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Abstract- Recent advancements in communication systems enable the collaboration of virtual software design teams, breaking the barriers of time and distance. In this paper we address a critical aspect of the collaborative work of virtual project teams, the negotiation of requirements in software development. We present an exploratory study of the effects of multimedia communication systems on group negotiation performance and behavior. An emphasis is placed on the development of a research methodology that uses multiple methods in investigating a complex phenomenon. Contrary to the belief that face-to-face interaction increases performance, our laboratory findings suggest that groups in face-to-face meetings perform no better than video-conferenced groups; moreover, we identified a particular distributed virtual team configuration that was qualitatively more conducive to requirements negotiation than face-to-face meetings.

Keywords: software virtual teams, requirements negotiation, group performance, multimedia communication systems, video-conferencing, empirical investigation

I. Introduction

In recent years, distributed software development has become more and more common practice and the creation of virtual project teams a reality. We focus on a specific aspect of virtual project teams: requirements negotiation and the involvement of the customer organization in such activity. Managing requirements is recognized as a critical activity that involves the communication of business objectives and constraints, the clarification of possibly conflicting goals, needs and expectations. It is an integral part of software development that involves many stakeholder groups: managers, various end-users and different systems development professionals.

Complex situations that involve negotiations on issues such as cost, performance, or functional requirements become an essential part of system specification: users negotiate amongst themselves and with analysts [18] and trade-offs are needed for a resolution of conflicts [16]. As organizations become more global, requirements often come from distributed groups and facilitating their communication at distance becomes a new challenge.

Recent developments in communication technologies allow organizations to make use of sophisticated meeting systems to bridge the gap; new communication media integrate audio, video and electronic shared applications for communication at distance. Such multimedia systems (e.g. Microsoft's NetMeeting) are becoming tradition in the new organization but the knowledge of their effects is sparse. Studies of media effects suggest that physical separation and lower emotional charge can in fact enhance group work [11,20], although the evidence does not sum up to a clear picture.

Questions in the realm of virtual project teams that we address are whether the group performance improves when the design team negotiates requirements through a less rich communication medium that integrates video, audio and shared electronic files. From a socio-psychological perspective, do stakeholders with different (conflicting) requirements/perspectives manage conflict differently when physically separated or co-located? These unanswered questions illustrate that, although the technology may be impressive, little systematic research exists on its social and psychological significance in negotiating requirements at distance.

This study investigates the role of multimedia communication systems in supporting groups in conflictual situations, in virtual software teams; it seeks to contribute to a better understanding of the effects of these systems on group performance and behavior in distributed requirements negotiations. It focuses on conflictual situations that involve stakeholders with multiple perspectives in software development.

A second goal of this study is to develop a methodology for the assessment of impacts of communication media on group performance and behavior in requirements negotiation situations.

We start by introducing relevant research in the areas of (1) conflict in requirements engineering and (2) media effects. Then we provide a detailed account of our research methodology, describing the various methods we use to investigate and reach an understanding of the phenomenon under study. Results of a laboratory experiment are shortly presented. We conclude with a discussion of our study and outline future work.

II. Theoretical Foundations

A. Conflict in virtual project teams

Delivering systems that meet all stakeholders' requirements is easier said than done in a software development world in which resource constraints are everyday realities. Conflict arises because of differences between the goals and desires of participants [6]. Often stakeholders are from competing

units of the same organization. The reward structure of a company makes resolution more difficult since individuals are being rewarded and promoted on the basis of their performance. When specifying requirements for a system, this may result in users defending opposing positions and attempting to improve the performance of their particular business unit, even if it is harmful for other units or the overall organization. Although such situations provide opportunities for integrative agreements in which parties can maximize joint gains without competing for resources in a direct win-lose fashion, the design team often settles instead for suboptimal compromises rather than searching for mutually beneficial agreements. Some models of conflict identification and resolution have been developed [3,6,18], but the emphasis is largely placed on the automated processes, with little attention to the socio-psychological aspects of the group process.

Although the use of communication technology for distributed software engineering is becoming not only a necessity but a reality, empirical research in distributed requirements engineering is in its infancy [3,13]. Our study contributes to a multi-disciplinary facet of the study of group work in virtual project teams; we focus on the negotiation of requirements as a form of conflict resolution and investigate the role of multimedia communication technologies in facilitating social processes in virtual project teams.

