The Evaluation of GRADD: a GDSS supporting asynchronous and distributed meetings

Karin Becker Ana Paula Terra Bacelo
Pontifícia Universidade Católica do Rio Grande do Sul

Abstract

GRADD is a group decision support systems targeted at asynchronous and distributed meetings. The distinctive features of GRADD are the combination of a rationale-model for discussion support, voting techniques for deliberation activities, and automatic norm control for process structure definition and control. The goal of this paper is to present the results of an empirical evaluation of GRADD functionality, with regard to these distinctive features. The experiment, though empirical, enabled to detect the strong and weak points of the proposed functionality and/or of the current GRADD prototype, and to establish future extensions and improvements.

Keywords: group decision, IBIS model, voting, norm, evaluation

1 Introduction

Decision-making frequently involves a group of people, who meet in order to exchange different points-of-view, expertise and information to detect and define problems, generate possible courses of actions, analyze and select among alternatives, etc. However, decision makers are beginning to resist attending the increasing number of lengthy meetings because they take time away from other critical activities [13]. Indeed, the effectiveness of meetings can be influenced by a number of factors, such as difficulty in scheduling meetings, interpersonal problems, failure to efficiently organize and analyze ideas, difficulty to develop a meeting strategy or plan (and to stick with the defined one), difficulty to convey to a common solution, etc. [15].

Group Decision Support Systems (GDSS) aim at improving the process of group decision making by removing common communication barriers, providing techniques for structuring decision analysis and systematically directing the pattern, timing and content of discussion and deliberation activities [12]. GDSS such as [7][8][5] focus on supporting distributed and asynchronous meetings, through a network of interconnected computers. A common feature of these systems is the use of a shared space for information capture [2], where ideas can be expressed, collected, related and commented upon by group participants. Discussion rationale-based models [10], also refereed to as rhetorical or argumentation models, have been widely employed as a means to help people to capture and structure informal knowledge. IBIS (Issue Based Information System) [9] is one of the most popular argumentation models, adopted in various GDSS [7][8][4][11][10]. It proposes a model based on three main abstractions, namely Issue, Position and Argument, which can be related to each other by nine pre-defined relationships. An Issue represents a decision problem, Positions are statements that resolve the Issue, and Arguments either support or object to Positions. The good trade-off between expressiveness and simplicity explains the popularity of the IBIS model.

Discussion rationale model-based GDSS focus on information capturing, sharing and retrieval/visualization, and solve some of the problems previously mentioned, such as the ones for scheduling meetings, as well as those related to the personality of the participants. However, they often lack of consistent support to the conveyance for a common, acceptable solution for the decision problem at hand. Moreover, there is no control over the process, in the sense that no support is provided for the development and/or control of a meeting plan. In other words, meetings are still potentially endless, and participants may not be able to convey to a common solution.

GRADD [4] addresses these problems by integrating into a GDSS the following main features: a) use of the IBIS *argumentation model* to structure the discussion process and help organizing ideas, b) use of *voting techniques* to aid in the selection of alternatives identified during the discussion, and c) adoption of an *automated group norm* that allows the definition and control of meeting rules to be followed by the participants. The Lotus-Domino platform was used to implement the current prototype of GRADD [3], enabling decision-makers to interact with it using any WWW browser.

Though many GDSS proposals can be found in the literature, very little is known about their effects on

0-7695-0828-6/00 $10.00 © 2000 IEEE

decisional processes (results, process, people, group, etc) [15]. The goal of this paper is to describe the results of an empirical evaluation of GRADD functionality, which aimed at evaluating the 3 main features of GRADD mentioned above.

The rest of this work is structured as follows. The striking characteristics of GRADD functionality and prototype are described in Section 2. Section 3 discusses the experiment structure, the sample and the results. Conclusions and future work directions are presented in Section 4.

