An Empirical Study of How People Establish Interaction: Implications for CSCW Session Management Models

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ABSTRACT
In this paper, we report the results of an empirical study of how people, as part of their daily work activities, go about to establish collaboration. We examine the empirical findings and relate them to existing research on CSCW session management models, i.e., the mechanisms in CSCW systems that define the way in which people can join together in collaboration. Existing models leave a lot to be desired, in particular because they tend to assume that *indexical elements* of interaction management are substitutable by objective representation of artifacts. Based on the empirical findings, we derive three principles to consider in the design of CSCW session management models.

Keywords
Session management, field study, ethnography, design implications

INTRODUCTION
Many people spend large parts of their working day interacting with others. The interaction can take place in physical face-to-face meetings or in an electronic medium. Both these kinds of interaction have increased the last couple of years. One reason for this is extensive adoption of new information technology (IT) [1]. In this paper, we use the term "CSCW systems" to capture all kinds of IT explicitly designed to facilitate cooperation and communication among people.

The need to "ground" the design of CSCW systems in empirical investigations of cooperative work is very much recognized in the literature. So far, the empirical oriented approaches have concentrated primarily on eliciting implications for a particular system, or a class of systems (e.g., coordination) or feature (e.g., awareness widgets). Very little effort has been aimed at understanding cooperation for the purpose of informing the design of *session management models*. A session management model defines the manner in which people can join together in CSCW systems [2]. Thus, all CSCW systems, although not always explicitly, rely on such a model, which makes it crucial that it is based on the right assumptions of how people collaborate.

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The purpose of the study reported in this paper is to begin to explore work in real settings in a systematic way, with a particular objective to inform the design of session management models. Because session management models define how collaborative sessions are initiated, proceeded and terminated, we started the empirical investigation by exploring the first issue: *how people, as part of their daily work activities, go about to establish collaboration.* By "establish interaction" we mean the various activities in which people are involved to make collaboration happen and not happen.

Related work
Because of the importance of session management in CSCW, the topic has received much attention in the literature [3]. One common assumption in this work is the explicit distinction between collaboration and other work activities [e.g., 2]. A collaborative session starts, proceeds, and ends in a sequential and explicit manner.

Moreover, many researchers [e.g., 3] make the distinction between explicit and implicit session management models, where explicit models require participants to take dedicated actions additional to the work itself to initiate a CSCW session. Implicit models do not require this.

Three kinds of implicit session management models are described in the literature. *Artifact based models* assume that people wish to join together in sessions when they use the same artifact, e.g., a document [e.g., 3]. *Activity based models* assume that people wish to join together in sessions when they are involved in the same activity, e.g., using the same system [e.g., 4, 14]. *Place based models* assume that people wish to join together in sessions when they are at the same gathering point in a place based groupware [e.g., 5].

The difficulties associated with setting up sessions automatically based on activity and artifact [4] could be one reason why few systems use these models. Workflow systems, which often use some kind of activity based model, is one exception. Place based models, e.g., collaborative virtual environments [e.g., 6], continuos connections between physical places [e.g., 7], and virtual

collaboration rooms [e.g., 5], are based on how people meet each other in the real world.

In contrast to the assumptions of many CSCW session management models are findings in, for instance, ethnomethodological studies of work [e.g., 8]. Hopper [9], for instance, in analyzing how conversations are established among co-located people, suggests a much more blurred distinction between collaboration and other activities:

"Co-present speech routinely grows from non speech pre-beginnings, such as visual recognition displays. It is difficult to pinpoint a moment when such encounters begin." [9, p. 217]

Knowledge of this body of work motivated us to question whether or not current session management models rest upon valid assumptions of collaboration. At the same time, the social science research cited above has not been conducted for the purpose of design, and for that reason, design issues have not been considered in, for example, the analyses of empirical data. The purpose of the study presented in this paper, is to elicit implications for CSCW session management models on the basis of ethnomethodological-oriented investigations of work. This way of working has been documented to be effective [17]. For a recent discussion of the use of ethnomethodology in design, see [11].

The most related research we find in the literature is the study by Whittaker and associates [18]. They studied informal workplace communication for the purpose of design. Although some of the results reported in their paper could inform the design of session management models, this was not the objective of their study, thus they did not plan, conduct or analyze the fieldwork with that in mind.

