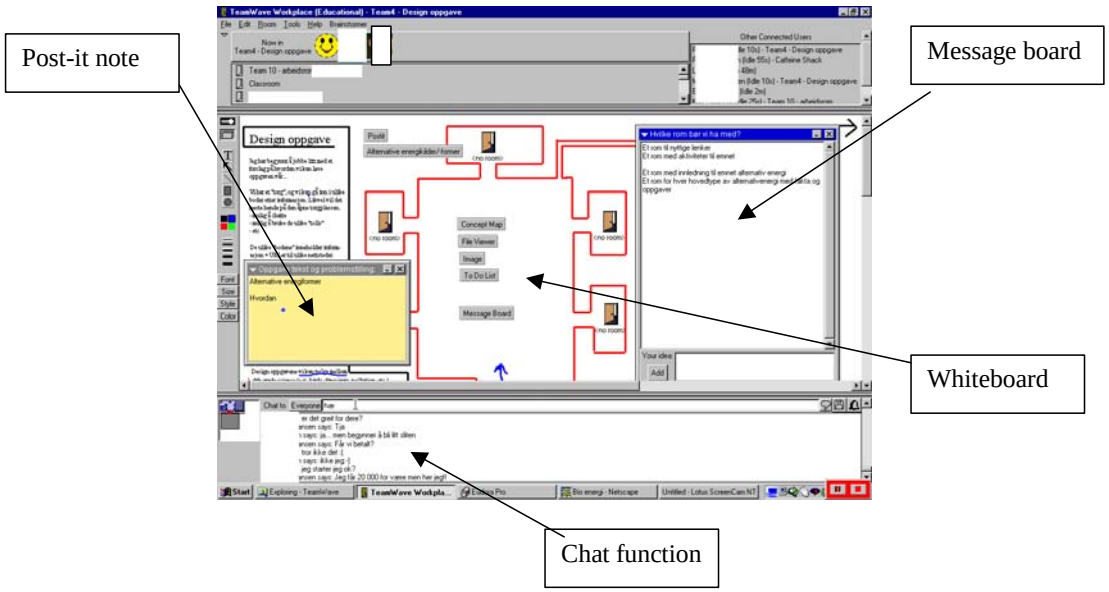

Fig. 1: Screen shot of group working together using TeamWave

2) http://www.teamwave.com

7. Analysis

7.1 The task

In the activity under scrutiny, the participants' task is to create a learning environment on the topic of alternative energy sources for pupils in 6th grade. The focus of attention is on an early stage in their work. At first, such an activity involves different actions to do with specifying and negotiating the task and formulating suggestions for how the task should be interpreted, understood, and carried out. All of these issues involve reflection and negotiation about the goal, the knowledge domain, the resources that should be available, and the skills and knowledge required by the pupils. In the following extract some of these issues are specified and negotiated in interaction.

The participants, Susan, Tony and Paul, are interleaving between different activities and tools. The tools they utilize are two Post-Its and the Chat. The Post-Its function as a kind of collective memory for the group in the sense that it enables them to save their specifications of the task for later reworking. What is being typed in the Post-It is character-by-character visible to the others in the room. When it is necessary to pose questions, requests or suggestions due to some specific need, the Chat function is used for quasi-synchronous communication. With the Chat, the typer has to hit enter before the others see what has been typed.

1.Tony: **hw** [erases] **how** [erases how and a text fragment "alternative
2. energy forms"]
3.Susan: [moves her pointer to the Post-It while Tony is erasing, then
4. immediately starts writing on a Post-It entitled "Task and
5. approach to problem:"] **why**
6.Susan: what are you planning to write there Tony? [Tony moves his
7. pointer to another Post-It while Susan types her message in the
8. Chat. Susan moves her pointer over Tony's icon/avatar at the
9. top, which displays that he is active and typing in chat.[3] Susan
10. extends the window of the Post-It then continues writing:]
11.Susan: the name "alternative" energy sources?
12.Tony: It's easier to continue if we have a problem to relate to…
13. (12.0 second pause)
14.Susan: more [Paul moved his pointer to the Post-It]
15.Susan: Which energy sources do we have?
16 (5.0)
17.Susan: Which are healthy for the environment?