2 GRADD

2.1 Overview

GRADD is a GDSS that supports asynchronous and distributed meetings, which aims at making meetings shorter and more objective, as well as providing functionality such that conveyance to an acceptable can be reached more rapidly and easily. To reach these goals, the design of GRADD was based on two premises. First of all, meeting objectivity and conveyance to a satisfactory solution depend heavily on reducing the noise involved in communication activities, providing support for consensus reaching activities and on the ability of defining and controlling a strict meeting plan. Secondly, this functionality should be provided through simple techniques, with which decision-makers are familiar, or at least which can be easily learned. To meet these requirements, GRADD integrates the following features:

- ***discussion rationale model IBIS***: this choice was motivated by the reported experiments on the successful use of the IBIS model [10], and by its adoption by a significant number of GDSS;
- ***voting techniques***: most people feel familiar with this choice technique, which is simple but powerful;
- ***group norm***: automated component allowing the definition and control of a meeting plan;
- ***form-oriented interface***: a user-friendly interface that allows users to easily navigate between the various subsystems in an integrated manner.

2.2 Norm Subsystem

The Norm Subsystem has to goal of providing GRADD with functionality to explicitly support the definition and control of the process to be adopted for the meeting. With this characteristic, more objectivity and shorter meetings are expected. GRADD assumes the existence of two distinct types of actor, referred to as facilitator and group member. The facilitator is the person responsible for presenting the decision problem, and by defining the rules to be followed by participants during the meeting. The group members are the people that discuss, find possible courses of actions, and select among the alternatives using voting techniques.

The group norm is the central element of this subsystem, and it has the goal of documenting and controlling the rules defined for the meeting. A meeting starts when the facilitator presents the decision problem to the group by creating the Issue representing the decision problem which should be discussed and solved, and defining the group norm for conducting the decision process. As it can be seen in Figure 1, four main aspects are defined in the group norm:

- ***meeting participants***: this feature enables the control of the integrity of the discussion and voting procedures. For example, only the facilitator may update the norm, and only people registered as a group member can discuss and vote.
- ***discussion rules*** : define the length of the discussion, whether the contributions are anonymous, and the number of interventions a group member can perform during the discussion (maximum number of positions and arguments). The definition of limits has the goal of achieving more objectivity in the meeting, by avoiding problems such as dominance, creation of nodes (i.e. positions or arguments) that add too little with regard to the existing ones and that end by jeopardizing the understanding of the discussion as a whole. The facilitator must define convenient limits according to the characteristics of the decision problem and/or of the group, and must constantly monitor the process and update these limits whenever needed. The possibility of anonymity in the discussion seeks to reduce the problems related to hierarchical positions and interpersonal differences, but this feature is not currently implemented in the prototype.
- ***voting rules*** : used to define how alternatives are extracted from the discussion, the number and the characteristics of each voting round, as well the alternatives to be considered in the next round in case no alternative gets the majority in the previous one. The properties defined for each round are its duration, voting method and extraction of voting alternatives in case of ties.
- ***Meeting Issue*** : it is defined by the facilitator, and it summarizes the problem to be solved through discussion and voting.

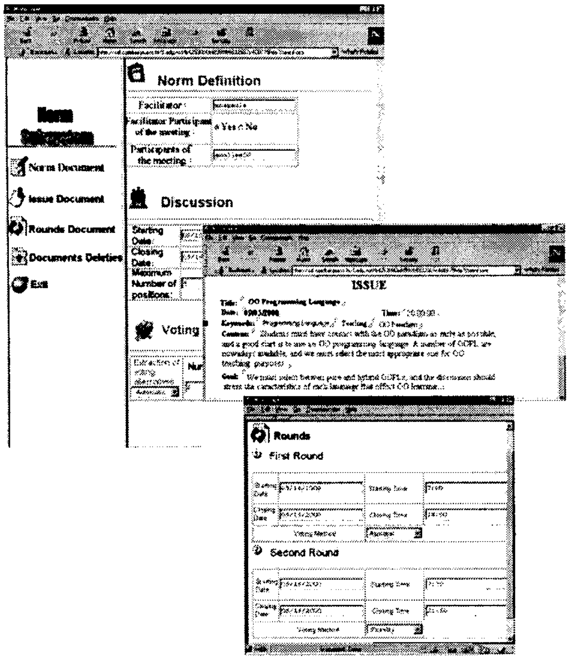

Figure 1 - Norm Subsystem Interface

2.3 Discussion Subsystem

GRADD adopts the IBIS model in its canonical form [10], which is limited to three abstractions and three relationships. In the canonical IBIS, an Issue is responded by one or more Positions, and each Position can be supported or objected by none or various Arguments. This limitation aims at avoiding digressions during the discussion [4].

