An Empirical Study of Facilitation of Computer-mediated Distributed Requirements Negotiations

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Abstract

Group facilitation is an important element of group approaches to Requirements Engineering (RE). The facilitation in 'traditional' face-to-face groups is challenged by the increased globalization of the software industry. Thorough empirical investigation of human facilitation in computer-mediated requirements meetings is needed. This paper presents findings about the facilitation of distributed group settings in a controlled environment. Three professional facilitators mediate 15 three-person groups negotiating software requirements. Facilitation in face-to-face meetings is contrasted with four group settings in which the facilitator is physically separated from the group or co-located with key stakeholders. Rich qualitative and behavioral data enables an understanding of differences and similarities in the facilitation of the distributed groups and of aspects that were detrimental or beneficial to their facilitation. The empirical evidence indicates a reduced richness of social behaviors in computer-mediated group settings which (1) made the group facilitation problematic but also (2) enabled certain facilitation support in the medium itself.

1. Introduction

Although the role of the group facilitator is well recognized in RE, evidence about the facilitation of requirements meetings is scarce. Recent studies indicate that facilitator-driven requirements collection processes are more effective than the conventional interview method [5] and Macaulay builds a model of facilitation based on six case studies of facilitated commercial requirements engineering meetings [7].

Moreover, the time of computer-mediated communication in distributed development teams has come. CSCW researchers acknowledge the importance of considering support for the facilitator's role in the design of computer support for group work [9], and studies show that even very little facilitation in groups using GSS can lead to effective meetings [10]. In RE, the role of facilitator in distributed teams is still subject for discussion and largely under investigated. The three panelists (experienced facilitators) at the ICRE'98 [6] debated the notion of conducting requirements as a distributed team and considered that face-to-face meetings were essential to effectively manage conflict as it arises.

The combination of distributed software development processes and the importance of supporting the facilitator's role in requirements meetings leads to a pressing need for empirical studies to determine potential problems or opportunities in the facilitation of distributed requirements meetings and to inform the design of meeting systems to support facilitation in RE. This paper presents an empirical investigation of facilitation in several distributed group settings in RE. The analysis is part of a larger empirical study of group work in distributed requirements engineering, presented at ICRE'2000 [2],[3]. First, the study design is briefly described, followed by a presentation and discussion of the evidence of facilitation of distributed meetings.

2. Study design

Three professional facilitators participated in an experimental simulation. Each of them mediated a group in each of the five group settings shown in Figure 1. The group task featured the negotiation of requirements for a banking management system and involved two system users with conflicting requirements (Bank Teller and Personal Banking Representative (PBR), referred to as negotiators henceforth), and a system analyst. The distributed group settings featured (1) the facilitator co-located with one negotiator (D1), (2) the facilitator co-located with both negotiators (D3), (3) the facilitator remote from the two negotiators (D2) and (4) the facilitator remote from the entire group (D4). The computer technology used in the distributed settings was Microsoft's NetMeeting, a multimedia meeting system with audio/video channels and real-time file sharing capabilities. None of the facilitators had extensive experience in using the system. A detailed description of the study design and distributed setting can be found in [3], where the results on the decision quality in the negotiation of requirements were presented (see Table 1).

Table 1. A: decision of the highest quality,
F: decision of the lowest quality (no agreement