3) This is an awareness function in TeamWave, that displays in text what the selected participant is doing in the room.

18 (39.0)
19.Susan: Advantages and disadvantages with the different types of
20. energysources
21.Tony: Main problem: how to teach children in 6th grade about
22. alternative energy sources with the aid of CSCL.
23.Tony: ???
24.Paul: Sounds good [erases it immediately after he's written it, and
25. before Susan posts her message in Chat]
26.Susan: shall we presuppose that they are already familiar with the
27 software?
28.Susan: if not it will be an extensive job [Susan moves her pointer to
29. another Post-It called "What kind of rooms should we make".
30. Types "activities" then erases it.]
31.Tony: agree with you… we'll presuppose that they can use TeamWave,
32 and the tools that exist within it.
33.Susan: Activities for groups/collaboration
34.Paul: I agree
35.Susan: ok

7.2 The social organisation of distributed collaboration

Susan's question in line 6 can be interpreted as a request for an explanation of what Tony is doing (lines, 1–2) and it is displayed as referring to the writing in the Post-It note. Her sentence is sequentially indexed to the previous activity he was doing, indicated by the use of his name and the use of the deictic category 'there'. Tony treats the question as directed at him (line 12). As such, they display that they have the necessary alignment to go on.

Now, let us speculate why Tony responded the way he did to Susan's utterance in line 6. What was it with Susan's utterance that made his interpretation reasonable and rational? The utterance could be doing at least three different things. First it could be a straightforward request for information in regard to what Tony was going to write on the Post-it and its relevance concerning their task and problem solving process.

Second, it could be oriented to the fact that since Tony erases something from the Post-It, there is a social norm at work saying that he is required to provide an account of why he did it. This norm might be that individual actions must be co-ordinated with other's actions and expectations in collaborative encounters such as this, were several students are engaged in achieving a task together. Since Tony neither explains why he erases something from the Post-It note, nor produces another sentence that replaces

it, he has in some way violated a social norm. As such, Susan's account makes visible and calls attention to the fact that Tony is accountable to this norm.

A third interpretation might be that she is orienting to a possible interruption of Tony's action. The Post-It allows only one to write at a time. In this case she is orienting to the fact that her own actions might be violating commonly accepted norms to do with interrupting others. However, something which does not support such an interpretation, is that she might have formulated her self differently. If this was the case it would have made more sense to start the sentence with for example "I'm sorry, but what …".

When we as analysts are engaged in making sense of naturally occurring interaction, we encounter problems if we only look at isolated utterances. That is to say, it is impossible to examine the participants' orientations this way – what they treat as relevant in their talk. As such, we need to look into the sequential unfolding of the activity to establish how the participants make sense of each other's utterances.

If we look at Tony's answer in line 12 we see, by the way he responds, that he does not treat her utterance as a simple request, but orient to the fact that he might have violated a social norm in regard to how such a collaborative activity is organised. This is because he does not provide a straightforward answer, but, rather, produces an argument for the requirement of a problem solving strategy for 'their' group.

The participants orient to and invoke norms governing interaction. In this particular case Tony is managing accountability to this norm by providing an argument for a particular problem solving strategy. Susan does not argue with Tony's account, but, rather, continues to write on the Post-It note. A question that arises is concerned with what it is with how Susan's utterance is put together that make this particular reading relevant.

It is difficult to establish exactly what it is with her utterance that makes Tony's utterance appropriate, because the sentence does not have any features of delivery that are common in talk, like intonation, pressure and so on. Perhaps it is the use of the personal pronoun, which in some way constructs Tony as a group member with certain obligations. The sentence also has certain directness to it. It is somehow confronting Tony. Her utterance makes an account of what he is doing relevant. He cannot simply say, "Well I was just writing something". He has to account for what he was writing and how it was related to the activity they were engaged in. As such, he is in and through his action accountable to the groups' joint collaborative effort. That Tony's interpretation is regarded as appropriate is made visible by the fact that Susan does not go through any efforts to repair her utterance. Neither does she produce any

disagreements with Tony's account. Instead Tony elaborates on his account and reiterates their common task goal in lines 21-22.