B. Media effects on group work

Beginning with the classic studies by Chapanis [4], behavioral researchers and computer scientists have gone a long way in investigating how people use different communication media for different tasks [19]. Media richness theory (MRT)[5] has been the most prominent theory of media effects over the last twenty-five years. It draws on organizational information processing premises and defines the medium's richness as its information-carrying capacity, in terms of feedback, channel, source and language. Five communication media (face-to-face, telephone, letters, written documents and numeric documents) have been fit on a continuum, with face-to-face being the 'richest' and numerical documents the 'leanest'. MRT argues that organizations process information to reduce uncertainty (lack of information) and equivocality (ambiguity, multiple and conflicting interpretations). Its fundamental claim is that the task performance improves when a medium with the appropriate richness is selected: equivocality reduction requires rich media, while uncertainty reduction occurs best in lean media. Over the years, extensions to MRT adapted this continuum to include newer communication forms such as computer-mediated and video-based media (e.g. [12]); face-to-face however, remained the "richest" communication medium.

Overall, however, empirical studies provide conflicting evidence in supporting MRT's predictions. Recent empirical studies indicate the poverty of MRT to account for the media choice between electronic mail and voice mail in organizations [7]. Studies of media effects on objective task performance, rather than media perception, challenge MRT's claims with respect to equivocal and conflict tasks [11]: while MRT indicated that "tasks requiring groups to negotiate and resolve conflicts of views or conflicts of interests may require the transmission of maximally rich information" ([14] pg. 92), in practice the objective performance for the face-to-face condition was lower than in other media used (e.g. video phone, telephone and computer-mediated communication) [11].

In the area of group decision making in particular, reduced socio-emotional communication can in fact enhance group work [19]. Complementing the findings on task performance, research into the socio-psychological aspects of telecommunications and computer-mediated communication (CMC) [10,19] provide some insights into these controversial empirical findings. It was found that computer-mediated decisions are less influenced by social norms and pressures than face-to-face group decisions [15], and group decision support systems appear to achieve useful group-level outcomes by dampening interpersonal communication.

Our study investigates the effects of multimedia systems that incorporate audio, video and a shared editor application; according to MRT, this communication medium should be less rich than face-to-face interaction. In face-to-face RE, we expect that socio-emotional concerns such as conflict or relationship management among the design team members would take time and effort away from task resolution. The question is then, would a less rich medium act as a mechanism to reduce the need to expend effort in managing interpersonal relationships and therefore enhance the group performance during requirements negotiation.

III. RESEARCH MODEL

We seek to understand the effects of multimedia communication systems on group work in requirements negotiation. Given the complexity of group work itself and the mixed evidence on media effects, formulation of hypotheses proves a difficult task. We designed an exploratory investigation of the phenomenon, an experimental approach that makes use and takes advantage of multiple research methods, employing both quantitative and qualitative assessments of data. Under investigation are groups comprised of customers (with conflicting perspectives) and system developers. We compare groups' negotiation performance in face-to-face settings and in several possible distributed settings. Our research model represents a sequential process as follows:

A. Design and conduct a controlled laboratory experiment: define experimental conditions for face-to-face and relevant distributed settings; obtain measures of group performance and gain an understanding of group behavior; identify specific experimental conditions (cases) that generate meaningful differences;

B. Investigate these specific cases in a field setting.

In our study the laboratory experiment allows us to reach an understanding of the phenomenon in a controlled setting, making possible the careful observation and precise manipulation of independent variables (e.g. communication media); it allows for greater certainty with respect to cause and effect, while holding constant other variables that would normally be associated with it in field settings. We seek to identify meaningful effects on the dependent variables (e.g. group performance) and pursue the investigation of these effects in the field setting.

The first stage of our study, the laboratory experiment is presented in the following. A detailed description of the research design and methods we used is given, followed shortly by the results of our study and their interpretation.

IV. The Laboratory Experiment

The approach of multiple methods is taken further at a microscopic view, within the laboratory experiment. Specific techniques we are employing to investigate the difference between face-to-face and distributed settings are:

1. Use quantitative methods to obtain measures of the group performance;
2. Use quantitative methods to obtain an assessment of interpersonal relationships; evidence on how people perceive one another in the interaction, give insight into effects of media on interpersonal dynamics and possible changes in behavior;
3. Document negotiation behavior using methods from negotiation theory, to get an understanding of the approaches group take when using different communication media;
4. Document group interaction behavior using methods from group research to reveal patterns in group dynamics that may be conducive or detrimental to the negotiation of requirements.

