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The Design of a GDSS Meeting Preparation Tool

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Abstract

The facilitator is a critical resource in computer supported decision-making groups. Facilitation is a complex task, encompassing social and technical abilities, analysis and synthesis skills, and making use of planning and flexibility, which opens multiple opportunities for computational support. This paper addresses specifically the current limitations of pre-meeting support. Having the objective of increasing support to the facilitation activities that deal with the process facet, we developed a meeting preparation tool around a comprehensive model of the decision process. An experiment revealed that the tool produces considerably different meeting agendas, especially in what concerns size and diversity. An attempt to evaluate the quality of the meeting agendas indicates an increase in the clarity criterion.

Key words: Group Decision Support Systems, meeting facilitation, pre-meeting support

1. Introduction

The escalating complexity of problems faced by organisations, due to lack of information and resources, is taking autonomy from individuals and substituting them with groups of human beings (Simon 1997). Unfortunately, dissatisfaction with group processes and outcomes is a generalised impression. For example, the 3M Meeting Management Team (1994) starts the discussion on this subject by saying that meetings "can be compared to a funeral." From the beginning of the 1980's, Group Decision Support Systems have been viewed as the Holy Grail to improve group processes and outcomes (Fjermestad and Hiltz 1999), but success seems to depend on how the GDSS is applied (Bostrom et al. 1993). One positive influential factor that has been found in GDSS usage is the human facilitator (e.g., Clawson et al. 1993).

Facilitation is a process in which a person who is acceptable to all members of the group intervenes to help improving the way they identify and solve problems and make decision (Schwarz 1994). Facilitation is one of the several third party processes studied in organisational behaviour (Lewicki et al. 1992).

According to Nunamaker et al. (1997), the human facilitator executes four functions: (1) provides technical support by initiating and finishing specific software tools; (2) chairs the meeting, maintaining and updating the agenda; (3) assists in agenda planning; and, finally, (4) provides organisational continuity, setting rules and maintaining an organisational repository. One more complex function considered by Schwarz (1994) and Miranda and Bostrom (1999) concerns improving the future group performance, which extends the scope from the specific problem and process at hand towards continued progress review.

Clawson and Bostrom (1993) and Clawson et al. (1993) assessed the roles of the human facilitator and provided empirical evidence that planning the meeting is one of the most critical roles. Niederman et al. (1996) also studied the critical factors that, from the facilitators' point of view, had more influence in the meeting success. Although 32% of the respondents elected group attributes (such as commitment or buy-in) as the critical factor of success, a high number of high-experienced facilitators (25%) mentioned having a good agenda. This study also identified critical factors to the facilitators' individual success. Personal abilities were elected by 74%, but it is interesting to note that planning and problem-solving skills were also mentioned by 14% of the respondents. On a sequel to this study, Niederman and Volkema (1996) reported that facilitators find agendas to have impact on meeting outcomes (3.3–4.4 on a scale of 1–5), particularly on the quality of outcomes.

We must conclude that preparing meetings is one critical role with impact on meeting outcomes, which raises the question of how do facilitators perform that task. Niederman and Volkema (1996) say that it depends most on the complexity and difficulty of the task, and emphasise the need for a facilitator to be familiar and comfortable with a large range of processes in order to respond to a large variety of situations. This variability and contextuality contributes significantly to the amount of work spent preparing meetings.

Several authors (Aiken et al. 1990, 1991; Limayem 1996; Niederman 1996) suggested an increase in the level of technological support to reduce this effort, one perspective that we share. After examining the existing technology, we found that at least one important functionality has not been sufficiently developed: process support, encompassing the important aspect of selecting and planning the set of tasks that best fit the problem at hand, group context and intended outcomes.

The paper describes the design of a system that covers this facet of facilitation support. The proposed system is a "level 2" system according to the classification scheme specified by DeSanctis and Gallupe (1987), which means that it uses models and group decision techniques aimed at reducing uncertainty in the group decision process. Furthermore, the models incorporated in the system are generic and thus respond to a large number of problems that facilitators may face. The system has been carefully designed to avoid rejection as a result of inflexible or restrictive approaches to meeting preparation.

We also report an experiment that was conducted to evaluate the impact of this system. The experiment was done with novice and moderately experienced facilitators, which we believe could benefit more from additional support. The results, although far from conclusive given the number of participants in the experiment, indicate that facilitators generate more clear agendas when they use process support.

Overall, we expect to contribute to increase knowledge about how to make meetings more easily and effectively prepared.

The remaining part of the paper is organised in the following way. First, we present our framework for categorizing facilitation roles, followed by an overview of pre-meeting technology. Next, we discuss the design of our meeting preparation tool and present some implementation details. Finally, we present results of the tool evaluation.

2. Framework

The literature on meeting facilitation presents an interesting breadth, blending pure technical aspects, such as technology support to groups, with the discussion of human and social abilities required to facilitate groups. We have seen some endeavour to provide structured views on this subject. For instance, several authors rely on a timing dimension where facilitation is divided in pre-meeting, meeting and post-meeting stages (Bostrom et al. 1993; Clawson et al. 1995). Others (Dickson et al. 1993) categorized different facilitation modes: the user-driven mode is associated to the absence of a formal meeting facilitator by making the GDSS functionality available to all group members, the chauffer-driven mode supports the intervention of a facilitator in order to manipulate the technology but not the decision process and, finally, the facilitator-driven mode considers that the facilitator influences the group on how to use the technology. Miranda and Bostrom (1999) also defined a framework were facilitation is divided between process and content facilitation.

In Figure 1 we present a view of meeting facilitation that blends together the different classifications. This view is strictly focused on the pre-meeting phase and organizes facilitation activities in four increasingly complex roles.

The first role deals with technology configuration and usage (direct guidance on the use of the system, Hiltz and Turoff 1978). Here we find support to the definition of an agenda, selection of participants, selection of decision techniques (VanGundy 1988) and GDSS configuration.