Another interesting aspect regarding how the participants are sensitive to each other's actions as part of a collaborative activity, concerns how Susan, while engaged in specifying the task, provides a possible invitation to the others to join in (line 14) if they have comments or additional formulations. This utterance is probably sequentially related to her formulation in the post it 'why' (line 5) 'the name 'alternative' energy forms?' (line 11). Since no one responds to her invitation she continues producing formulations relevant to the Post-it 'task and approach to problem' (lines 15,17,19,20). As such, she coordinates her activities with the other interlocutors by explicitly inviting them to participate in the process, something which is made observable and available to the other interlocutors in and through her action.

In collaborative activities such as these, it might create difficulties if one of the participants takes too much control over the collaborative effort. In that sense her actions can be interpreted as a way of managing this potentially delicate issue. She's managing accountability in the sense that she later might be held responsible for not inviting the others to collaborate in the problem solving process. In this sense the sentence "more" does two different things. It is both an invitation to participate, and an orientation to the social rules and norms that structure collaborative processes. Collaboration processes are composed of locally situated actions like these, where participants are sensitive to the social organisation of interaction.

In lines 26–27 Susan introduces a new topic by asking a question, or at least it is formulated as a question. However, in light of her formulation in line 28 it might be read as an assertion since in line 28 she produces an additional description that works as an argument for her previous assertion. Tony's uptake in lines 31–32, where he produces an agreement, indicate that this is the way he made sense of her utterance. Moreover, Paul produces an agreement in line 34, something which is acknowledged by Susan in line 35, thereby constituting it as an opinion agreed upon by the group as a whole.

The establishment of some kind of joint focus or common interpretation is a presupposition for doing joint problem solving. But it is also important to notice that this can conflict with individual work. The relations between individual work and collective decision making, is continuously negotiated. In this particular case this is illustrated by the way the participants co-ordinate the production of statements in Post-Its with the actions of the others.

However, how the ordering of the tool interplayed with the participants' sense making has not been made into a specific analytical concern. This is the topic of the next section.

7.3 Distributed communication

One feature of the extract above that might indicate a problem with quasi-synchronous distributed communication happens in line 24 where Paul says 'sounds good'. This is occasioned by Tony's request for acknowledgement in line 23, a request which again is sequentially related to his formulation of the 'main problem' in lines 21–22. It is interesting to note that Paul produces the acknowledgement using the Post-It note instead of the chat function. Although he erases it immediately, it might be an indication of two interrelated issues.

Firstly, in social interaction there is often a need to be able to produce a quick response, especially after one of the other interlocutors explicitly has requested a response. Secondly, it might be an indication of the fact that it is difficult to coordinate multiple tools, tools which make available different opportunities for action, as part of an activity which also require more synchronous forms of interaction. Even chat, which is designed in order to support more synchronous forms of communication, does not provide the same opportunity for providing immediate answers (Garcia & Jacobs 1999).

Anyhow, it is obvious that such an activity involves considerable challenges for the students in regard to how they coordinate their activities and the tools they employ in the process. However, this is something which cannot be attributed to the tool as such. How participants develop practices that enable them to manage such problems is the topic of the next section.

7.4 The use of Post-it notes for synchronous communication

As mentioned above, a problem with Chat is its quasi-synchronous character. The sequential aspects of talk becomes rearranged, because the utterances are not necessary related even though they appear in next positions (Garcia & Jacobs, 1999). There is a delay between the production and the posting of the utterance, and this might pose problems for the participants' sense-making practices. This does not seem to be such an immense problem for the participants in the first extract. This is due to the specific activity that they are engaged in, where they are not really in need of continuous synchronous communication. The main activity is to specify subtasks and the Chat is mainly used as a co-ordination tool. However, perhaps Paul's utterance in

line 24 is an indication of a minor problem with Chat. He uses the Post-It, among other things, because it allows for the provision of immediate feedback to a previous utterance.

In a different group (figure 2) the participants found a way around this problem, when they where in a phase of their work that required more synchronous communication. In this phase they were co-ordinating some activity, recalling and discussing earlier work that had been done, and planning future activities. The participants used the Post-It's as a form of Chat, that is, they created a chatroom by placing Post-It's beside one another and by putting their names as headings. These tools provided them with the opportunity to monitor what the others where saying, something which enabled them to respond at the appropriate time. The Chat does not allow for the monitoring of the speakers' actual production of the utterance. This might be important when doing synchronous interaction, because the other participants can co-ordinate and make sense of each other's activities, react properly and respond at the right time to questions, assertions and arguments. Even though we do not go into any detail in regard to this extract, we believe it is an interesting illustration of how such tools provides certain opportunities for acting and how this is closely intertwined with what the participants are trying to accomplish.