The use of these techniques provides a multi-faceted evidence in the exploratory study of the phenomenon.

A. Experimental design

Task. We designed a simplified scenario of requirements negotiation to be used in the laboratory setting. It illustrates the conflict between requirements scope and resource constraints in the development of a banking management system. The task involves the communication between a software developer and two representative customers (a Teller and a Personal Banking Representative (PBR)), socially mediated by a facilitator. The two customers are from two different organizational units and have different perspectives (thus requirements) of the functionality of the system, based on their job responsibilities at the bank. During the task, they are presented both with (1) the business goal of the bank and (2) a list of requirements for the system. The developer represents that it is not possible to implement the system in the given time frame and proposes that a subset of the requirements be implemented. The group is then asked to reconsider the requirements selected by the analyst and, if they are not agreed as helpful in aiding both customers do their jobs efficiently, agree on another subset of the original requirements to accommodate the time constraints. This triggers the need to resolve conflicts between the requirements of the two customers.

During the pilot sessions, the task was validated with a bank officer to confirm its validity and was refined with three experienced software engineers to ensure a sufficient level of conflict.

Experimental conditions. Under investigation are groups interacting in close proximity (face-to-face) and distributed settings. We design therefore face-to-face and a distributed conditions. Within the distributed condition, we define four "group settings" distinguished by different physical configurations (figure 1, D-1 to D-4). These were chosen to vary the relative location of the two customers, the developer and the facilitator. These settings resemble situations where the two customers possible join the meeting from two branches of the same bank (D-1), or from the same branch (D-2), or the developer collaborates from his/her office (D-3) or the facilitator joins the meeting from his/her office (D-4). Our purpose in including the facilitator is to examine potential changes in the facilitator's behavior in distributed conditions compared to face-to-face meetings. Future work will report on media effects on the facilitation style in such

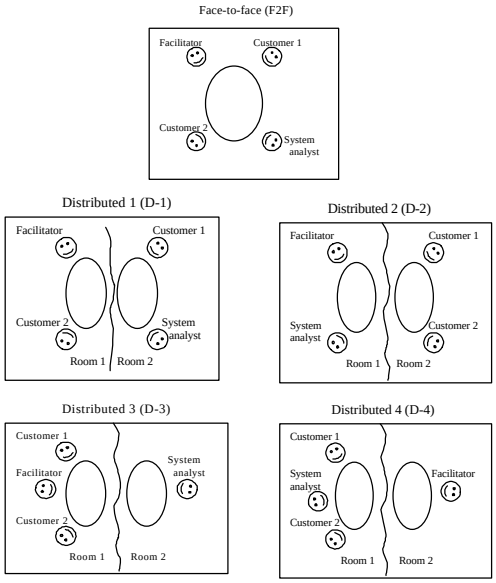

Figure 1. Experimental conditions

group settings.

Our goal is to identify particular group settings (distributed) that are meaningfully different than the face-to-face setting (either more conducive or detrimental to the negotiation of requirements).

Equipment. In designing any experiment of this nature a large number of decisions have to be made concerning the equipment used. As the goal of this study was to investigate the effects of multimedia meeting systems currently used by the software industry in remote collaborations, this study used widely available meeting technology (Microsoft's NetMeeting system with full video/audio and shared files facilities).

Figure 2 depicts the equipment configuration in the distributed conditions. The two rooms were connected such that the images and sounds from one room were transmitted with high quality to the other via audio/video conferencing facilities (an 100Mb Ethernet link was used). Further, the task was electronically mediated through a shared editor to reflect the results of the negotiation and displayed on both electronic displays. All groups (including those in face-to-face interaction) used the shared editor in completing the task.

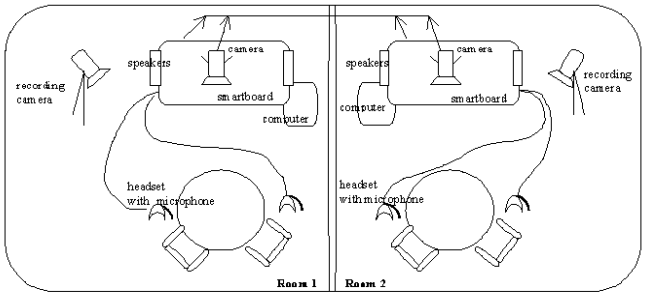

Figure 2. Equipment used in the distributed setting

Variables. The independent variable is the communication media, varied from face-to-face to distributed setting. Dependent variables are group performance and person perception. They are described in the sections to follow.