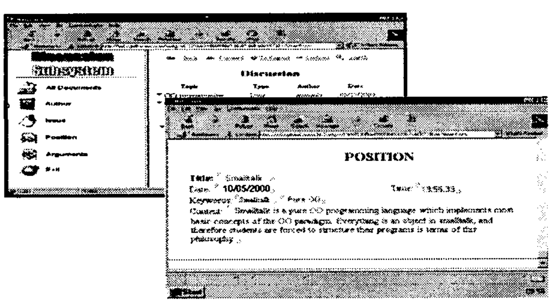

Figure 2 - Discussion Subsystem Interface

The meeting norm is in charge of opening and closing the discussion, according to the time limits specified in the norm. Only registered participants can contribute to the discussion, by adding positions and arguments, within the limits also defined in the norm. Figure 2 presents the interface of the Discussion Subsystem: the overall structure of a discussion is displayed on the left screen, and the contents of specific Position is shown on the right one.

2.4 Voting Subsystem

The voting process is divided into two main steps aspects : the extraction of alternatives from the discussion and the voting itself, represented by a set of one or more rounds. The second and subsequent rounds, if defined in the group norm, take place in case of ties.

When the discussion is finished, the voting alternatives must be extracted from the discussion. To consistently integrate the discussion and voting subsystems, we chose to use the concept of Position, and to define different procedures for extracting the alternative positions to be voted [4]. Three alternative extraction procedures have been defined for GRADD, referred to as *automatic*, *manual* and *approval*. The former considers all positions as voting alternatives. The manual extraction is performed by the facilitator, who inspects and selects the relevant positions using subjective criteria. The approval extraction involves the whole group, where each group member selects as alternatives the positions he/she judges most significant. Then, each position selected by at least one group member is considered as a voting alternative. The current GRADD prototype only implements the automatic extraction method.

GRADD implements 2 voting methods: plurality and approval. Using the plurality method, each voter can select at most one alternative, whereas using the approval method, the user can select as many alternatives as desired. In both methods, the alternatives that receive the majority of votes win. The original design of the GDSS [4] also includes two additional voting methods, which are not included in the current prototype: *Borda-Kendall* e *NAI*.

When a voting round is open by the norm, each group member can vote on the alternatives available for that round, according to the voting method defined in the norm (Figure 3). Voting is always anonymous. Each member may vote only once at each round, and the system is in charge of maintaining that integrity, as well as monitoring the opening and closing times of each round. At any point of the process, the interface allows users to inspect the details of discussion, by navigating through its nodes and visualizing the properties of positions and arguments, in order to help deciding among the most suitable candidates. When the round is closed, all votes are retrieved, the results are computed and recorded, and the winner is informed to the group members. In case no alternative gets the majority, another round takes place, until either there is a winner, or the maximum number of rounds was attained.

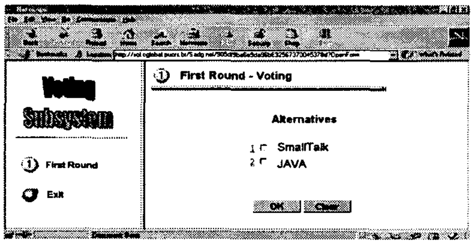

Figure 3 - Voting Subsystem Interface

2.5 GRADD Prototype

Lotus - Domino platform was chosen to implement the current GRADD prototype. Lotus Notes (LN) is an Information Management System that provides different ways to create, locate and share information in a cooperative workgroup. Domino adds to this architecture a web server that enables users to interact with LN using any WWW browser (e.g. Netscape). Besides handling all communication aspects between an http server and a LN server, Domino also automatically converts all LN elements (e.g. navigators, views, documents, links) into HTML documents, such that they are accessible through a WWW browser. The combination of Lotus - Domino allows one to take advantage of all information management functionality offered by LN (e.g. replication, document management, information retrieval, security, etc), and of the wide information accessibility enabled by WWW.