The second role regards facilitation as a combination of technical and social abilities. At this level, we consider reviewing previous meetings (Dubs and Hayne 1992), classify-

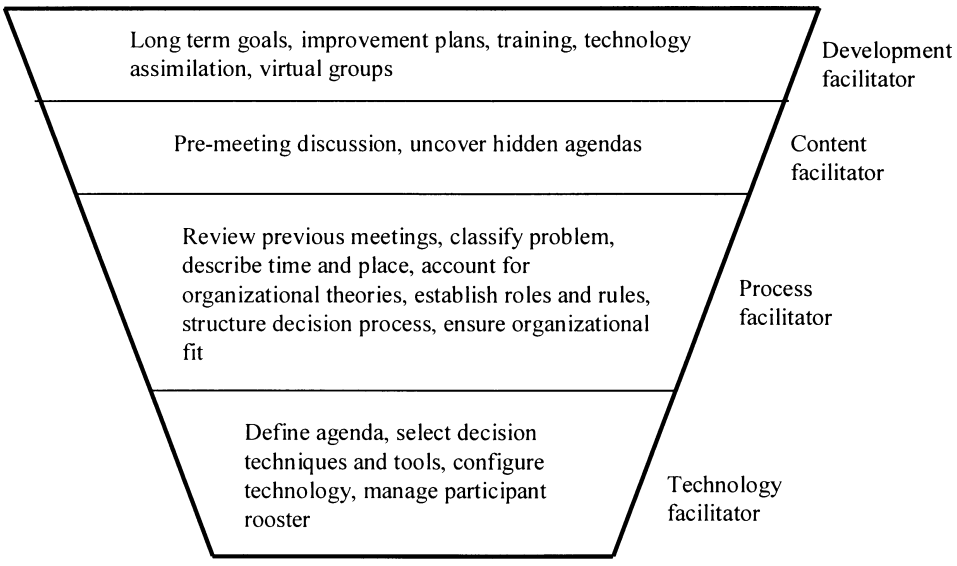

Figure 1. Comprehensive view of pre-meeting facilitation roles.

ing the problem (McGrath 1991), instructing the group on the use of a decision model (Kraemer and King 1988), establishing roles and rules (Kerr 1986), defining time (Aiken and Vanjani 1998) and space (Ackermann and Eden 1994), and providing organizational fit (Nour and Yen 1992).

The following facilitation role addresses content facilitation (Miranda and Bostrom 1999). This level accounts for much work done in the area of facilitation that comprises direct content interventions by the facilitator, especially in what concerns data modelling (issues, goals, options, beliefs, etc.) and identification of emerging strategic goals (Ackermann 1993; Eden and Ackermann 1992). At this level, we also account for pre-meeting discussions, intended to reduce both the equivocality and uncertainty of the meeting (Bellassai et al. 1996).

The final facilitation role concerns group development. The new perspective that is introduced is one of virtual groups enrolled in long-term goals and building high performance abilities (Johansen et al. 1991; Niederman and Beise 1999; Schwarz 1994). Clearly, this final level is intended to address several critics to the rigidity and limited scope of many decision models. The decision models are scrutinized in a strictly local sense, as contingency descriptions of sub-processes or, as VanGundy (1988) poses it, as miniature processes. In fact, the whole decision process often requires groups to cycle and move between multiple intertwined processes as new problems, alternatives and insights emerge (McGrath 1991). Furthermore, decision models should not be viewed as prescriptions, implicit at the process level, but rather as guides which avoid divergent or erratic processes. Finally, we should consider at this level many other support processes that are related to the primary decision process, such as group training (Miranda and Bostrom 1999) or technology assimilation (Applegate 1991).

3. Pre-Meeting Technology

Our next goal is to analyse pre-meeting technology currently available to facilitators. We will use the classification scheme that was defined by DeSanctis and Gallupe (1987), where "level 1" systems provide technical features, "level 2" systems add modelling and group decision techniques, and "level 3" systems extend this support with machine induced decision aids and recommendations.

Technology facilitation seems to be common in generic-purpose GDSS, e.g., SAMM (Dickson et al. 1992), GroupSystems (Nunamaker et al. 1991a, b) and Meeting Works all have agenda tools, participant rooster and support technology configuration. These features were classified at "level 1."

Unfortunately, there are not many examples of more advanced systems. There is the Expert System Planner (Aiken et al. 1990, 1991), which uses an expert system approach ("level 3") to help facilitators preparing an agenda and selecting GDSS tools. ESP addresses three main concerns: determine the appropriate participants for the meeting, schedule a calendar for the meeting and identify which GDSS tools may be most adequate to tackle the problem. To select meeting participants, ESP asks for the type and topic of the meeting and matches this information with personnel interests and responsibilities available in a

knowledge base. Similarly, ESP makes 14 questions to the facilitator concerning problem characteristics (e.g., if problem can be partitioned, familiarity with the topic, etc.), confronts that information with GDSS tool profiles available on the database and produces a report with tool recommendations. Note that ESP does not recommend any decision process, which classifies this functionality as technology facilitation in our framework. One negative characteristic of ESP is that it produces opaque recommendations, which do not allow facilitators to interpret the decisions made by the system.

Concerning process facilitation, we concluded that generic-purpose GDSS provide very limited "level 1" support, basically because agenda tools arrange the list of selected GDSS tool according to a temporal order. This is an interesting remark, since we know that generic-purpose GDSS have been developed with the rational model of decision-making in mind (Vogel and Nunamaker 1990), but decided not to make it explicit, in favour of modularity, flexibility and a short learning curve.

The Distributed Facilitation System (Dubs and Hayne 1992) provides support for reviewing previous meetings ("level 1"), a feature classified as process facilitation. Note however that this is a very small piece of the whole functionality classified as process facilitation.

Dickson et al. (1996) and Limayem et al. (1993) describe an add-on to the SAMM system that uses a multi-criteria decision-making model. Although qualifying at "level 2," the tool is very limited in terms of pre-meeting process support, since it supplies a fixed meeting agenda. Essentially, the major goal of this tool is to use the decision model as a basis for offering recommendations during meetings.

The SISCO (Bellassai et al. 1996) system provides a good example of content facilitation. This system is not intended to substitute meetings but to provide a pre-meeting discussion environment where no decisions are made. Group discussions use the IBIS argumentation model (e.g., Conklin and Begeman 1988), which makes SISCO a "level 2" system.