Group performance. As mentioned in section 2.2, results of studies of media effects that used objective measures of group performance proved to be a challenge to the MRT and suggest new and worthwhile paths for investigation.

In software development, it is important and desirable that the system to be implemented meets the needs and expectations of all involved stakeholders. The current study defines the dependent variable objective group performance as the extent to which the group's agreement incorporates the conflicting perspectives (maximizing joint benefit in the negotiation), and provides maximum support for the overall business goal of the customer organization.

A scoring system based on numerical weights to account for the relative importance of each issue in discussion is used to calculate the objective group performance.

Person perception. Aspects of interpersonal relationships such as the perception of one's partner are seen as critical in conflictual situations [19] and represent another testing ground for theories of media effects.

In our study the second dependent variable on which we gather quantitative evidence is *person perception*. The design of the experimental conditions enables each individual participant in D-1, D-2 and D-3 to interact with and thus rate both a *local* (physically co-located) and *remote* partners (encountered through video-conferencing) at the same time.

The participants rated their partners (except the facilitator) on 13 five-point scales: 'polite', 'rational', 'predictable', 'confident', 'trustworthy', 'dominant', 'sociable', 'emotional', 'cooperative', 'argumentative', 'active', 'formal' and 'competitive'. The instrument was developed primarily from the work of Short, Williams and Christie [19] and Williams [21] on interpersonal evaluation. A score of 1 indicated a positive evaluation of the person, while a score of 5 indicated a negative evaluation.

Qualitative assessment in our study. Complementary to the quantitative assessments we conduct on the two dependent variables we employ qualitative assessments methods to investigate the group interaction and negotiation behavior. The following sections describe them in detail.

Negotiation behavior analysis. We use general concepts from negotiation literature [17] in describing and understanding the groups negotiation behavior. Negotiation behavior can be distributive or integrative. While distributive behavior reflects the situation "your loss is my gain" (here: only one customer perspective is supported by the system), integrative behavior consists of incorporation of opposing proposals, communication of goals and constraints, as well as searching through extreme alternatives and multiple issues [18,17] (here: the incorporation of both customer perspectives to support the overall business goal).

The two customers are interested in different functionality of the system and are faced with choosing among several alternatives. Here an alternative represents any proposed and accepted change in the list of requirements during negotiation. Integrative agreements however are only possible to the extent that the situation has integrative potential, that is, that some of the available alternatives offer higher joint benefit than others. The design of our experimental task allows for integrative behavior and we seek an understanding of the group negotiation behavior in different experimental conditions.

To do that, we are using the systematic concession model (17), based on the assumption that a heuristic and trial strategy leads to agreements with maximal joint benefit for both parties in the negotiation. The reasoning is that each party's multiple goals and aspirations can be reduced to a single utility scale on which it is possible to locate every alternative that can possibly be conceived. In our requirements negotiation task, the two customers' goals and expectations can be represented on a single utility scale (figure 3).

Point A represents the given starting point in the negotiation (the payoffs of the developer's initial proposal). In order to maximize individual payoffs, each customer proposes alternatives that he/she finds acceptable. The set of available joint profit alternatives are bounded by edges (a), (b) and (c). The design of our task defines three maximum joint benefit

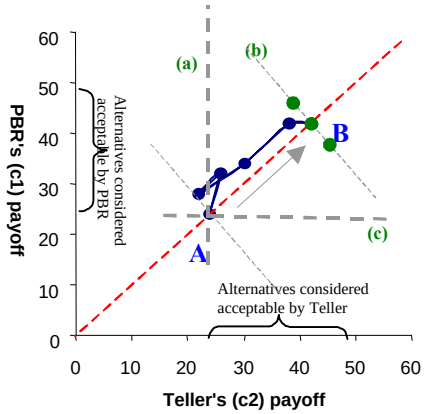

Figure 3. Negotiation trajectory of group interaction in D-

alternatives, arrayed as points on edge (b). While any point on line AB represents an alternative that equally incorporates both customers' perspectives, point B is the only one available that provides maximum support for the organization's business goal. Therefore, according to the definition of group performance, it represents the optimal negotiation outcome, and any other alternatives are suboptimal. Due to space limitation, figure 3 includes data representing the results of a selected case (a group in D-1); this data is further explored in the results section 4.3.