Figure 4 shows the prototype implementation architecture based on Lotus - Domino. As already mentioned, we took advantage from LN functionality to create, maintain and retrieve the memory of the discussion, as well as voting results. Once the contents of the database was defined, together with the corresponding creation and query processes, Domino functionality was used to enable access to the database, by converting the interface into a set of corresponding HTML forms. CGIs written in Java Script implement all norm subsystem functionality, since a number of constraints must be checked before an action can be performed by the user (e.g. registered participant, discussion limits, etc). Though such type of constraint can normally be verified using LN functionality, this is not accessible when interacting through WWW.

3 Empirical Evaluation

As already mentioned, very little is known about the effects of GDSS on group decision processes, people, results, etc, constituting an important area of research in DSS [15]. The present work aims at reporting the first results of an empirical evaluation of GRADD functionality. As already mentioned, compared to existing asynchronous/distributed meeting support systems, such as [7][11][10], GRADD has three main differences, which were the object of this evaluation: a) use of a norm to structure and control the process, b) use of canonical IBIS model, and c) use of voting techniques to help to convey to a common solution. These features actually constitute one of the premises that guided the design of GRADD, namely objectivity and conveyance towards a common solutions depends heavily on reducing the *noise* involved in communication activities, providing support for *consensus reaching activities* and on the ability of defining and controlling a strict *meeting plan*. It should be stressed that the evaluation was empirical, and it is not intended to constitute a formal assessment, in which variables, sampling and analysis techniques should be considered in a more scientific manner [15].

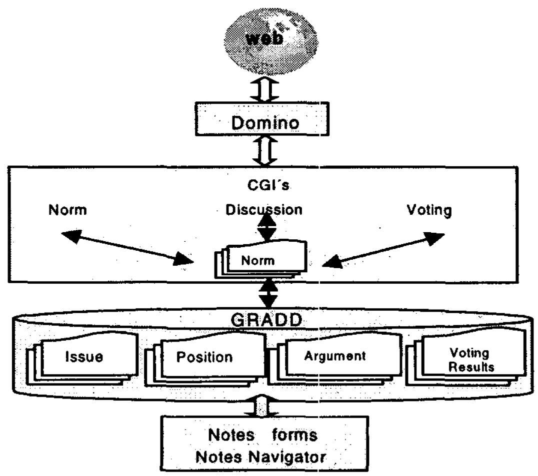

Figure 4 - GRADD Prototype using Lotus – Domino

3.1 Experiments Description

All experiments were conducted with the help of undergraduate and graduate students, involved in courses where the issue GDSS was addressed. In all cases, the decision problems were chosen by the students, and constituted problems of their realm of interest.

A first experiment was used to define and assess an evaluation process structure, and a questionnaire to evaluate GRADD functionality was created. The experiment involved around 30 students, who decided about a specific aspect of their graduation party: music alternatives (e.g. DJ, band). They were expected to suggest alternatives, and later on, to vote on these suggestions. No specific training on the use of IBIS was offered, nor on GRADD: students learned how to use them as the meeting would take place. Later, the students used the questionnaire to evaluate GRADD features, and the results revealed a generalized satisfaction with the decision support offered by GRADD. Nevertheless, we noticed a number of problems that compromised the analysis of the results obtained. First, according to their answers, we realized that the students were not sufficiently aware of the difficulties involved in group decision processes in order to evaluate the specific contributions of GRADD features with regard to these problems. Actually, they felt GRADD was a nice way to interact, but most of them have not pictured themselves in face-to-face interactions, trying to solve the same problem. Second, the type of problem chosen imposed no difficulty on the use of IBIS, because each position would correspond to a musical option for the prawn. Consequently, the available voting alternative extraction and voting procedures were also very natural for that particular problem.