COPE (Ackermann and Eden 1994; Eden and Ackermann 1992) is a system that supports content and strategy formulation by multiple groups along time. Information modelling uses the notion of cause maps (Huff 1990), a "level 2" functionality. Furthermore, the system uses various computational techniques to cluster concepts into manageable parts and identify most central concepts, which supports development facilitation at "level 3."

In our view, the situation summarized in Table 1 shows that not much attention has been given to process facilitation. The most sophisticated approach applies a fixed process, which reduces its applicability to a limited range of problems. Clearly, there is an opportunity for developing pre-meeting technology at the process level.

Table 1. Classification of pre-meeting technology

	Group Systems, Meeting Works SAMM	ESP	DFS	SAMM Add-on	SISCO	COPE
Development						+++
Contents					++	
Process	+		+	++		
Technology	+	+++				

4. Design of the Meeting Preparation Tool

The following synopsis, which recaps most of our previous discussion, describes in generic terms the guiding principles used in the development of our tool.

Vision: Reduce uncertainty in the group decision process
Mission: Provide a meeting preparation tool capable to reduce such uncertainty
Goal: Develop process support in the tool, given that current technology does not provide sufficient support to this aspect of the problem
Target 1: A "level 2" functional system
Target 2: A system with added value, when compared with other meeting preparation tools
Approach: Use a Model-Design-Prototype-Validate approach

Model-Design-Prototype-Validate is a methodology suggested by Limayem (1996) to develop facilitation support. The major difference to other traditional methodologies, for instance waterfall and prototyping, is that a model is the vital element steering system development. Such a model scales down the complexity of the problem (which could not be handled with the waterfall process) and allows starting the design process with an initial set of user requirements (which would otherwise not be available to start with the prototyping process). In this methodology, the prototypes are more used to validate the model of the system than to gather users' requirements.

4.1. Model definition

The first step of our design consisted then in the selection of a model describing the group decision process. The group decision process may be broadly defined as a bundle of tasks that include gathering, interpreting and exchanging information; creating and identifying alternative scenarios; choosing among alternatives; and implementing and monitoring a choice (Guzzo and Salas 1995). This task perspective is outcome-directed: a task departs from an initial state, where several perspectives exist, and, by integrating perspectives in a new one which represents some shared understanding, reaches a final state. Departing from this notion, MacGrath (1984) has developed a comprehensive typology of tasks, which in its lowest level of detail encompasses four tasks of generating, executing, negotiating and choosing.

To some extent, the above characterization should also be regarded as a logical process, where the desired outcomes can be obtained systematically, following a series of steps. This approach has its roots in decision models where there exists a goal and a wish to maximize some utility function (Simon 1997). Considering that individuals have cognitive limitations, the group context offers more complete and systematic ways to resolve problems. Another perspective considers that the complexity of the problems and differences among individuals require some division of labour and result in the establishment of an organization. Thus, the organizational context is a factor that influences decision-making beyond the logical process. This organizational view accounts for imprecise or conflicting goals,

conflicts among people, power differences, conformance pressures, time and money constraints, etc. Overviews of many other decision models can be found, for instance, in March (1994), Rasmussen et al. (1995) and Simon (1997).

So, which model to select? We were more interested in planning "how" the decision process would evolve rather than "what" had to be done or "who" would accomplish it. This criterion pushed the adoption of a logical model (the later would have emphasised task and organizational models, respectively). Then, we were interested in a model that emphasises detail, rather than generic, un-supportive, information. Arrived at this point, two models have been selected, one defined by Schwarz (1994) and another defined by Kaner (1996). The Schwarz's model divides the decision process in nine steps: define the problem; establish criteria for evaluating solutions; identify root causes; generate alternative solutions; evaluate alternative solutions; select the best solution; develop an action plan; implement the action plan; and evaluate outcomes and the process. On the other hand, the Kaner's model follows a slightly different approach, with a separation of concerns in multiple levels and also more flexibility in process definition. These observations dictated the adoption of the Kaner's model (see left portion of Table 2 for more details):

- The leading concept defined by the model is related to time. Four *zones* specify where a group is in the decision process temporal route: divergent (search for information), groan (discuss issues), convergent (attempt to reduce the number of solutions) and closure (select one solution by consensus or voting).
- Each *zone* stands for one or more miniature processes, designated *strategies*, which can be used alone or in sequence, depending on the problem complexity. For instance, a very complex problem may require a divergent zone with three strategies: *survey territory*, *search for alternatives* and *raise difficult issues*. A simple problem may simply require one strategy, e.g., *search for alternatives*.
- Each strategy is accomplished by one or more *activities*. As an example, we find in the *survey territory* strategy an activity characterised as *who*, *what*, *when*, *where*, *how*? (Identify who is involved, what must be done and so forth).

Let us consider a facilitator wishing to plan a decision process using the model described above. She may analyse the problem and arrive to the conclusion that the decision process must go through the divergent, groan and convergent zones but, since the problem in not very complex, only three strategies are necessary: brainstorming, "solutions and needs" and "risks and consequences." From the point of view of process definition, this plan seems sufficiently detailed. Suppose now that this facilitator has also the intention to implement this plan using a GDSS. In that circumstance, the plan should be further detailed, at least to the point where the list of GDSS tools to be used during the meeting is identified. We believe that there should be a natural continuity between process definition and tool selection, i.e. between the process facilitation and technology facilitation roles specified in Figure 1.

To afford this continuity, we decided to extend the decision model to cover tool selection (see right portion of Table 2 for details). Besides the zones, strategies and activities defined by the Kaner's model, we added two more levels of detail designated *task* and *tool*. The task level suggests which generic GDSS module is most adequate to carry out an ac-

tivity. It defines four generic modules: creative confrontation, polling of experts/participation, systematic structuring, and implementing and controlling. This classification was adopted from Hwang and Lin (1987). Although Hwang and Lin define an additional simulation module, we excluded it from our model given that it is not supported by the generic-purpose GDSS cited in this paper.

The tool level supplies more details about tool recommendations. It uses knowledge about specific GDSS to recommend a particular GDSS tool (currently, GroupSystems and Meeting Works).