While oversimplified, this model is an aid in understanding both the position of the negotiation outcome and the negotiation trajectory (the path of alternatives chosen during the negotiation).

Group interaction behavior analysis. The importance of coding and analysis of group behavior in order to better understand group work has long been recognized [8]. In our study we use SYMLOG [2] (a system for the multiple level observation of groups), which is one of the major theories that focus on aspects of group behavior. It is a methodology for the observation, coding and analysis of group dynamics. Its advantage is in the ability to provide a picture of the images of team-members in a three-dimensional interpersonal space.

The three dimensions are: 1) Up-Down (U-D dimension) representing dominant vs. submissive behavior, 2) Positive-Negative (P-N dimension) representing friendly vs. unfriendly behavior, and 3) Forward-Backward (F-B dimension) representing task-oriented vs. emotionally expressive behavior.

The main output of a SYMLOG coded session is a picture is in the form of a field diagram (due to space limitations we refer the reader to figure 4 in the results section) which summarizes group behavior by representing each participant as a circle whose radius conveys the level of dominance. The larger the circle, the more dominant the person. The circle is located in a two-dimensional plane whose vertical axis is the F-B dimension and whose horizontal axis is the P-N dimension.

The field diagram represents the position of team members as they might appear to a team member or an observer. Our belief is that, by analyzing the field diagrams of meetings in all experimental conditions, the investigator may discover relationships between behaviors that illuminate questions of social influence, competitive or cooperative behavior in the negotiation or other questions about interactive behavioral patterns.

B. Subjects

Forty-five volunteers from the student population of the *University X* (not identified here in this version of paper) took part in this study, 16 females and 29 males. The participants ranged in age from 19 to 44. The prerequisite for their participation was experience in software engineering and/or negotiation. They gave informed consent and were paid for their participation. Three professional facilitators volunteered to mediate these meetings.

C. Procedure

Participants were informed of the nature of the task prior to the study. A one-page set of instructions on the role was distributed and the need to become familiar with the role was explained. During the briefing period the understanding of the role was validated with each participant. They were introduced to their partners and completed a warm-up task designed to familiarize the participants both with each other and with the medium. Then they started the software requirements session, which was presented as a scheduled meeting of 40 minutes. Each facilitator mediated a series of five group interactions, one in each setting in figure 2. Each group participated in only one negotiation session. The sessions were ended after 40 minutes and the final list of requirements was recorded. The participants then completed a post-session questionnaire.

Collection of data. The usage of the electronic shared editor has been recorded for groups in all experimental conditions.

The final list of requirements that the group agreed on was analyzed and scored as described above. The post-session questionnaire was used in collecting both quantitative data on person ratings (using rating scales) and qualitative data on the aspects of videoconferencing that helped/hindered the negotiation process (using open-ended questions). The sessions were video recorded for future analyses of group behavior.

IV. Results

Due to the small sample size in each experimental condition, we used non-parametric tests to analyze the results. These tests included the Mann-Whitney test for the analysis of results on the group performance variable, and the sign test for related samples for the analysis of results on the person perception variable.

A. Group performance

Thirteen out of fifteen groups reached an agreement. The outcomes were scored with values ranging from 60 to 68 points and the groups with no agreement were scored 0 points. The obtained scores and their frequency is shown in Table 1; Table 2 illustrates the distribution of these scores across all five experimental conditions (F2F, D-1, ..., D-4). The customers' payoffs at the end of the negotiation are provided in brackets (Teller: PBR), to illustrate their variability across groups and conditions.

Two analyses were performed on the group performance variable in order to explore differences among the five experimental conditions, as follows.

Objective negotiation outcome:	I Optimal **68**		II Sub-optimal **65**		III Sub-optimal **62**	IV Sub-optimal **60**	V No agreement **0**
Frequency:	(a)	(b)	(a)	(b)			
	2	3	3	2	1	2	2
Totals:	**5**		**5**		**1**	**2**	**2**

TABLE 1. Negotiation outcomes and their frequency

	F2F	**D-1**	**D-2**	**D-3**	**D-4**
Facilitator 1	68 (a) (42 : 42)	68 (b) (42 : 42)	62 (36 : 36)	65 (a) (38 : 44)	68 (b) (42 : 42)
Facilitator 2	0	68 (b) (42 : 42)	65 (a) (38 : 44)	65 (b) (44 : 38)	60 (34 : 34)
Facilitator 3	65 (a) (38 : 44)	68 (a) (42 : 42)	65 (b) (44 : 38)	60 (34 : 34)	0