We then redefined the experiment structure, which is currently being applied to groups of graduate students. The new experiment structure defines that each group has to conduct 4 decision processes: 1 face-to-face meeting, 1 virtual meeting using email, and 2 virtual meetings using GRADD. For the first problem, group members are limited to face-to-face interactions, and conventional communication tools, such as telephone, memos, etc (the use of email is forbidden). Groups are also not allowed to solve the problem unless all group members were present in the meeting. For the second problem, group members are asked to interact exclusively using email, and a group member is chosen to coordinate the process. For the third and fourth problems, interaction is limited to GRADD functionality, and emails can be exchanged exclusively with the facilitator. The first GRADD decision problem involves no difficulty on the use of IBIS model, corresponding to a problem where ideas can be easily classified as positions and arguments (e.g. electing a student representative). In the second one, the decision problem would involve many aspects to be considered by the participants, and the structuring in terms of IBIS would be much more complex (e.g. how to improve the infrastructure of the laboratory). Groups are given 7 to 10 days to solve each problem.

The goal of this new experiment structure is to make the participants of group decision processes aware of the strengths and weakness of each type of group interaction, so as to be better placed to evaluate GRADD group support functionality.

Two new evaluation questionnaires were developed for the face-to-face and email meetings. For the face-to-face meeting, participants are asked to describe the structure of the process, to rank the difficulties faced from a pre-defined list (e.g. agenda, interpersonal problems, meeting objectivity and length, conveyance to a common solution), as well as to highlight the strong points of the process. For the email meeting, participants are asked to describe the process, and to point out the problems of face-to-face meetings solved by virtual interaction, the ones not solved, as well as new types of problems faced. In both cases, they were asked about their satisfaction level with both the process and results. The GRADD questionnaire developed for the first experiment, discussed in more detail in the next section, was maintained. Additionally, we have included a training session, in which students would experiment the use of IBIS and GRADD using a simple problem (e.g. let's go out tonight!) prior to the beginning of the experiment.

3.2 Sample and Results

This paper describes the results obtained so far with two small groups of graduate students. The first group (Group 1) involved 4 people, and the second one (Group 2) had 5 elements. This experiment is currently being repeated with a third group, but it is not concluded yet. At first, students chosen a set of decision problems pertaining to their realm of interest, and we selected among those, problems with similar characteristics for each type of process, such that results from both groups could be compared. The main results are described below.

a) Face to face meetings

For the solution of the first problem, group 1 met once and group 2 met twice. As a general result, group members highlighted the following difficulties:

- Common agenda
- Process structuring
- Conveyance to a common solution

In these particular groups, no interpersonal problems were detected, and group members were all highly satisfied with both the process and its results. Interpersonal relationship was pointed out as a very positive aspect of the process. Nevertheless, they all recognized that the above mentioned problems have deeply jeopardized the objectivity and effectiveness of the meetings, making them longer than actually necessary.

b) Email meetings

For the solution of the second problem, Group 1 exchanged about 50 emails in total, and Group 2, around 70. The same aspects as in face-to-face interaction were evaluated, but in a comparative way: which problems were solved, which ones were not, and new difficulties faced. Again, group members were satisfied with the results and the process, but they pointed out that only agenda problems were solved with email interaction. They had even more difficulty for structuring and following the process, and consequently to convey to a common solution.

Additionally, they all complained about new problems related fundamentally to asynchronous communication:

- difficulty for organizing ideas and maintaining the different discussion streams;
- interaction was too long over time, since frequently people would add a contribution at an inappropriate time (e.g. some participants would take too long to give an opinion, or would discuss a topic already closed, etc);
- many of them felt that group members were less committed to the solution of the problem, than in a face-to-face meeting.

c) GRADD meetings

As already mentioned, two decision processes were conducted with the use of GRADD: one involving no difficulty on the use of IBIS, and another one, in which the complexity of the aspects involved in the decision made it hard to classify contributions in terms of IBIS abstractions. It should be clear that in GRADD, difficulties for using the IBIS model have a straight influence on the voting process, since only positions can become voting alternatives. For each process, a group member volunteered to play the facilitator role, and he/she had to define the discussion and voting rules, as well as to formulate the issue to be discussed and voted on. The facilitator should monitor the process, and change these rules if necessary.