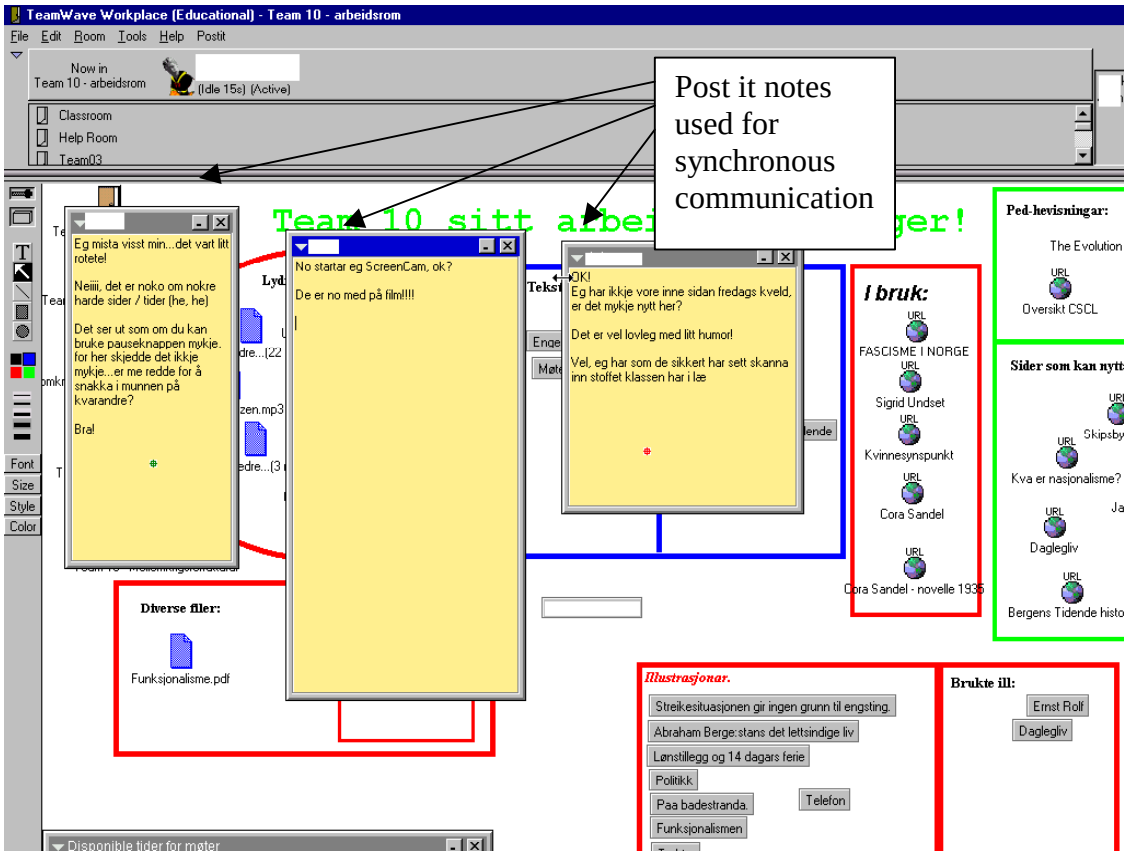

Fig. 2: Screenshot of group doing synchronous communication using Post-It notes

8. Conclusions

In and through this analysis we have tried to demonstrate how a collaborative activity such as this can be organised and how the participants in and through their actions establish a form of ordering that enable them to manage their task. What is more, we have demonstrated how the opportunities that groupware systems make available in regard to distributed collaboration, is closely intertwined with what the participants are actually doing with it for what purposes. The use of the Post-It to conduct synchronous communication, works as an illustration of the fact that a technological tool, which is not necessarily designed for such a purpose, can be actively constituted and ordered as part of practical activities.

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