RESEARCH SITE AND METHOD

Site

Participants in the study were a group of researchers at a pharmaceutical research company in Gothenburg, Sweden. The group employed six people: one group manager, three clinical trial managers, and two secretaries. The main task of the group was to prepare and manage clinical trial projects. Their point of departure is one or several hypotheses about how well a drug recovers a certain indication, documentation of which is demanded by the authorities to certify commercialization of the drug. Many different actors, such as the pre-clinical researchers and the marketing staff suggest hypotheses. These hypotheses and demands from the authorities guide the design of the trial, e.g., sample size and number of treatments. The duration of the trials ranged from one to four years, the number of participating patients from 200 to 10 000, and the number of participating countries from one to ten

Data collection

The empirical study aimed to investigate in detail the day to day work in the clinical research group. In particular, we were interested in *how do people, as part of their daily work activities, go about to establish collaboration*? However, to get an insight in the domain of clinical trial work, with which we were not so familiar, we started the empirical study with interviewing the group members. To investigate the research question we conducted participant observation studies of staff. We spent approximately 80 man-hours doing close participant observations, i.e., following every single move of a particular person [12], and about 240 man-hours doing site observation, i.e., talking to the group members, checking who was doing what, etc. Everybody was aware of the research and its purpose, and field notes were taken continually. The observations were followed by another round of interviewing. This time, the aim was to let people reflect upon some of the notes we made during the observational studies. All together, we conducted 12 interviews, each lasting between 45 and 90 minutes. All interviews were taped.

Data analysis

The analysis of the empirical data aims to "make sense of massive amounts of data, reduce the volume of information, identify significant patterns, and construct a framework for communicating the essence of what the data reveal" [12, p. 371-372]. Having transcribed the interviews and field notes, we started the coding of the empirical data. This meant going through the data carefully, making notes and labeling data that seemed to capture underlying patterns. Gradually, the coding process became a matter of interpretation, i.e., "attach significance to what was found,..." [12, p. 423]. The empirical work was guided by the framework of ethnomethodology, described next.

ETHNOMETHODOLOGY AND INDEXICAL ELEMENTS

The empirical work can be characterized as an ethnomethodologically-oriented investigation [13]. In particular, the notion of "indexical expressions" served as an analytical vehicle.

Indexical expression are utterances whose meaning cannot be established without interpretation that is based on *knowledge* about the *purpose* and *history* of the person using the expression, the *circumstances* of the utterance being made and even the *relationship* between the user and the interpreter. These utterances cannot straightforwardly be repeated or reused outside the context in which they originated, without changing their meaning. Garfinkel [13] comments upon the agreement between many sociologists that indexical expressions are "awkward for formal discourse" and ideally substitutable by objective (i.e., "context-free" or "complete") expressions [13, p. 6]:

"Nevertheless, whenever practical actions are the topic of study the promised distinction and substitutability of objective for indexical expressions remains programmatic in every particular case and in every particular occasion in which the distinction must be demonstrated. In every actual case without exception, conditions will be cited that a competent investigator will be required to recognize, such that in that particular case the terms of the demonstration can be relaxed and nevertheless the demonstration be counted an adequate one."

We believe that this argument about indexical expressions can be used to inspire and inform an analysis of session management beyond utterances. Our thesis is that many session management models (and, thus, CSCW systems) describe and implement *objective elements* of interaction management. Based on a study of practical action we wish to investigate the different roles of indexical elements in how people establish interaction. Moreover, and with particular import to design activities, we aim to resolve the problematic consequences, if any, of using objective elements as mechanisms of establishing interaction.

FINDINGS

In this section we present results from the empirical study. The question investigated was: *How do people, as part of their daily work activities, go about to establish collaboration*?

The role of artifacts in establishing interaction

We found that artifacts played an important role in the process of establishing interaction. Let us consider two examples: the door and the whiteboard.

The door

When people do not want to interact with others, e.g., because they host a meeting, they often shut the door to the office. When doing so, they often try to make it visible for others what they are trying to do, e.g., by explaining for others that they are "shutting the door."

EBS arrives together with another researcher concerned with [and partly responsible for] "the catastrophe project" [a "very badly designed project" which had been discussed among the researchers in the group extensively the last couple of days]. When entering her office, EBS says to the secretary: "I'm shutting the door."

In the situation described above, EBS does not simply "shut the door," but she also explains to the secretary (IG) that this is what she is doing. "Shutting the door" seems to be a social activity that does not only involve the physical operations of shutting the door.