Table 2. Model adopted for the meeting preparation tool

Zone	Strategy	Activity	Task		Tool
			GS	MW	
Divergent	Survey territory	Say your point of view	CC	TC	GEN
		Specify requirements	CC	TC/CAT	GEN/ORG
		Who, what, when, where, how?	CC	TC	GEN
		Facts and opnions	CC	TC	GEN
		Initial positions	CC	BST	GEN
		Perspectives not represented	CC	BST	GEN
	Search for alternatives	Brainstorming	CC	BST	GEN
		Analogies	CC	BST	GEN
		Anything not said?	CC	TC/CAT	GEN
	Raise difficult issues	How does it affect me?	CC	TC/CAT	GEN
		3 complaints	CC	TC/CAT	GEN
Groan	Create shared context	Learn others' perspectives	SS	CAT	ORG
		If I were in your place. . .	SS	CAT	ORG
		Solutions and needs	SS	GO	ORG
		Alternative futures	SS	GO	CROSS
Convergent	Explore principles	Case studies	SS	TC	CROSS
	Creative reframing	What cannot be changed?	SS	TC	CROSS
		Revert assumptions	SS	TC	CROSS
		Remove restrictions	SS	TC	CROSS
	Reinforce good ideas	Catastrophising	IC	TC	CROSS
		Clarify criteria	IC	GO	ORG
		Risks and consequences	IC	GO	ORG
		Who else needs to evaluate?	IC	GO	ORG
		Who does what when?	IC	GO	ORG
Closure	Voting	Doyle and Straus Fallback	POLL	VOT	EVAL
		Vote to vote	POLL	VOT	EVAL
		Meta-decision	POLL	VOT	EVAL

Key to task types: CC – Creative confrontation; SS – Systematic structuring; POLL – Polling of experts/participation; IC – Implementing and controlling. **Key to GroupSystems' tools**: BST – Brainstorming; TC – Topic commenter; CAT – Categorizer; GO – Group outliner; VOT – Vote. **Key to Meeting Works' tools**: GEN – Generate; ORG – Organize; EVAL – Evaluate; CROSS – Cross impact.

Going back to our example, the model tells the facilitator that brainstorming, "solutions and needs" and "risks and consequences" can be implemented using three generic modules: creative confrontation, systematic structuring and implementing and controlling. It also tells that, if she intends to use GroupSystems, the recommended tools are Brainstorming and Group Outliner. We make a note that although the task level may seem unnecessary to match activities to GDSS tools, in fact it is useful to clarify how GDSS tools should be used. For instance, in our example, the model recommends using Group Outliner with two very different purposes, systematic structuring and implementing and controlling.

Unfortunately, we have not built in the model additional information describing exactly how to configure the GDSS tools in order to accomplish the specified tasks. In Table 1 we present the model that was specified for the meeting preparation tool.

4.2. Other design issues

Besides the decision model, there are a few more design aspects worth to be mentioned. First, the meeting preparation tool is intended for planning more than one decision process. Either because some problems are complex enough to require a partition in several processes (the example in Figure 2 shows one such process, "launch new product," that was partitioned in three consecutive processes), or because facilitators may have to manage several decision processes at the same time. We have designed a solution, illustrated in Figure 2, allowing facilitators to manage a process repository, organized according to a hierarchical structure. This solution introduces one more element, designated *issue*, referencing a decision process (i.e., a sequence of zones, strategies, activities, tasks and tools). To some extent, this approach provides necessary basic facilitation support aiming at the development level, although no explicit group development process is currently supported.

As a second design detail, the meeting preparation tool should prevent any rigidity associated to the model approach. This requirement resulted in an open/flexible implementation of the adopted model rather than a prescriptive one. Basically, the model is proposed to the facilitator, as shown in Figure 3, but the tool allows planning decision processes with any sequence of zones, strategies, activities, tasks or tools.

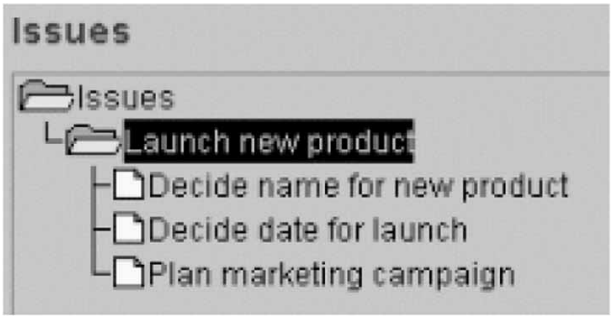

Figure 2. Design detail concerning classification and organization of processes.

We had one final design concern. The tool should provide explanations about the different components defined by the model, a first approach to support facilitators' exploration of alternative process designs and learning abilities. This requirement resulted in small text messages that are shown to the facilitator when the different model components are selected. This functionality is illustrated in Figure 4.

5. Implementation

The meeting preparation tool was developed as a Java Applet that can be downloaded from a WWW home page using a standard browser. This approach allows future integration with other components (e.g., we are currently developing facilitation support for remote meetings).

The tool supports several attributes situated in the technology level of our framework. It has a participant rooster, calendar, e-mail notification functionality, and selection of GDSS (GroupSystems or Meeting Works). The tool also provides a customized view that facilitators may use during meetings (it allows to track and comment tasks, and manage time) and generates post-meeting reports (describing process structure).

The remainder functionality supported by the meeting preparation tool is situated in the process level of our framework. The case that we have selected to illustrate this functionality deals with the problem of an industry wishing to launch a new product.