	F2F	D1	D2	D3	D4
Facil.1	A	A	C	B	A
Facil.2	F	A	B	B	D
Facil.3	B	A	B	D	F

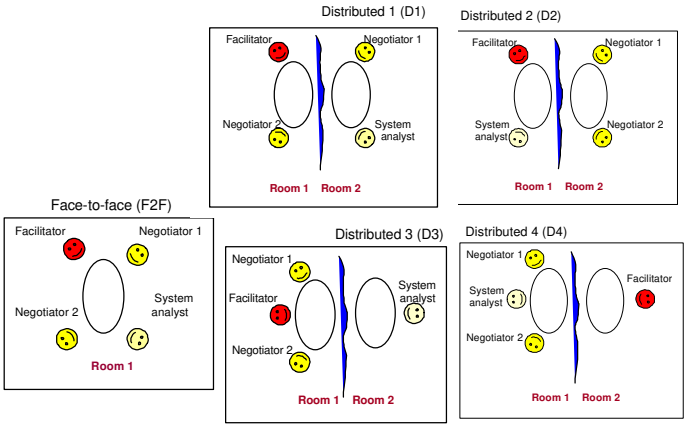


Figure 1. Facilitation of face-to-face and distributed requirements negotiations

Analysis framework. In models of facilitation [4],[7],[9] there is general agreement that the role of facilitator is to help the group members perform their collective task as a group. Observing, attending and monitoring are critical to gaining an understanding of the groups' interaction and to design processes to assist them. In monitoring the group dynamics and designing processes, facilitators use skills ranging from listening well, observing interpersonal cues, to keeping aware of all aspects of the conversation. While in a face-to-face meeting these activities are supported through both audio and visual channels, facilitation in computer-supported distributed teams takes on new dimensions, since socio-emotional issues may be harder to detect and facilitators need to learn how to use the new media as an effective communication tool [7].

In this study an exploratory approach was taken in investigating the affordances of the communication medium in each distributed group setting (Figure 1) in relation to the facilitator's activities. Restrictions in the area of richness of social behaviors in computer-mediated group settings were thought of affecting the facilitator's ability to monitor the group dynamics and consequently the ability to assist the group with the process activities.

Multiple data collection procedures include questionnaires and interviews, both targeted at gathering evidence on aspects that were beneficial or detrimental to facilitation in distributed settings, when compared to the face-to-face meetings. Also, observations of groups' behavior enabled an analysis of group interaction and facilitation.

The paper is structured as follows: A description of the facilitation in each distributed setting, enriched by qualitative data from interviews is presented in Section 3. Results of the detailed behavioral analysis are described in Section 4, followed by a discussion of the aspects that were detrimental and beneficial to facilitation in distributed settings in Section 5. Limitations of the study and future research directions conclude the paper.

3 Facilitation of distributed group settings

The interviews were transcribed and analyzed for patterns in the facilitation in each distributed setting. They are described in the next subsections.

3.1 Facilitation in D1

The distinguishing feature of this group setting was the physical separation of the two negotiators and the co-location of the facilitator with one negotiator. Facilitators' comments indicate a lowered ability to observe interpersonal cues in the interaction but also an enhanced ability to assist the group's process.

The "screen" between the two negotiators troubled the facilitator at one end of the videoconferencing. Monitoring group dynamics relies largely on the ability to observe the interpersonal interaction, the individuals' participation and contribution to the process, and interpersonal relations generated by the participants. Aspects that hindered the observation of interpersonal cues in this group setting were reported.

"Seeing is one of the very important skills in the facilitator's repertoire. The facilitator looks for gestures bearing messages and much can be gleaned from the group simply by reading their eyes" ([9], p. 195). In this setting the separation of the two negotiators at the two ends of videoconferencing caused the need to heavily use the "screen", i.e. "*although I was in the same room with the teller, my interaction with her and observations of her were more through the image on the screen. Very brief /few times of direct eye contact with her*" (Facilitator 3). This appeared to have lowered the ability to observe the local participant and "*having to use the screen to view the cues of the person in the room with me rather than being able to observe him directly*" was noted as a hindrance to facilitation (Facilitator 1).

A similar effect was reported with regard to observing the remote participants. Although the video channel was of high quality, it appears it was 'not good enough' for the facilitators, possibly affecting their ability to ensure equal contribution of group members: "*I am not sure if it's a matter of not being able to observe or more a matter of not being attuned to observing... sometimes in face to face interaction it is easier to get a sense of whether quiet means reflecting/thinking behavior, or quiet means uninvolved or shy behavior*" (Facilitator 3).

The restriction in the communication medium caused less communication, and more formal and structured conversations in the meetings, i.e. "*could certainly feel the distance. The technology added a degree of formality to the discussion and the relationship*" (Facilitator 3). Participants were more polite, i.e. "*people do not feel like they can speak at the same time so tend to let others*

finish statements" (Facilitator 1), and "*politely waiting for sentence to finish before interrupting*" (Facilitator 3). Facilitator 2 regarded this as a potential advantage of computer-mediated communication: *"In this scenario, I think it was better to have the video in some ways... when you are face to face you tend to go much faster… it forces people to slow down, to think about how they are going to get things done, and it forces someone to concentrate on the display, and the task"*.