GRADD evaluation questionnaire was used to analyze group members' opinion on the following aspects:

- the proposal of a norm to rule meeting activities;
- acceptance of time limits for discussion and voting activities;
- acceptance of restrictions for the participation in a discussion (limits for positions and arguments);
- acceptance of a simple structured communication model (IBIS);
- comparison between the participation level with GRADD and face-to-face interaction;
- objectivity in communication;
- voting alternatives extraction method;
- possibility of dividing voting into rounds;
- voting techniques offered by GRADD;
- social issues affected by the use of GRADD (virtual interaction, anonymity, etc);
- overall GRADD structure for decision processes;
- GRADD interface;
- GRADD performance.

Participants would provide answers for these questions. As already mentioned, it was expected that group members would be better placed to evaluate the GRADD functionality after carrying out the two previous decision processes. This expectation was actually met, as revealed by the analysis of participants' evaluation.

To assess the experiments results, questions evaluating related aspects were grouped into more abstract indicators. After analyzing their answers, they were tabulated according the following scale: *yes*, *no*, *sometimes* and *indifferent*. The summarized results obtained for the two groups are presented in tables 1-3. The answers were used to further interpret these results.

The results displayed in Table 1 refer to the *Norm Subsystem*. They reveal that both groups felt quite confortable with the time restrictions defined by the facilitator, thus suggesting an evidence of the acceptance of this type of mechanism to obtain objectivity in meetings. More specifically, time limits were pointed out as a possible solution for problems such as agenda conflict, group commitment to the process, and meeting-related activities coordination. Less acceptance was observed with regard to the limits established for discussion contributions and for the existence of voting rounds. The analysis of the answers revealed that limits can only be established if constantly monitored by the facilitator, and dynamically changed according to the course of the discussion. As for the existence of voting rounds, both groups were small, and therefore, they felt that two rounds (as defined by all facilitators) were unnecessary. Answers indicated that this rule should also be monitored and altered by the facilitator according to the process flow. According to these results, there is an evidence that establishing a meeting plan is important, *as long as it is flexible* to adjust itself to the intermediary results of the process.

Table 1- Norm Subsystem Evaluation

Indicators	Group 1				Group 2			
	Y	N	S	I	Y	N	S	I
Appropriateness of the time limits settled for discussion	75 %	25 %	0 %	0 %	80 %	0 %	20 %	0 %
Appropriateness of the time limits settled for voting	75 %	25 %	0 %	0 %	100 %	0 %	0 %	0 %
Acceptance of limitations to discussion contributions	100 %	0 %	0 %	0 %	40 %	60 %	0 %	0 %
Is the division of voting into rounds tiresome?	50 %	25 %	25 %	0 %	80 %	20 %	0 %	0 %

Y- Yes *N- No* *S – Sometimes* *I – Indifferent*

According to the results displayed in Table 2, referent to the *Discussion Subsystem* evaluation, there is an evidence about the adequacy of IBIS model for reducing the noise during communication, as well as for structuring the discussion. In general, participants revealed that they were more objective in the discussion, doing less interventions, and that they have observed much less redundancy in the contributions. Problems identified with email interaction regarding the organization and synchronization of ideas were also solved. The results confirm as well the wide acceptance of IBIS model due to its good tradeoff between expressiveness and simplicity. The only restriction expressed regarding the adequacy of the canonical IBIS model to any discussion is that some participants suggested the inclusion of a sub-issue relationship. No other extension was suggested. Since anonymity is not implemented in the GRADD prototype, this issue could not be evaluated.