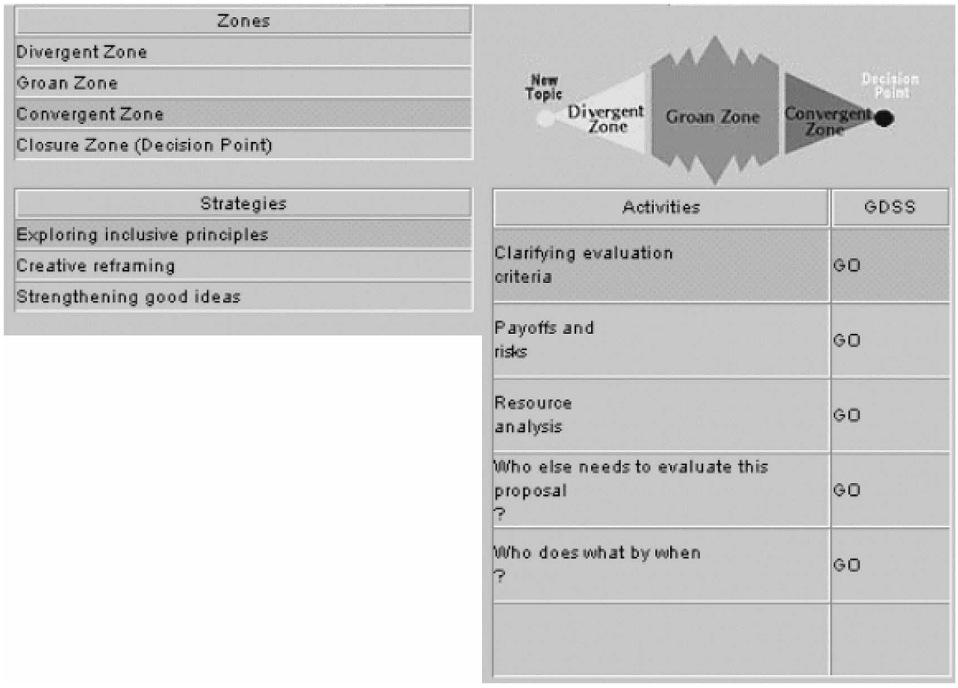

Figure 3. Design detail of the model implementation.

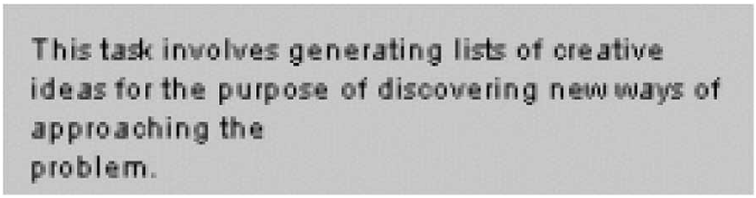

Figure 4. Design detail concerning explanations about the zones, strategies, etc.

Considering that this a very long process, involving different concerns, the facilitator opted for a "divide and conquer" approach, dividing the problem in three different *issues*: (1) decide name for the new product; (2) decide a date for launch; and (3) plan marketing campaign. This means that, for a fact, there will be three different decision processes planned (Figure 5.1).

Having selected the "decide name for the new product," the facilitator starts playing with zones, arriving to the conclusion that the divergent zone is the most adequate to start the decision process (Figure 5.2). Each time a different zone is selected, different *strategies* to tackle the problem are displayed. In this case, there is one obvious alternative, which is to get as many names as possible from the participants, i.e., survey the territory (Figure 5.3). The next step consists in selecting an *activity* that accomplishes the adopted strategy. In

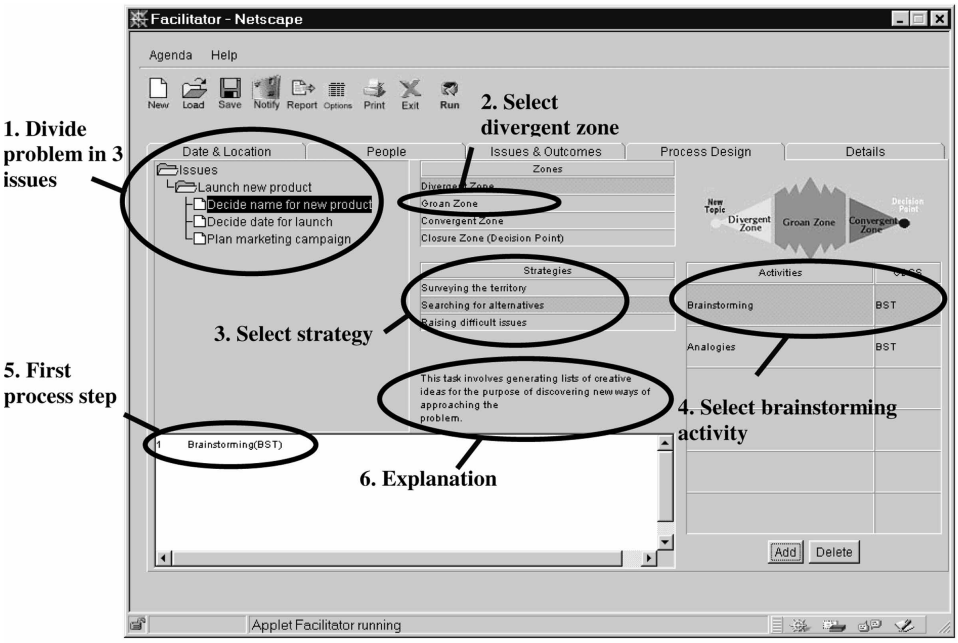

Figure 5. Process design window, brainstorming selected as first activity.

this case, it is naturally the brainstorming activity. Because the facilitator decided to use GroupSystems, the model immediately proposes the GroupSystems' Brainstorming *tool* (Figure 5.4).

Finally, the bottom left corner of the window shows the first process step defined by the facilitator (Figure 5.5). Explanations about the different model components are displayed each time the facilitator makes a selection (Figure 5.6).

Having selected the brainstorming activity, the facilitator decides to move on to the groan zone, where the different name proposals can be discussed. The intention is to build a shared context, which means that the "learning more about others perspectives" is the activity that best fits this objective.

The tool consequently recommends that the GroupSystems' Categorizer should be used and creates this second step in the bottom left corner of the window (Figure 6). Having built a shared context among meeting participants, the facilitator believes that the decision process can proceed to the convergent zone, where a small set of names for the product can be selected (Figure 7). Instead of asking the group to decide on a list of best names (strengthening good ideas), the facilitator adopts a different strategy: asking the participants to expose and clarify the selection criteria. The tool recommends using GroupSystems' Group Outliner to accomplish this purpose, thus building the third process step in the bottom left corner of the window (Figure 7).