TABLE 2. Outcomes for each facilitator and experimental condition

Face-to-face vs. Distributed condition. In analyzing the effects of communication media (Face-to-face vs. Distributed communication) on group performance, the face-to-face condition was used as a control group and compared to each of the four distributed conditions (D-1 to D4). The non-parametric Mann-Whitney test indicates that none of these comparisons demonstrated statistically significant difference (F2F:D-1 U=1.5, p>.10; F2F:D-2 U=4, p>.10; F2F:D-3 U=4, p>.10; F2F:D-4 U=4, p>.10).

Within the distributed condition. We observed the group outcomes within the distributed condition in order to analyze the effects of group settings on group performance. There was an indication that the groups in condition D-1 had the highest scores and thus an analysis to compare D-1 to a combination of all other distributed conditions (D-2, D-3 and D-4) was performed. A Mann-Whitney test indicates that this comparison reached statistical significance (U=1.5, alpha =0.05).

B. Interpersonal relationships

A sign test for two related samples on the person perception indicates that *local* partners are rated differently than *remote* partners on some attributes. *Local* individuals were regarded as more emotional (p=0.008), argumentative (p=0.033) and competitive (p=0.029) than those encountered remotely through computer conferencing.

C. Negotiation behavior analysis

Negotiation trajectories (paths of alternatives considered during the negotiation) are drawn for groups in all experimental conditions. Both customers' payoffs during and at the end of the negotiation are calculated with the same scoring schema used to asses the group objective performance. A sample negotiation trajectory is shown in figure 3. It illustrates the negotiation behavior of one group in D-1, group that reached an optimal agreement at the end of the 40 minutes of interaction. It suggests that although the alternatives considered during the meeting mostly favored the PBR , the group negotiation ended with the maximum joint benefit represented by point B (also the only optimal agreement possible).

We seek an understanding of the data on group outcomes and the customers' payoffs presented in table 1 in relation to the graphical representations of the negotiation trajectories and the group field diagrams described next.

D. SYMLOG analysis

We performed SYMLOG analyses of the behavior of groups in the two experimental conditions that generated meaningful results: F2F and D-1. Video tapes of group interactions have been coded and analyzed and field diagrams have been produced. Figure 4 represents the field diagram of one group in condition D-1, related to figure 3, which represents the negotiation trajectory for the same interaction. It can be seen that the field diagram provides rich information not only on the behavior of individual members (e.g. the facilitator (F) was the most dominant member of the group) but also on the relative position of members in the interaction (e.g. c2 was more dominant than c1, but more positive and less task-oriented than c1).

A detailed analysis is conducted in order to reach an understanding of the dynamics of the meeting in the two experimental conditions (F2F and D-1). We define meeting

splits, which are segments of interaction bounded by moments of time when the group chooses a alternative. Field diagrams are produced for each meeting split. A detailed presentation of SYMLOG analysis (all field diagrams) is beyond the scope of this paper and it will be reported elsewhere.

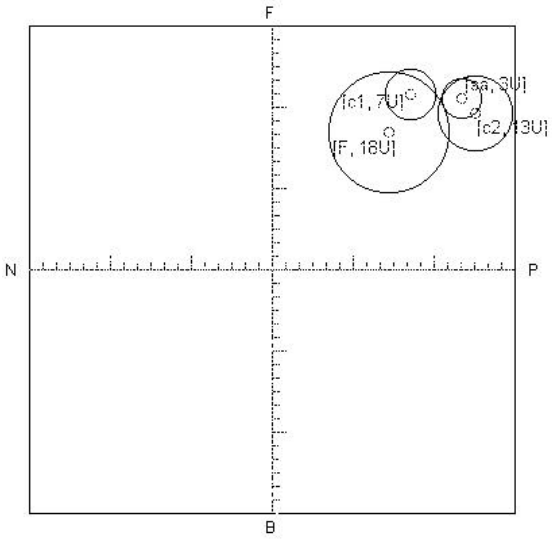

Figure 4. SYMLOG analysis for group behavior in D-1

V. Discussion

According to media richness theory (MRT), the face-to-face communication is the richest and all other media (including the multimedia meeting system used in this study) are thought to restrict aspects of these communication modes, thus are less rich. The group performance on equivocal and complex tasks (such as the negotiation of requirements), is said to decrease when media other than face-to-face is used, due to a mismatch between the task needs and the medium's information richness.