Consider the following situation that took place some minutes later.

PJ arrives. He glances into the secretary's office, which is next to EBS, saying "Her door is shut?" The secretary replies: "Yes, they just arrived,..."PJ while heading towards EBS's office to join them: "This might take some time,..."

[...]

After a while, KK shows up, [also] glancing in to the secretary's office: "I need to discuss my study with EBS, but she's busy now, right?" The secretary replies: "Yes, ... you know,... "the catastrophe," they [EBS and PJ] have a meeting with someone from the UK." KK: "Yeah, ..."

Both PJ and KK thus seemed to have noticed that the door to EBS's office was shut, and both of them appeared to have ideas about the implications of the shut door. For PJ, it meant that a meeting he was going to join has started, i.e., that he was supposed to enter the office (as soon as possible), while for KK it meant that she could not talk to EBS at the moment, i.e., she was not supposed to enter the office. Even though the latter seemed to be the general meaning of "the shut door," PJ (effortlessly) appeared to easily recognize that he was supposed to enter the office.

Thus, "the door" does not seem to regulate the manner in which people join together in cooperation in a fixed, single way. For example, a shut door does not necessarily mean "do not disturb." The meaning of the door seems partly to be derived from interaction between people in the particular situation. Another observation is that even though both PJ and KK seemed to know the (different) implications of "the shut door," both of them wanted their interpretations of the situation confirmed. They did so by addressing "the shut door" in conversations with the secretary.

The whiteboard

A whiteboard was placed on the wall in the corridor outside the offices. It comprised the name of the people in the research group and the days of the week. The idea was to make people aware of each others' schedules.

Similar to how people seemed to make "shutting the door" visible to others, the person updating the whiteboard often seemed to try to make others aware of what she was doing. Consider the following excerpt from the fieldwork.

EBS leaves here office and walks to the whiteboard. "'C-a-n-a-s-t-a U-K'[1] [spelling every single letter while she writes] on

[1] The company name is changed for anonymity.

Friday Dec., 12 oh my good...," she says while filling in the schedule. KK [whose office is close to the whiteboard] has apparently recognized EBS, and says: "I thought you liked them,... [laughing, they were responsible for "the catastrophe project"]. EBS replies: "Well, if you like them, then you could join us,... then I update your schedule too!" KK says: "No, no,... I was only joking."

One possible interpretation of the excerpt is that EBS produces an "indexical element" for the group, and in doing so, she manages to establish interaction that seems to give (additional) meaning to the entry.

Below is an example of how the entry made by EBS was used for the purpose of establishing interaction.

[PJ and KK have been discussing how to solve a problem in a trial project.]

PJ says: "OK, let's talk about it over lunch... Wouldn't it be good if EBS could join us?" KK replies: "She has left to,... France I think, I think that was what the schedule [i.e., whiteboard] said this morning. But let's check it out." KK leaves the office to check the whiteboard. KK [from the corridor to PJ in the office]: "Yes, she left 11 o'clock,... for the UK." IG [the secretary] shouts from her office: "She has left,..." KK replies: "Right,..." walking back to PJ's office. KK to PJ: "Then we have to sort it our ourselves..." PJ replies: "But lets call her. If she left the office 11.00 o'clock, then the plane is taking of,... at 12.30 or so, and then it shouldn't be a problem to reach her now.... I'm giving her a ring and then we go for lunch."

PJ and KK need to talk to EBS. KK recalls that EBS was going away, and, it seems, that the whiteboard contains more information about the visit. To check it out, she walks away to the whiteboard. At the whiteboard, she shouts the whiteboard entry to PJ, who still is in the office. Apparently, the secretary notices the "investigation," confirming that EBS has left already. KK then concludes that EBS cannot join the discussion.

PJ does not agree with that. He explains what it typically means to make a visit to the UK: leaving the office 1,5 hours before the plane takes off, thus being reachable at least one hour after having left the office. Therefore, he concludes, EBS should be reachable until 12 o'clock, thus "give her a ring."

Again, the artifact itself — here the whiteboard — does not seem to regulate the manner in which people join together in cooperation in a fixed, single way. The conclusion made in the situation above relied, among others, on local knowledge such as going to the UK mean going away by plane, going away by plane means leaving the office 1,5 hours before departure, etc.