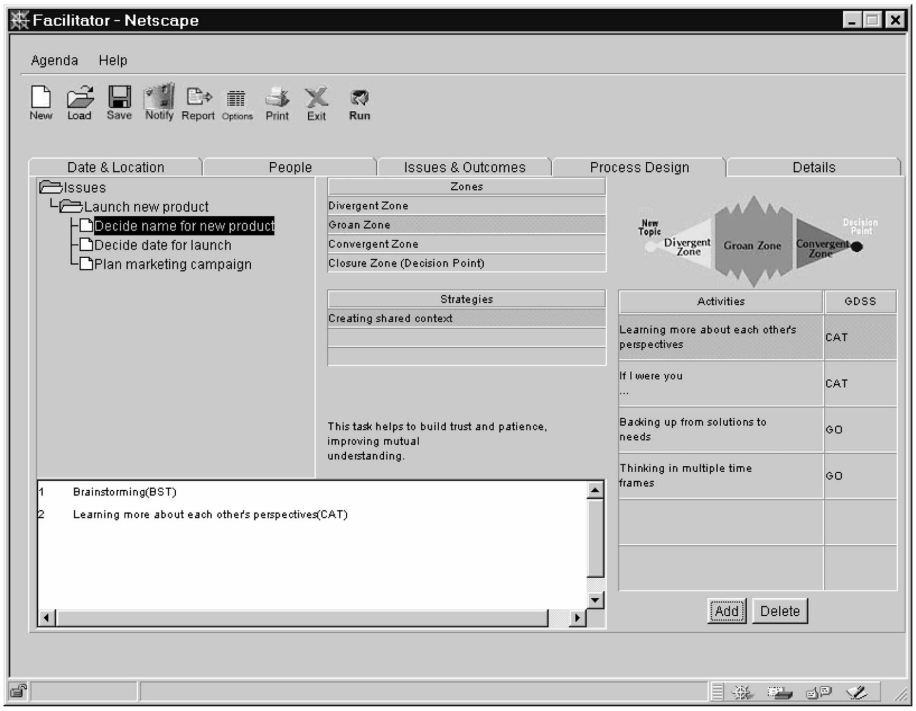

Figure 6. Second activity selected from groan zone.

Finally, with a shared understanding of the selection criteria, the facilitator decides to move on to the closure zone and use the "Doyle and Strauss fallback" technique (Figure 8). According to the help text provided by the tool, this procedure helps groups with a person in charge to reach an agreement. This final step in the decision process is built in the bottom left corner of the window.

6. Evaluation

As we have previously expressed, the meeting preparation tool should achieve two targets, one saying that the tool should be classified as a "level 2" functional system, and the other declaring that our development effort should result in a system with added value, when compared with other meeting preparation tools. We believe that have sufficiently demonstrated the accomplishment of the first target in the previous section. Therefore, our major apprehension was centred on evaluating the realization of the second target.

Regarding our overview of pre-meeting technology, summarized in Figure 1 and Table 1, we notice that there is an increasing complexity in facilitation roles as we move upwards the classification. Thus, we believe, the best practice is to evaluate tool contributions step

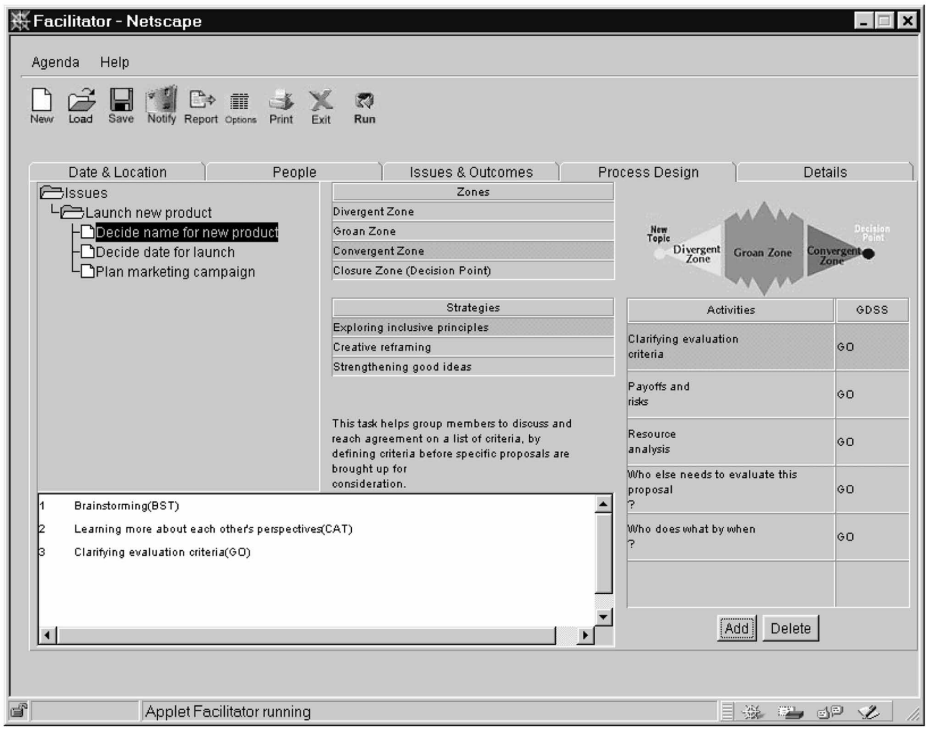

Figure 7. Third activity selected from convergent zone.