The enhanced task orientation of distributed sessions was further seen as beneficial in managing the group's process. Unlike face-to-face meetings, where "*discussion would have been more animated, spontaneous - perhaps more 'issues' would have been raised/emerged*" (Facilitator 3), the technology mediated sessions were more sequential in approach, there "*was very little tangential communication to take the process off track*" (Facilitator 2), and "*once a process was defined we certainly stayed with it to see it through. In that way it was helpful*" (Facilitator 3).

3.2 Facilitation in D2

In this group setting the facilitator joins the system analyst in the communication with the two negotiators at the remote site. Given the co-location of the two negotiators, a reported distinguishing feature of this group setting was that the main conversation took place at the remote site (in relation to the facilitator). The facilitators' comments suggest not only an increased ability to remain objective in the facilitation but also aspects that were a hindrance in monitoring group dynamics, in supporting the group process and in maintaining group cohesion.

Enhanced ability to remain impartial in the conversation. "During discussion, the facilitator should recognize spoken ideas for what they are, rather than for who is presenting them… not only should the facilitator disregard *who* presents the ideas, but also *how* they are presented. This is easier said than done." ([9], p. 194). In this direction, a positive aspect reported by Facilitator 3 is the ability to remain detached from the interaction at the remote site, i.e. "*it was easier to distance myself from the 'friendly, extroverted, likeable' behavior of the teller*" and "*easier not to get drawn into the friendliness of the teller, to remain more distant/objective in my role*."

Difficulty in monitoring group dynamics. Facilitator 1 noted that in this group setting "*all used 'the screen' for interpersonal cues*" and believed that it was difficult to perceive the interpersonal relationship between the two at the remote site. The fact that the main conversation took place through the computer link, since "*the two seldom looked "at" each other so that statement target was not clear immediately*", was considered a hindrance in meeting facilitation. Keeping aware of all aspects of the conversation is an important aspect in the facilitator's activities that was affected in this group setting: "*I couldn't tell at the beginning whether they were talking to each other or talking to the developer…having the conversation mostly in the remote site and that's really where it was, and that itself I don't think it would have been too bad, but they didn't talk to each other, they talked to the screen, so I couldn't tell, I lost a whole lot of cues when they were talking. All I had to go with were the verbal cues, I mean other non-verbal cues I couldn't get, cause they were looking at the screen … There was one or two times that they actually glanced at each other … they did a lot of talking to each other, but through the screen, and when they did that I was really lacking a lot of information that I would normally have*" (Facilitator 1).

Lowered ability to ensure that everyone contributed equally to the decision. Monitoring the level of agreement in negotiation was difficult: "*I suspect the PBR was less committed to the solution than the teller. Difficult to tell the degree of resignation even though I checked verbally re: his agreement*", and "*not sure I was accurately able to gauge the degree to which the PBR simply accepted the solution that the teller was so ecstatic about*" (Facilitator 3). When this situation was contrasted to face-to-face communication, Facilitator 3 believed that *"[in face-to-face] it would have been easier to ally with the PBR to ensure that his needs were being addressed adequately*", and that he "*probably would have been more persistent in trying to maintain equality in expression of interests*".

Lowered ability to assist the group process and maintain group cohesion. In a similar manner, Facilitator 1 found that he was unable to follow and help the group with its process, since the process was directed mainly from the remote site: "*the process was not clear; the teller started this process about "what I want" and then the PBR did the same and then… I cannot tell whether they came up with that list or just happened? Or it is the process that would lead to that? The fact that they were in the same room? …*".

"A good facilitator maintains authority and control in the session" ([9], p. 195). In this group setting the facilitators' comments indicate that the physical isolation from the two negotiators meant in fact isolation from the main conversation and that appears to have affected their ability to maintain group cohesion and control, and to ensure that everyone was contributing equally to the process and to assist the developer in following the group process: "*what they did was 'I need that' .. and then the developer had to jump in and impose a constraint that they would kind of missing and then it turned out to be fine. I found it difficult for him [analyst] to follow; the reason…. he was unsure about his calculations … they were engaging him in the conversation.. and he was trying to hear their conversations while he was trying to build this out. And I thought we had very little influence on the [other] side and I found myself wanting to make some statements more*

so that I did in any other session, cause I thought I wasn't involved, I wasn't following, and the only way I came in was to help him and to say 'are you sure, let's make sure that…', cause it was happening too fast" (Facilitator 1).