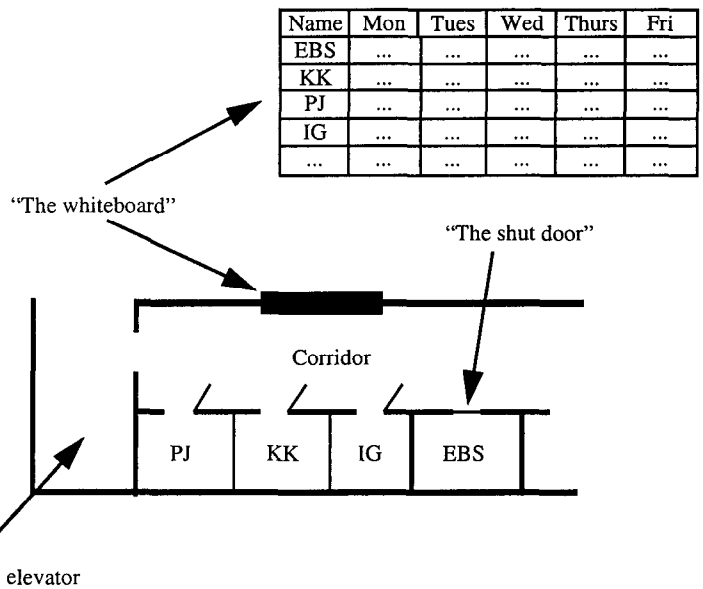

Figure 1. The door and the whiteboard.

Establishing interaction "face to face"

Occasionally, one person started to talk to someone already engaged in a conversation. In all cases documented, with no exception, this made the interrupting party excusing herself, e.g.: "Oh... sorry! I didn't recognize you two were talking...". The

implication is not that people do not "interrupt" each other, but that they do not usually interrupt each other *in such a way*. We found that interruptions were very common, and that many conversations were "replaced" by new conversations. Consider the following excerpt:

EBS is discussing a future study together with JD, who is a medical advisor for the project. GW arrives to the office. She does not interrupt the discussion, but she places herself in the door. EBS and JD immediately realize that GW arrives, and EBS asks JD: "But we're done, aren't we?" JD replies: "Well, I guess we are. Talk to you later..." and leaves the room. EBS starts a conversation with GW..."

The arrival of GW seems to be noticed by EBS and JD immediately. EBS then says "But we're done, aren't we?". One possible interpretation is that EBS here, at least partly, addresses the possibility for JD *and* GW that GW wants to talk to her. Two main actions follow. First, by saying "Well, I guess we are. Talk to you later...," JD indicates that for him it makes sense to close down the conversation with EBS. Second, by remaining quiet GW does not do anything that contradicts the explanations of EBS and JD, and by being quiet, she seems to confirm the interpretation of the other two parties. Hence, GW manages to interfere with the ongoing conversation in a way that was seemingly effortless and unproblematic for *all* parties involved: the ongoing conversation was "smoothly" finished, and neither EBS nor JD indicated that GW in some way acted inappropriately. However, GW did *not* interfere with the ongoing conversation alone. On the contrary, EBS and JD seemed to play the major roles.

A third party

Another empirical observation was when one person informs others about *another* person's current work activities, and in doing so, provides a context for the potential interaction with that person. Consider the following excerpt:

AS and EBS are engaged in a conversation in EBS' office. PJ arrives, and he starts to talk to EBS. AS does not leave the office. She seems to believe the new interaction will not be long. The conversation between EBS and PJ concerns one of PJ's upcoming studies. When PJ mentions the possibility to involve GW in the discussion "to sort it out once and for all," AS intervenes: "No, she's not available now,... well I mean she is, but no,... that's not a good idea, "the salaries," you know." [EBS and PJ do not contact GW]

In this case, AS informs PJ and EBS that GW, who they consider contacting, is working with "the salaries." This implies, AS explains, that she probably should not be contacted.[2] Inasmuch as PJ and EBS do not contact GW, the reason given by AS seems to be intelligible for everybody involved.

Redirected telephone calls

When people for one reason or another do not want to be accessible for telephone calls, they direct the telephone to the secretary. Sometimes when the secretary receives a redirected phone call, she immediately decided to let it (back) through. We found two main reasons for that: first, because she has been provided with *instructions*, e.g., to let through an awaiting call from a particular person; second, because she *knew by experience* that importance of people, e.g., that a particular professor was very important for the study and that he was virtually impossible to reach, thus that people did not want to fail to talk to him if he happened to call.