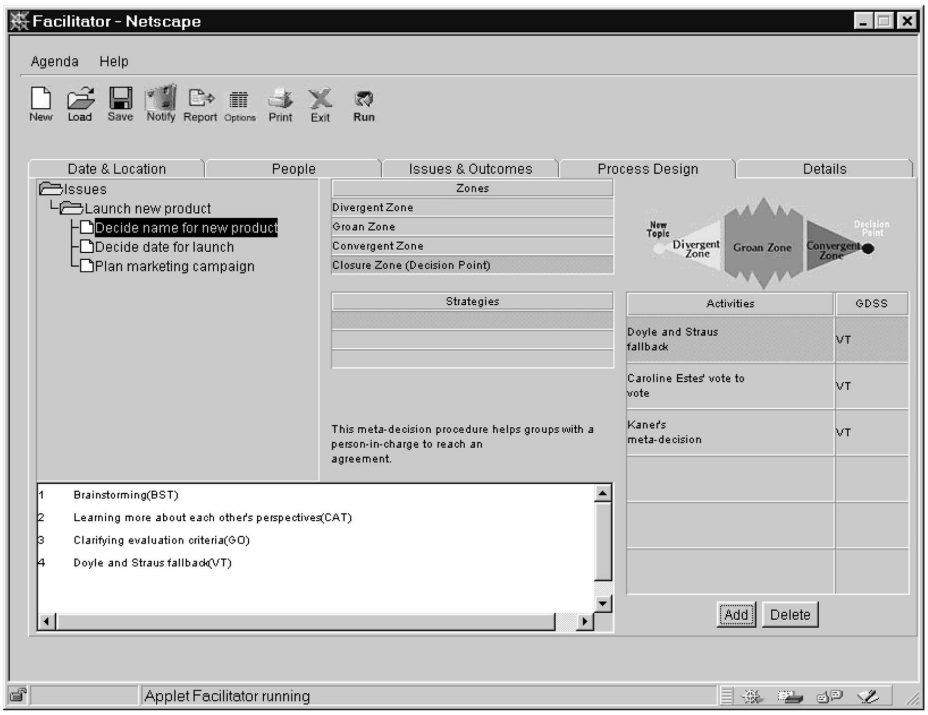

Figure 8. Final activity, closure.

by step, from technology up to development roles. Since our tool is classified at the process level, then the evaluation process should confront our tool with tools classified either at the process or technology levels.

From the alternatives available, both DFS and SAMM add-on have a very limited functionality in what concerns process support. The former is targeted at reviewing meetings and the later supplies a fixed agenda for multi-criteria decision-making. Thus, we selected the GroupSystems (GS) agenda tool for the confrontation. One aspect relevant to the evaluation process is that both tools produce exactly the same outcomes, i.e. a list of tools organized according to a temporal order. Thus, the major difference is that we are evaluating different levels of sophistication in the agenda creation functionality. The details of the experiment are given below.

Question: Are there any differences between agendas done with our tool and GS agenda tool?

Variables: One single dependent variable was studied, the quality of agendas specified by subjects.

Sample: Four facilitators moderately experienced with GDSS.

Procedure: Two problems were presented to the participants. Each facilitator was requested to build an agenda for the proposed problems according to a

distribution shown in Table 3.
Problem 1 – A car company must decide either to launch a new model or wait for the design team to introduce a new feature, which will make that model ahead of the market.
Problem 2 – A training course is taking more than the 9 months expected. The problem is how to avoid delays without reducing quality.

Physical environment: The experiment was done face-to-face at our electronic meeting room. Subjects were requested to execute the tasks individual and silently.

Analysis of results: Two senior facilitators rated individually the quality of generated agendas, from 1 (low) to 5 (high), according to the following criteria: (1) structure; (2) logical sequence; (3) clarity; and (4) efficiency. No particular details or instructions were given about these criteria.

The agendas generated by the facilitators that participated in the experiment are summarised in Table 4 while the ratings from the senior facilitators are presented in Table 5.

From these results, we attempted to draw some observations concerning the design of our meeting preparation tool.

Our initial comment is that, considering that GS and our tool produce the same outcomes, the obtained agendas show more considerable differences than expected. Two types of differences may be found. The first one is that the facilitators using our tool generated agendas with a greater number of tasks (8) than the facilitators using the GS tool (4.25). It is also interesting to note that the differences are much larger for Problem 1 (12 tasks) than for Problem 2 (3 tasks). Since Problem 1 is more complex that Problem 2, one possible explanation is that the complexity of the model amplifies the complexity of the problems perceived by the users.

The second difference between these agendas is related to the diversity of tasks. It is interesting to note that the agendas generated with GS present small variations over a traditional sequence of three GDSS tools: brainstorming, categorizer and voting. On the contrary, the agendas generated with our tool present much more diversity: they introduce two other GDSS tools, group outliner and topic commenter; and two out of four agendas do not finish with voting, apparently seeking for consensus rather than voting. One possible explanation to the more diversity in meeting arrangements is that the adopted model guides users through a top-down design approach that delays the selection of specific GDSS tools.

So, although the observation of the available agendas indicates that there are two major differences in the planned decision processes, size and diversity, what remains open is to understand if these differences improve or not the quality of the agendas. Regrettably, the data we could obtain on this matter comes from just two facilitators, which puts any sug-

Table 3. Procedure

Facilitators	Problem 1	Problem 2
F1, F2	GS agenda	Our tool
F3, F4	Our tool	GS agenda

gested differences at risk. The only consistent result, supported by non-parametric testing, is that out tool generates more clear agendas.[1]

Table 4. Tabulated results

F1P1	**(GS tool)**
	Introduction
BST	Alternatives
CAT	Group alternatives in categories corresponding to the problem dimensions
VOT	Identify most important categories
CAT	Generate alternative strategies for each category
VOT	Select one category

F3P1	**(Our tool)**
	Issue: Launching. Discuss pros and cons.
TC	Discuss points of view
TC	Specify requirements
TC	Discuss facts and opinions
CAT	Clarify evaluation criteria
GO	Costs and benefits
	Issue: Delaying. Discuss pros and cons.
TC	Discuss points of view
TC	Specify requirements
TC	Discuss facts and opinions
CAT	Clarify evaluation criteria
GO	Costs and benefits
	Issue: Compare pros and cons.
GO	Clarify evaluation criteria
GO	Costs and benefits
	Issue: Make a decision.
VOT	Consensus voting

F2P1	**(GS tool)**
	Introduction
CAT	Pros and cons of delaying
CAT	Pros and cons of launching
CAT	Costs of delaying?
VOT	Delay or not?