3.3 Facilitation In D3

If the previous two distributed group settings featured the separation of facilitators from one or both negotiators, condition D3 was characterized by the co-location of the facilitator with both negotiators, while the system analyst joined the meeting from a remote location. This group setting appears to have produced fewer difficulties in facilitating the meetings and the following paragraphs present mainly positive aspects of facilitation in this group setting.

Enhanced ability to monitor group dynamics and to maintain group cohesion. The facilitators noted that being co-located with the two negotiators enabled the facilitators to have "*felt 'part' of the group*" (Facilitator 1), and that was beneficial to their ability to monitor group dynamics, i.e. "*being in the same room with the bank representatives made it easier to see the interaction between them, with the developer separated it did not appear to make it more difficult to observe*" and "*it didn't feel there were any great impediments to being able to see dynamics*" (Facilitator 3), indicating that this group setting resembled mostly, from the facilitator's perspective, the face-to-face situation.

The shared display caused a change in facilitator's behavior. The video image represented the window into the system analyst's room and the notepad was an important element in the communication with the system analyst. While Facilitator 3 noted that his tendency was to focus on the screen as well, unlike face-to-face situations where he would have had "*more face to face interaction with those in the room*", a positive aspect was recorded with regard to the group interaction. The focus on the screen was seen as possibly beneficial to the completion of the task, since it contributed to a more functional interaction: "*the task may have been simplified by keeping focus on the screen"* since in face-to-face the communication "*possibly would have been less focused on the task, more on the interpersonal*" (Facilitator 3).

3.4 Facilitation In D4

This group setting was one of the most important and interesting ones in the investigation of the facilitation style in distributed requirements negotiations. Advances in communication technology represent promising opportunities for facilitators to mediate meetings from their own offices. In D4, the system analyst joined the two negotiators in a meeting mediated by the facilitator from a remote location. Due to the total physical separation of the facilitator from the rest of the group, the facilitators commented on issues that were not raised in the other distributed conditions.

Consistent context for observing the interaction. On the positive side, Facilitator 1 doesn't note any hindrances in this setting. He "*felt involved"* and the technology appears to have enabled him to monitor the interaction: "*could identify many interpersonal cues from the link*". When a comparison was made with face-to-face facilitation, he mentioned, "*my style would have remained the same*." Also, Facilitator 3 noted that the shared display played an important role in enabling him both to follow the group's activity and interaction with the list of requirements, i.e. "*typing and keeping it visible helped*", and to monitor the group dynamics from a detached position: "*seeing all 3 together was helpful in so far as it provides a consistent context for observing the interaction*."

Missing the personal "press the flesh" element. It is worth noting that the comments reported above were provided by the two facilitators who mediated sessions without any technical difficulties. The session mediated by Facilitator 2 instead experienced some technical difficulties, although minor. The overload of the communication channels at one end caused some noise in the audio communication. Facilitator 2 noted that they were a hindrance to facilitation in this particular group setting and provided a different story than the one reported above. He appeared to have been most involved with the group process in all the other conditions, and in D4 he thought it was "*very hard to manage over the video*", due to "*voice time delay (me to them)*", "*lack of clarity on video*" and "*'graininess' of video of remote site*" which made it "*hard to see the eyes … and minute facial expressions*". Since "facilitators need to be able to get a point across clearly and succinctly" ([9], p. 193), it becomes clear then the frustration reported by Facilitator 2; with a lowered ability to communicate and see well at the remote site the facilitator is left with little in managing the meeting.

Feeling of isolation. "A thread weaving throughout the facilitator's repertoire is listening… He listens for hidden agendas and for that crucial moment when the participants have reached consensus so the decisions can be restated, agreed to, and documented." ([9], p. 194). Facilitator 3 reported a sense of isolation that was possibly triggered by the inability to listen to the remote site very well: "*I really remember a sense of isolation; I think probably not hearing people was distracting… face-to-face would have reduced the isolation factor!*". Besides not hearing the group participants, the lack of good visibility of certain things at the remote site, i.e. "*what was being written on paper*" (Facilitator 2) appear to have influenced the ability to maintain group cohesion and work with the group process: "*from meeting start it was difficult to influence this group*" (Facilitator 2), "*I*

definitely felt like an outsider in the process. I'm not sure how important that was, however, to the outcome" (Facilitator 3).