Table 2 - Discussion Subsystem Evaluation

Indicators	Group 1				Group 2			
	Y	N	S	I	Y	N	S	I
Adequacy of discussion structuring	50%	25%	25%	0%	80%	20%	0%	0%
Difficulty for using the IBIS model	25%	50%	25%	0%	0%	100%	0%	0%
Adequacy of IBIS model to any discussion	25%	0%	75%	0%	40%	40%	20%	0%
Same amount of interventions if compared to face-to-face interaction?	0%	100%	0%	0%	20%	80%	0%	0%
In case it was not possible to contribute to the discussion (e.g. due to limits), was the discussion affected?	25%	75%	0%	0%	20%	80%	0%	0%

Y- Yes N- No S – Sometimes I – Indifferent

The results for the voting functionality of GRADD are summarized in Table 3. Recall that the only voting alternative extraction method currently implemented in GRADD extracts all positions as voting alternatives (automatic extraction). In particular in the second interaction with GRADD, where the decision problem was much more complex, users felt that the voting alternatives were not clear, nor representative of the possible solution alternatives raised during discussion. Thus, the results in Table 3 clearly point out the limitations of the automatic extraction method. In general, users did not feel more at ease to express their opinion due to the anonymity provided for voting. Participants have mentioned that their tendency towards one or more alternatives has already be revealed during the discussion. It should be stressed that both groups were small, composed of classmates. Perhaps their evaluation would be different in a more competitive and hostile environment, were hierarchical pressure could influence the results. The results also show that voting may require a deep analysis of the solutions alternatives raised during discussion, and thus the integration of the voting and discussion subsystem in that aspect was positively evaluated. Participants revealed a generalized satisfaction with the voting techniques offered by GRADD, and the implementation of additional implementation voting methods was not considered necessary. Finally, participants were all satisfied with the use of *voting to reach a consensus solution*.

Table 3 – Voting Subsystem Evaluation

Indicators	Group 1				Group 2			
	Y	N	S	I	Y	N	S	I
Adequacy of voting alternative extraction method	50%	0%	50%	0%	40%	60%	0%	0%
Easiness of expression due to anonymity	25%	50%	0%	25%	0%	80%	0%	20%
Need of access to discussion contributions during voting	75%	0%	25%	0%	80%	0%	20%	0%
Is the division of voting into rounds tiresome?	50%	50%	0%	0%	0%	40%	4%	20%
Appropriateness of the voting methods selected for to the particularities of the decision processes at hand	50%	0%	50%	0%	80%	0%	0%	20%

Legend: Y- Yes N- No S – Sometimes I – Indifferent

Table 4 presents other issues evaluated during the experiments, related to the overall functionality of the tool. Participants have claimed that the use of GRADD did not particularly influenced the way they behaved during the process. It is interesting to notice that many participants revealed that they prefer some mixture of face-to-face and virtual interaction. The interface of GRADD was also evaluated positively. Finally, though not displayed in Table 4, GRADD performance was also evaluated by participants, but we disregarded this aspect due to the extremely diverse conditions of access for each participant, not allowing to evaluate the performance of the Domino server independently of each participant's own particular configuration for WWW.

Table 4 – General Evaluation

Indicators	Group 1				Group 2			
	Y	N	S	I	Y	N	S	I
Did you feel more at ease by interacting through GRADD comparing to face-to-face meetings?	0%	25%	25%	50%	20%	80%	0%	0%
Necessity of face-to-face interactions	25%	50%	25%	0%	40%	40%	20%	0%
Navigability among GRADD subsystems	75%	25%	0%	0%	60%	20%	20%	0%
GRADD interface	50%	25%	25%	0%	80%	20%	0%	0%

Y- Yes N- No S – Sometimes I – Indifferent

4 Conclusions and Future Work

This paper discussed the results of an empirical evaluation of GRADD, a GDSS to support asynchronous and distributed meetings. GRADD differs from other similar systems in that it contains a norm to rule the process, uses the canonical IBIS model to reduce the noise in communication, and voting as a mechanism to support the conveyance to a common solution. It should be clear that this evaluation constitute only a first step into a more complete evaluation framework, in which variables, sampling and analysis techniques should be considered in a more scientific manner [15]. Though we are aware of the limitations of this evaluation, we believe we have obtained through these experiments, enough empirical evidences of the strengths and limitations of GRADD for improving the current prototype, as well as to confirm some design choices.