F4P1	**(Our tool)**
	Issue: Launch or delay?
BST	Present problem and alternatives
TC	Discuss costs
TC	Discuss benefits
CAT	Organise costs
CAT	Organise benefits
TC	Identify possible obstacles
CAT	Reduce costs list
CAT	Reduce benefits list

F3P2	**(GS tool)**
BST	Hypotheses to reduce time
CAT	Categorise by similarity
VOT	Select one category, according to viability

F1P2	**(Our tool)**
BST	Identify important aspects of training
VOT	Vote most important aspects
	Issue: Identify which aspects can reduce time
TC	Specify requirements
CAT	Resource analysis
VOT	Consensus voting

F4P2	**(GS tool)**
	Introduction
BST	What makes the delays?
CAT	Common scenarios
CAT	Requirements to preserve quality
BST	How to reduce delays?
VOT	Select the 3 most viable ideas

F2P2	**(Our tool)**
	Present the problem
TC	Discuss facts and opinions
TC	Discuss others' perspectives
BST	Brainstorm consequences of delaying
GO	Discuss costs and benefits
CAT	Categorise topics found in brainstorming
GO	Discuss solutions and needs

Table 5. Ratins from the senior facilitators

	GS agenda									Our tool								
	F1P1		F2P1		F3P2		F4P2		Average	F3P1		F4P1		F1P2		F2P2		Average
Structure	2	3	3	2	4	2	2	3	2.57	2	5	3	3	3	3	2	4	3.00
Logic sequence	2	5	4	3	4	2	2	3	3.14	3	3	4	4	3	4	3	3	3.43
Clarity	1	3	4	3	4	2	2	2	2.71	3	4	3	4	4	4	2	3	3.43
Efficiency	1	4	4	2	4	2	2	2	2.71	2	3	2	3	2	4	2	3	2.57

Furthermore, the ratings from the senior facilitators show very significant differences in the appreciation of agendas. For instance, the logic sequence of F1P1 received a bad score (2) from one evaluator and an excellent score (5) from the other. Another interesting example is F3P2, who designed an extremely simple agenda consisting of brainstorming, categorizer and voting tasks. F3P2 received 2 in all criteria from one evaluator and 4, again in all criteria, from the other evaluator. What originated such a difference? Certainly it reflects different styles of doing facilitation that are difficult to assess or even reconcile.[2]

However, we make a note that the agendas generated with GS resulted in more conflicting appreciations. This, we believe, emphasises that the agendas generated with our tool conveyed more clear information; in a way the senior facilitators could make a more objective appreciation.

7. Discussion and Future Work

We arrived to the conclusion that our tool produces significantly different agendas and seems to improve their clarity. We could not find any evidence that it improves the structure, logic sequence or efficiency of the agendas.

While analysing the agendas, we also identified two plausible causes for the differences encountered. One is an amplification effect, where the complexity of the decision model built in the tool, separating concerns in multiple levels (zones, strategies, activities), increases the perceived complexity of problems. Another is a delaying effect, where the decision model leads users through a top-down approach, proposing different alternative solutions and delaying the selection of specific techniques.

Will the above differences produce more qualitative meetings? It certainly depends on the role of an agenda in the development of a meeting. If the agenda is a plan that should be strictly followed, then we believe that the amplification effect prejudices meetings. However, if the agenda just delivers a context to jump-start meetings, then the amplification effect may in fact benefit meetings. Retrospectively, we should have asked what type of usage the senior facilitators had in mind when they classified the agendas.

We have seen the argument that one of the advantages of group support systems is that they require planning meetings, thus inducing more qualitative results. Our view is that one of the advantages of our tool is that it requires a thorough reflection on the decision process, which may also induce better meeting results.

Concerning a practical usage of the tool, we see that many important issues remain open. Perhaps the most important one is to understand if the tool benefits all types of facilitators. On the one hand, the top-down approach may be more adequate to novice facilitators, which have to spend more effort deciding upon a decision making process. On the other hand, we have received comments from experienced facilitators saying that they usually decide beforehand what type of process to use and will change it anyway during meetings if needed. To experienced facilitators, our approach is rather seen as obtrusive. We argue that experienced facilitators may use our tool to enlighten meeting participants before the meeting, or even start a discussion about the process, which might lead to a better perspective over the problem at hand.

Considering the future development of the model, it should also match the process with the organization. This requires incorporating many organizational criteria such as seriousness, endurance or politicality of the problem (Cray et al. 1991). Most importantly however, the model does not support one vital attribute classified at the technology level, that one of technology configuration. Many GDSS configuration options have more significant impact on the quality of results than the definition of an adequate process structure. Anonymity is one clear example of a configuration option that has such impact (Fjermestad and Hiltz 1999). This functionality requires a characterization of generic GDSS configuration options and their implications to the decision process. We are currently working in this area of concern.

Of course, many current limitations of the tool are associated to the kind of sophistication it provides. Future "level 3" developments would include support to the elaboration of social and psychological profiles of meeting participants, recommending processes well adapted to specific problems and contexts, as well as iterative learning among facilitators. This "level 3" functionality is necessarily related with post-meeting support. For instance, iterative learning also requires further development of post-meeting assessment tools and feedback mechanisms (e.g., Limayem and DeSanctis 1993).

8. Conclusions

We argue in this paper that facilitators need better meeting preparation tools than the ones currently available. Our approach was to incorporate a model of the decision process in such a tool.

The proposed system is a "level 2" system, which means that it uses models and group decision techniques aimed at reducing uncertainty in the group decision process. The selected model provides a top-down detailed view of the decision process, going through zones, strategies, activities, tasks and tools. The design method preserves the necessary flexibility and at the same time gives explanations about the decision process to facilitators.

An experiment with the tool revealed that it produces significantly different agendas, when compared with less sophisticated tools. The main differences were more extensive and diverse agendas. The experiment also attempted to evaluate the quality of the agendas generated by the tool but revealed imprecise results. On the positive side, they indicate that

having a model of the decision process built into the tool seems to slightly increase the clarity of generated agendas. On the negative side, we could not find any significant differences in the structure, logic sequence and efficiency of the agendas.

Overall, we expect to have increased knowledge about how to make meetings more easily and effectively prepared.

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Notes

1. Wilcoxon test: $Z_{0.95} = 1.645$; Structure, T = 1,396908; Logic sequence, T = 0,646997; Clarity, T = 1,725324; Efficiency, T = 0.
2. Curiously, one of the senior facilitators was skilled in facilitating natural groups, while the other had more experience facilitating technology-supported groups.

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