Need to see the people before the meeting! The circumstances around the meeting mediated by Facilitator 2 were such that he did not meet with the rest of the group prior to the meeting. Facilitator 2 mentioned that this was an important factor that appeared to have influenced the meeting facilitation: "*It really does make a difference… I had no real sense of physical stature or dominating characteristics. Felt like tunnel vision*."

4. Behavioral analysis

Detailed behavioral analysis of four groups in the study (see shaded area in Table 1) was performed. Groups in D1 consistently reached decisions of highest quality in the negotiation and a better understanding of the interaction processes in groups mediated by Facilitator 1 (passive facilitation) and Facilitator 2 (active facilitation) was sought.

The videotapes of the four groups were transcribed, coded and analyzed using SYMLOG methodology [1]. Each diagram in Figure 2 shows the outcome of such analysis. Each diagram represents the group members as images (in the form of a circle) along two dimensions: P-N (friendly vs. non friendly behavior) and F-B (task-oriented vs. socially-emotional behavior). The larger the circle, the more dominant the behavior. In Figures 2&3 the circles identified by the letter *F*, refer to the image of the facilitators and the numerical value refers to the dominance level (ranging from 18D to 18U; while the former refers to dominant behavior, the latter refers to submissive behavior). Similarly, *c1* and *c2* refer to the images of negotiator 1 and 2 respectively, and *sa* to the image of the system analyst.

This detailed analysis provided further insights into the facilitator's behavior in face-to-face (F2F) and D1 settings and they are discussed in the next sections, together with the evidence presented above.

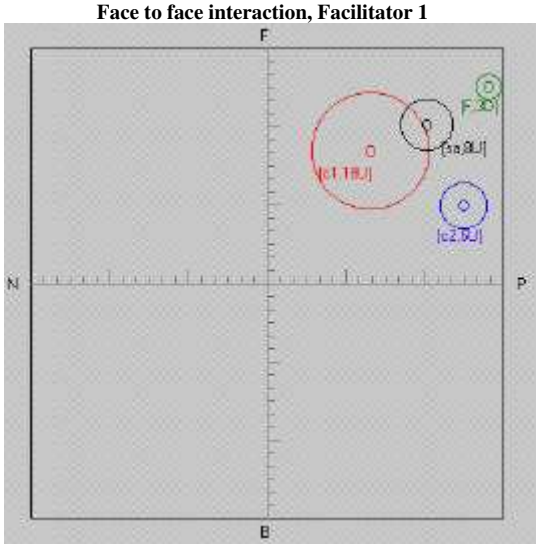
5. Discussion

In this study, the computer technology consisted of real-time audio and video channels, and application sharing capabilities. No facilitation-specific tools such as agenda keeping or voting tools were used in addition to the capabilities provided by NetMeeting. With regard to the facilitator's activities of monitoring the interaction, intervening when problems developed, and assisting the group process [4], it was assumed that the audio and video channels were appropriate tools, in that the facilitators could see and hear who would participate in the meeting and how much. However, it was anticipated that group settings in which groups use a multimedia meeting system (restricting the transmission of social behaviors when compared to face-to-face meetings) would present challenges to the facilitation.

Our exploration of the facilitation of four possible distributed group settings in which the facilitators were co-located with key stakeholders revealed a number of important aspects of facilitation in distributed teams and they are summarized below. This section discusses the evidence detailed in Section 3. It begins with a discussion of the positive aspects reported by facilitators. They represent interesting opportunities that the computer-mediation may bring to facilitation at a distance, aspects that were not anticipated. This is followed by a discussion of aspects that hindered facilitation and caused the facilitation to be problematic in the distributed conditions.

Aspects beneficial to facilitation	Aspects detrimental to facilitation
A sense of detachment from members of the group enabled impartiality and consistent context for observation Enhanced ability to follow the group process due to slower conversation and the use of the shared electronic workspace	Not seeing and hearing well hindered in: • Monitoring group dynamics • Observing interpersonal behavior • Perceiving participants' attitudes • Gauging level of agreement • Maintaining equality of expression • Maintaining control and authority