Through the results obtained, it is possible to confirm that the use of a norm to rule the process is considered a positive functionality, as long as it is constantly monitored by the facilitator, and it is continuously adjusted according to process evolution. Therefore, we conclude that facilitators must be provided with more powerful mechanism to monitor the process, as well as to notify to the participants, the adjustments made to the process structure. As for the IBIS model, the only extension considered for the time being is the inclusion of the subposition relationship. As for the voting subsystem, the approval of voting as a choice conveyance mechanism was clear. No need for more elaborated voting techniques was suggested by the users, but clearly the extraction methods must be extended and improved. A number of suggestions were made to improve the GRADD interface, but in general participants evaluated very positively the tool.

Future work includes, besides the above mentioned improvements, the inclusion of various awareness mechanisms for both facilitator and meeting participants, integration with other communication tools (email, chat), improvements in GRADD performance, among others. A more sound evaluation process is to take place after improvements have been implemented in GRADD.

5 References:

[1] ABECKER, A. & DECKER, S. Organizational Memory: knowledge acquisition, integration and retrieval issues. In: 5th German Conference on Knowledge-based Systems. Wurzburg, 1999.

[2] ACKERMAN, M.S. Augmenting Organizational memory: a field study of answer garden. ACM TOIS, 16(3): 203-224. July, 1998.

[3] BACELO,A. P.T.; BECKER, K.; MARQUARDT, C. GRADD: a Lotus-Domino implementation of a distributed meeting support system. In: CLEI99, Assuncion, 1999. Proceedings. pp. 985-998.

[4] BECKER, Karin e BACELO, Ana Paula. Integrating Voting Techniques into a Discussion Rationale Model-based GDSS. Accepted for publication in: 4rth International Conference on Decision Support System, Lausanne, 1997. Proceedings. pp. 375-390.

[5] BELLASSAI, G. et alli. An IBIS-based model to support group discussions. In: IFIP WG8.4 Working Conference on the International Office of the Future, Tucson, 1996. Proceedings. Chapman & Hall, 1996. pp. 49-62.

[6] BELASSAI, M. Cataldo, et alli.Pre-meeting System Evaluation. In: CRIWG'98, Buzios, 1998. Proceedings. pp. 169-179.

[7] BORGES, M.R.S. et alli. Key issue in Design of an Asynchronous System to Support Meeting Preparation. Proceedings of 7th Workshop on Information Technologies and Systems, 1997, Atlanta, Georgia, USA. pp. 130-139.

[8] CESAR, F.L. & WAINER, J. vIBIS: A Discussion and Voting System. Journal of Brazilian Computer Society, 2(1): 36-43. Nov., 1994.

[9] CONKLIN, Jeff. The IBIS Manual A Short Course in IBIS Methodology. In: http://www.gdss.com/IBIS.htm, May, 2000.

[10] CONKLIN, Jeff & BEGEMAN, Michael L. gIBIS: A Hypertext Tool for Exploratory Policy Discussion. ACM Transactions on Office Information Systems, 6(4): 303-33. June, 1988.

[11] CONKLIN, J. "Capturing Organizational Memory", In: Groupware'92. Proceedings. 1992, pp.133-137.

[12] DeSANCTIS, Gerardine & GALLUPE, Brent. A Foundation for the study of Group Decision Support Systems. Management Science, 33(5): 589-609. May, 1997.

[13] KRAEMER, Kenneth & KING, John. Computer-Based Systems for Cooperative Work and Group Decision Making. ACM Computing Surveys, 20: 115-146. 1988.

[14] LEE, Jintae. SIBYL: A Toll for Managing Group Decision Rationale. In: CSCW90. Proceedings. 1990, 79-92.

[15] STOHR & KONSYNSKI. Information Systems and Decision Processes. IEEE Computer Society Press, Informational, 1992.