When it was not so obvious for the secretary whether to let through the call or not, then she typically started to explain *why*. Consider the following excerpt.

"Canasta[3], IG speaking" [IG, the secretary answers the phone]. IG: "She's at a meeting,... unfortunately, would you like to leave a message for her?"

In this case, the secretary seems to say *what* the receiver is doing as a way of describing *why* she is not available. When this happened, the receiver sometimes explained why she was calling, which in turn often made the secretary offering her to leave a note. This does not usually give rise to problems: "They [the callers] understand," IG told us.

Sometimes the caller managed to be let (back) through. The reason why seemed to be that the circumstances offered by the caller made re-directing the call an adequate move, both for the caller, the secretary, and the receiver. Interviewees argued that the secretary was very skilled when it came to making the right decision in this situation: "She *never* makes a wrong decision," as one of them put it. From this it would follow that in all these cases "the rules" for who to let through are relaxed. Nevertheless, the decisions made by the secretary are "always" appropriate and accountable. This would imply that important factors are open when the interaction starts between the caller and the secretary.

Meetings were sometimes held so close to the secretary that she could "control" exactly how they progressed. This helped her to handle re-routed calls (from meeting

[2] "The salaries" referred to the annual negotiation about next year's salaries, which was a frequently discussed issue among staff at the time of the empirical study.

[3] The company name is changed for anonymity.

attendants to her) appropriately. For example, when EBS hosted a long meeting at her office the secretary handed over an incoming telephone call to her during a break, and when the secretary had noticed that a meeting had ended earlier than excepted a call re-routed to her from EBS was re-routed back.

Summing up

Below, we summarize the empirical findings:

- Artifacts are used to regulate interaction. They are given meaning by operation and explanation. The meaning of artifacts is partly open prior to the particular interaction. Therefore, artifacts do not regulate interaction in a fixed, single way. The meaning is "closed" (or, "made less open") through interaction. Particular circumstances can be quoted to temporarily relax the meaning of artifacts used to regulate interaction.
- Establishing interaction usually involves more interaction. Interaction often interrupts, or "replaces" interaction. This is done in an unproblematic, effortless and effective way.
- Knowledge about the receiver, third parties and the previous unfolding of events can play major roles in the interaction to establish interaction. Inasmuch as *rules* are stipulated as regulating the interaction, again, particular circumstances can be quoted to temporarily relax the application of these rules to regulate interaction.

DISCUSSION

The empirical study shed light on important issues in how people, as part of the day to day work, join together in collaboration. In this section, we relate the findings to a typical example of the current way of thinking about session management: *session management based on shared artifact*, as proposed by Edwards [e.g., 3]. Because Edwards' contribution is central and typical for the literature on session management models, we believe it could serve as an appropriate reference model against which to relate the findings.

Many attempts to complement explicit models for session management propose a strategy based on shared artifacts. Edwards [3] presents a model in which activity information, and in particular representations of shared artifact is used to initiate collaborative sessions. Activities are described as tuples of *Users, Tasks* and *Objects*. When activities are detected to subscribe to the same *Object*, a collaborative session is implicitly defined and initiated.

Let us now relate the empirical findings described above to the model suggested by Edwards (the concepts of the model in italics).

The role of the door in establishing interaction

In our case, the door is not in an integral way connected to the *Activity* that takes place, i.e., an informal yet restricted (even confidential) meeting. Indeed, the door, as a regulating artifact, is aimed to inform, to various degrees, also people who are not *Users*. The role it plays is non the less important in indicating who can and who cannot join, therefore Edwards' model breaks down.

Assuming that, in this case, a similarly fine-grained and situated regime applied to a shared object of the activity, there is nothing in Edwards' model that allows the "owner" of the artifact to explicitly inscribe an indexical meaning to it, and different users to be afforded different interpretations. This analysis also applies to the use of the whiteboard described in the fieldwork excerpts.

Establishing interaction "face-to-face"

In these excerpts, there are no *Objects* that are shared in ways that indicate how a collaborative session is to be established, except the "interrupting" persons themselves.

New sessions seem to be able to interrupt without interfering. By this we mean that an awareness of the desire to communicate is itself communicated and acknowledged, before the session actually starts. This can be interpreted as a session in itself, but in many ways this is not an activity, it merely (and subtly, yet significantly) requests communication at a suitable point. The discrete nature of current session management models (including Edwards') prevents support for such activities.