Face to face interaction, Facilitator 1



Distributed interaction (D1), Facilitator 1

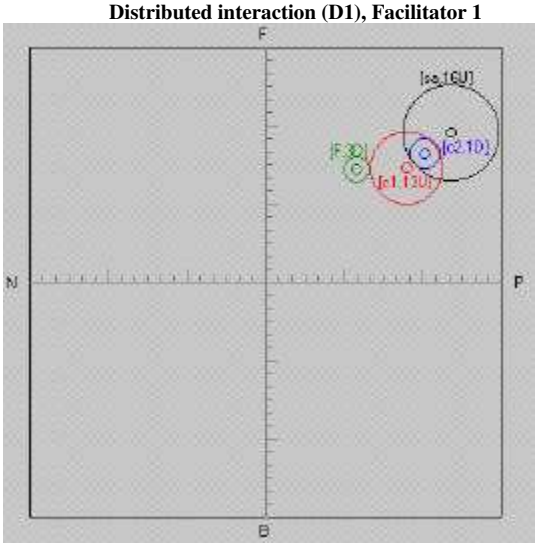


Figure 2. SYMLOG field diagrams for group interactions in face-to-face and distributed group setting D1, Facilitator 1

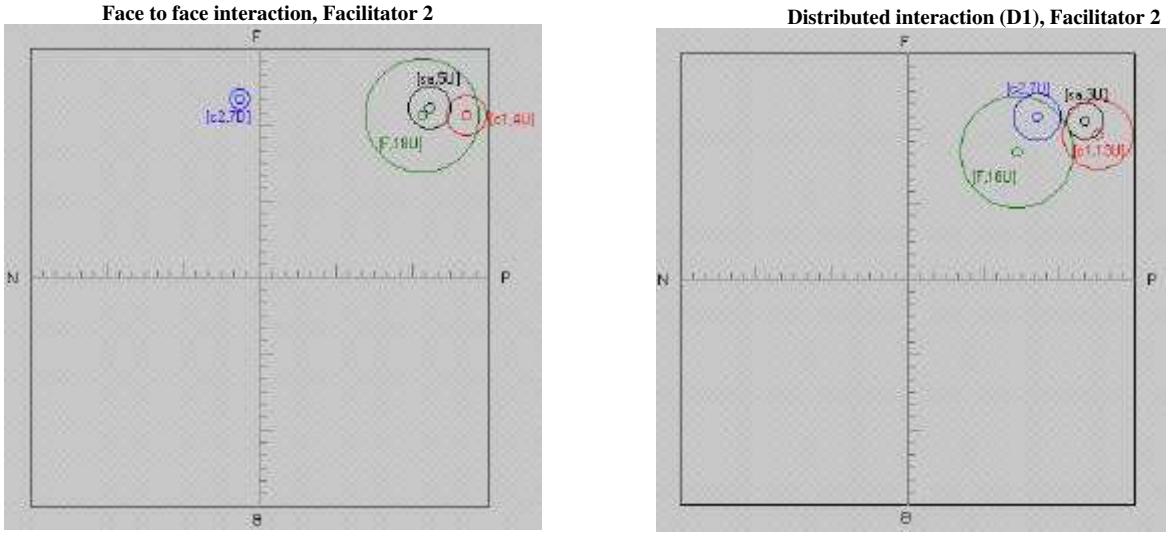


Figure 3. SYMLOG field diagrams for group interactions in face-to-face and distributed group setting D1, Facilitator 2

5.1 Positive aspects of the facilitation of computer-mediated sessions

Two main themes emerged as positive aspects in the facilitation of four distributed conditions:

1. A *sense of detachment* from some or all participants in the group was reported as a positive aspect in computer-supported requirements negotiations. Detachment was perceived as a combination of physical separation and a decrease in the exchange of social cues. This resulted in an enhanced objectivity in facilitation, and a greater ability to evaluate participants' attitudes and to ensure that everyone contributed to the decision. An interesting finding was found in D4 where the total physical separation of the facilitators from the rest of the group seemed to have provided a consistent context for observation of group dynamics. This finding is surprising, since one would expect that group settings in which the facilitators were in a remote location from the rest of the group would suffer from a perceived lowered ability to observe the (remote) group.

2. The slowing down in computer-mediated conversation (with the exception of group mediated by Facilitator 1 in D1) resulted in an *enhanced ability to assist the group with the process*. The fact that fewer conversational acts were exchanged made it easier for the facilitators to follow not only who contributed and what, but it also facilitated the group process. Further, there is evidence that the use of the shared electronic workspace resulted in an enhanced visibility of what would have been "otherwise written on paper", and helped the facilitators follow the activities in the process. For example, Facilitator 2 took an active role in directing the group process and in managing the relationship between the task and technology. The goals and objectives in the task were written on the shared notepad and thus the group activities were kept visible at all times.