In this study we investigated the groups' performance on a requirements negotiation task when less rich media was used in distributed settings. Contrary to most studies that support MRT, we used an objective measure of performance.

The analysis of quantitative data on groups performance in face-to-face and distributed settings indicate that we did not find support for the claim that groups in the richest communication medium would perform better than those using less rich communication media. Moreover, all groups in D-1 reached agreements of higher or equal quality with those in F2F. This is the opposite of what MRT would predict.

Second, we wanted to investigate whether various physical group configurations would provide new insights into the groups' performance in the distributed condition. The results indicate that groups in D-1 (figure 2) performed better than those in other distributed conditions. When optimal vs. suboptimal agreements are considered, groups in D-1 reached three agreements that are optimal and none suboptimal, while groups in conditions D-2, D-3 and D-4 combined reached only one optimal but eight suboptimal agreements. Important to note is that D-1 was the only group setting in which the customers with two conflicting views are physically separated. The results indicate here that the electronic mediation of the customers' discussion is conducive to a negotiation behavior that results in agreements most favorable to the overall business goal, while equally incorporating the perspectives of both customers.

The results on person perception may aid in understanding the trends of group outcomes in the distributed conditions. We found that the remote partner was seen as less emotional than the local partner. This indicates that the electronic mediation might have helped the group place greater emphasis on the task-related matters rather than interpersonal aspects of the interaction. When this is considered in light of group outcomes in D-1, in which the two customers were separated, it may indicate a change in group's behavior that enhanced its performance: the lowered ability to perceive emotional cues may have been beneficial to a more objective exploration of alternatives which resulted in improved consideration of the overall business goal and consequently optimal agreements.

A post-hoc explanation that provides deeper insights into these results is offered by considering the theory of Argyle and Dean [1]. They proposed an intimacy equilibrium model, in which ‘intimacy’ is a function of proximity, eye contact, smiling, topic of conversation and other factors. They hypothesize that immediacy has a -shaped relation to liking, so that either too high or too low intimacy is avoided. This suggests that with tasks of very high intimacy – perhaps personal or conflictual ones – a less rich medium (e.g. computer-conferencing) would lead to more positive evaluations. Then it is only necessary to consider the requirements negotiation situation, in which the two customers had to decide on the relative importance of particular requirements that were often critical for one customer but not important at all for the other customer. We found a predominance of suboptimal outcomes in distributed conditions where the two customers were co-located. The fact that close proximity led to more negative evaluations (local partner was perceived as more argumentative and competitive) suggests, in the light of the 'intimacy' equilibrium model, that the two customers changed their behavior accordingly, change that seem to have exacted a toll on the objective outcome.

Given the results on the group performance variable, we are particularly interested in achieving a deeper understanding of the group behavior in two interaction settings that generated a meaningful difference: F2F and D-1. While the intimacy model provides a possible explanation of results,

we are also analyzing the negotiation trajectories (e.g. figure 3) together with field diagrams produced with SYMLOG methodology [2]. The field diagrams corresponding to meeting splits for each group interaction are representations that convey the flow of interaction in a way that allow us to observe patterns of interactive behavior that are either conducive or detrimental to negotiation.

VI. Conclusions and Future Work

In summary, our investigation relates to studies that used an objective measure and not perceptions of media in evaluating media effects [11], and to studies that found electronic mediation to create a more task-oriented environment [20]. Our results align most with the results of these studies, in challenging the claims of MRT.

The results of our study have very important practical applications for virtual project teams. Commonly the design team is gathering requirements from customers scattered across different physical locations. Our laboratory findings suggest that the use of multimedia meeting systems to enable group settings in which customers with conflicting perspectives are remote would be a first step in developing systems that satisfy the customers' needs better; and therefore an advancement in creating more effective virtual project teams. It is for these situations that the investment in advanced meeting systems pays off.

We completed the first stage of our exploratory investigation as presented in section 3, namely the laboratory experiment. We identified two experimental conditions (F2F and D-1) that generated a meaningful difference in the negotiation of requirements. We believe that it is worthwhile to study them further in the field setting, to see whether or not there is sufficient continuity between the laboratory and field settings from which we wish to generalize about a particular effect found in both arenas.

Arrangements have been made with a major industry partner to carry out a field investigation of conditions F2F and D-1.

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