Referring to a third party

In this category, local knowledge is used to modify access to a third party. The object of work ("the salaries") is included in accomplishing session management, but in a prohibitive rather than facilitating manner. This situation (and the "whiteboard" example as well) illustrates the importance of related sessions (logically and physically as well as temporally) in establishing interaction. Aspects of activities that take place elsewhere are brought to bear on the current situation. In Edwards model, as in all other models of which we are aware, sessions are isolated events.

Redirected telephone calls

This excerpt illustrates how people in an effortless and unproblematic way, "quote circumstances" to temporarily relax the meaning of artifacts used to regulate interaction. This observation seems to discourage a very common design proposal, namely the introduction of elaborate and explicit rules to regulate interaction. The model of Edwards involves such assumptions, e.g., collaborative session are defined and initiated when two *Activities* subscribe to the same *Object*.

The role of gatekeepers ("the secretary") is not covered in current models. In our case, "the secretary" was one of utmost importance, not only in administrating and aiding the interpretation of indexical elements, but also in monitoring the ongoing session to detect progress and re-route calls accordingly.

In the discussion above, we related our work to one main contribution on the topic of session management, namely the paper by Edwards [3]. As mentioned previously, this is central and typical for state of the art research on the topic. We maintain the discussion has pointed out general weaknesses in existing research.

CONCLUSIONS

In this section we conclude the paper. We do so by eliciting three principles for session management models derived from the empirical study.

We found that people form *agreements* of artifacts by operation and explanation. Operation is changing the state of the artifact, e.g., by physically shutting the door. Explanation is explaining the operations, e.g., telling others that the door is being shut. Because the agreements concern *the meaning* of the artifacts, we can view artifacts as *agreements of meaning*. If artifacts can "illustrate" agreements of meaning concerning interaction, then they can guide the process of establishing interaction. Therefore, the following principle can be derived:

- **Principle 1**: Artifacts "illustrating" agreements of meaning, obtained through operation and explanation, help people to establish interaction.

Some CSCW systems provide the user with icons that can be operated in various ways. In *Montage*, for instance, the user can configure a door icon to indicate her desired accessibility [15]. A wide open door means you want to interact with people, a shut that you do not, etc.

However, this is not enough, as was clearly shown in the discussion above. There does not seem to exist an objective meaning of the position of a door in regulating interaction. For some people (in a given situation) a closed door means "come in, we have already started," while for other it means "stay out, I'm busy."

Our study documented the importance of *explanation* in forming agreements of the meanings of artifacts. Without explanation it would be difficult to form agreements about meaning, and thus, what to illustrate with the artifact. The importance of explanation has not been considered in the literature so far. This could bee seen as a critique against existing systems and concepts, but also implies a novel observation.

Our study documented that the meaning of session management is partly open prior to the interaction. Even if rules regulating interaction exist, circumstances can be quoted to temporarily relax the meaning illustrated by the artifact. Therefore, interaction seldom has a fixed, identifiable starting point (and, consequently, it "never" ends). Session management models should support a recursive network of interactions that spin-off new opportunities for collaborative work. This should not be interpreted as a normative *formula* for CSCW, inasmuch as there clearly seems to exist, in each particular case, a convenient "grouping" of interactions that can be seen as belonging together. Designers should *be aware*, however, that a general rule for identifying such events seems hard to establish. The critical principle seems to be:

- **Principle 2:** Establishing interaction always involves interaction. Interaction often interrupts, or "replaces" interaction. This is done in an unproblematic, effortless and effective way.

Since actors of a social setting deals with the seemingly eternal loop in an unproblematic way, there is reason to believe that it could also be support "from the bottom up" by CSCW systems, by allowing sessions to be nested in a situated fashion.

In existing research on CSCW session management models there seems to be an underlying assumption that the notion of "task" or "activities" is important. In addition we found that "non-activity" related knowledge about, for example, the history of events, interaction and information is brought to bear on (the potential of) establishing new interactions. This suggests a third principle:

- **Principle 3:** The participants' knowledge about potential participants, their work and previous interactions plays a major role in the *interaction to establish interaction* as well as the *application of rules that are stipulated to regulate interaction.*

This principle seems to introduce a paradox in our account of how people establish sessions, namely that it is at the same time an integrated aspect of accomplishing work, yet it (sometimes) refers to elements that are *external* to elements of that work. We prefer to see this as a general lesson to be learned from this study, that the *work* that we aim to support is, indeed, far more than just *tasks*.

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