These two aspects are particularly interesting since they were found to be beneficial to the facilitation in distributed settings. This evidence suggests that both the perceived detachment from the group interaction and the slowing down in conversation acted as "*useful facilitation tools*" in the distributed settings (Facilitator 1).

5.2 Problems in the facilitation of computer-mediated requirements negotiations

If the detachment from some of the participants, on the one hand, was perceived as beneficial in ensuring the facilitators' objectivity in the meeting, it did, on the other hand, cause significant problems in facilitation. They largely relate to the ability to monitor the group interaction which, in turn, affected the facilitators' perceived ability to assist the group process activities.

Monitoring the group dynamics. This activity has to do with observing the interaction and keeping track of what was being observed in the meeting, who is participating and how much, and relationships between participants, the tools being used, and the meeting technology [4].

The two main problems reported were difficulties in observing the interpersonal relationships between the participants, in particular the two negotiators, and in hearing the conversation well.

Seeing is one of the most important skills in the facilitator's repertoire [9]. Evidence was found that there were difficulties in seeing well in those distributed conditions in which there was some sort of separation between the facilitator and the two negotiators. Although one would expect that observing the participants located in the same room with the facilitator would not be problematic, this was not the case. In D1, where the facilitator was co-located with only one of the negotiators, problems in observing the local participant developed. Evidence was found that the "screen" between the two negotiators was a hindrance in viewing the cues of the local person, due to the lack of eye contact between the

facilitator and the person in the same room. A possible explanation for this is in the design of experimental condition D1: the separation of the two negotiators resulted in the negotiator who was co-located with the facilitator attending mainly to the screen (i.e. the remote partners) and not to the facilitator.

Furthermore, observing the interaction between the two remote negotiators was no easier for the facilitator in D2. An interesting finding was the evidence related to a lower ability to perceive the interpersonal cues at the remote site, due to the communication of the two remote negotiators being mediated by the shared display. The facilitators were restricted in observing the attitudes of the negotiators towards each other, consequently lowering their ability to point out personal relationship problems.

If high quality audio is considered necessary for synchronous work, the ability to listen well is of even greater importance in the facilitator's repertoire [9]. First, some technical glitches in the audio link in the D4 session mediated by Facilitator 3 seemed to have had negative impact on the facilitation. This incident reveals potential for great impediments in facilitation when the audio channel is of low quality. Important to note is that technical difficulties in the video channel were not reported and thus evidence of potential problems in facilitation due to low quality video images was not found. "*However, one should not assume that the quality of the video channel matters less, and both channels should be supported equally, since seeing and hearing well are equally important for facilitators*" (Facilitator 3).

Further, a trend in the facilitators' comments with regard to the ability to hear well was observed in D2, not only in D4. Interesting to note is that these were group settings that featured the separation of the facilitator from the two negotiators. Evidence was also found that private conversations occurred at the remote site and they appear to have hindered the facilitation, as discussed next.

Assisting the group with the process activities. Facilitators monitor the group task activity and play an active role in pointing out potential problems to be dealt with [4]. The facilitators' ability to assist the group in achieving its goal is highly dependent on the monitoring activity. Evidence was found that problems developed because of a lowered ability to monitor group dynamics, especially in D2 and D4.

The hindrance in seeing well and subsequently in observing interpersonal relationships appears to have influenced the facilitators' ability to see the participants' attitudes in the negotiation and to intervene if problems developed. Evidence was found that the facilitators found it difficult to gauge the remote participants' degree of agreement with decisions being taken. It was reported that maintaining equality in expression of interests in the process was problematic. Similarly, not hearing well, especially when private conversations occurred at the remote site, made it difficult to observe whether the participants were following the conversation and the process. There is evidence that knowing whether there was a process in place or ensuring equal contributions to decision at the remote location was problematic.

These factors appear to have caused the facilitator a feeling of isolation from the two negotiators or from the rest of the group, which subsequently resulted in a lowered perceived ability for the facilitator to maintain control and authority in the session.

5.3 Did the facilitators' behavior change between group settings F2F and D1?

The field diagrams of the four groups in F2F and D1 (Figures 2 and 3) indicate that both facilitators had consistent behavior across the two experimental conditions. Facilitator 2 was more actively involved with the groups' process activities than Facilitator 1 and this is emphasized by the results of the SYMLOG analysis. While Facilitator 2 is represented as the most dominant figure on both field diagrams (Figure 3), Facilitator 1 appears the least dominant figure on both field diagrams in Figure 2. This is an interesting finding, since it may indicate that the facilitation behavior did not change between the face-to-face and computer-mediated interaction, in spite of the evidence about problems in facilitating the distributed settings. Or, it may indicate that the facilitators' skills enabled them to adapt to the changes in the communication medium and find ways to overcome the restrictions in the medium.

Another interesting finding is that both groups in D1 reached the same negotiation outcome, i.e. the most integrative agreement. Although a Kruskal-Wallis analysis [8] did not find any statistical significance with respect to the facilitator's effect on the decision quality, these two facilitators had different facilitation styles. One question that comes to mind is whether having a human facilitator had any influence at all on groups achieving the task in this study. It may be that, as Facilitator 1 mentioned, there were facilitation tools in the medium itself, and that the need for human facilitation in such computer-supported situations is minimal. However, participant's comments indicate that the human facilitation was helpful in this study. The fact that both groups in D1 reached the same outcome, in spite of the two different facilitation styles, may also indicate that the characteristics of the group were a stronger determinant factor of success than the facilitation style.

6. Limitations

Although a generalization of results was not sought in this study, but rather an understanding of the aspects of facilitation in different distributed settings, a discussion of its limitations is relevant in understanding the empirical evidence. First, the task was fairly structured and, as

discussed above, the need for assisting the groups in achieving resolution may have been minimal.

Another possible limitation is that the three facilitators mediated the five sessions, with few exceptions, in the same order (F2F, D1,…, D4) and a learning effect with the technology may have occurred. This implies that aspects that were found to be detrimental to facilitation during the early sessions might have been present during the later ones, but the facilitators may have devised strategies to overcome them by a more effective use of the technology. However, it is worth observing that even if a learning effect occurred, evidence shows that this did not affect the negotiation outcome, since groups consistently achieved the most integrative agreements in D1 (second facilitated session). One would expect, if an effect occurred, that the higher decision quality would have been observed in the last conditions, e.g. D3 or D4.

7. Conclusion and Future research directions

This study investigated the largely unexplored aspect of human facilitation in distributed RE meetings. This evidence indicates that distributed facilitation was possible and that the medium itself provided useful facilitation support, although potential problems in facilitating computer-mediated requirements negotiations were identified. These findings have implications for the design of computer support for facilitation in distributed RE teams. Not only high quality audio and visual channels were highly valued, but *"the use of the shared electronic workspace between the two sites was a key success factor in distributed settings"* (Facilitator 2).

In this study the requirements negotiation task was fairly structured and was designed as a scheduled meeting of 40 minutes. As long as the resources that make computer-mediated requirements meetings possible are only available for a pre-determined amount of time (e.g. the videoconferencing room is scheduled for an hour), these results are relevant and thus distributed facilitation is possible. However, more complex and open-ended the task, "*face-to-face meetings may be preferred. I know that personally I would facilitate in a distributed manner only if the task and timelines were clear"* (Facilitator 1).

Important paths for further research include the study of facilitated vs. non-facilitated groups to identify whether human facilitation is useful in these settings and if yes, the study of a larger sample of facilitators to mediate groups in each condition, to identify the extent of the effects of the communication medium on the facilitation and negotiation outcome. Similarly, facilitated meetings in which facilitators mediate the meetings in different orders, to eliminate a possible learning effect with the technology, need to be the topic of future studies. In this respect, industrial situations offer the opportunity to investigate facilitation of distributed requirements negotiations when technology with which the facilitators are familiar.

When asked whether they would consider facilitating future distributed meetings, two facilitators responded that, although face-to-face meetings are preferred, they would not hesitate to do it again. The third facilitator mentioned that it would depend on the technological characteristics present in the communication link. Although facilitation in distributed settings may prove cost-effective, a significant trade-off that emerges is in the area of interpersonal relationships, i.e. *"I didn't build relationships the same way I would to in face-to-face"* (Facilitator 3), and *"…hard to build a relationship… and that may be a limiting factor, that may make the difference between successful and failed meetings"* (Facilitator 2). These findings suggest that face-to-face contact with people before the meeting contributes to the establishing of interpersonal relationships beneficial both to the group interaction and its facilitation in computer mediated meetings.

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