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How Are Distributed Groups Affected by an Imposed Structuring of their Decision-Making Process?

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ABSTRACT
Groups often suffer from ineffective communication and decision making. This experimental study compares distributed groups solving a preference task with support from either a communication system or a system providing both communication and a structuring of the decision-making process. Results show that groups using the latter system spend more time solving the task, spend more of their time on solution analysis, spend less of their time on disorganized activity, and arrive at task solutions with less extreme preferences. Thus, the type of system affects the decision-making process as well as its outcome. Notably, the task solutions arrived at by the groups using the system that imposes a structuring of the decision-making process show limited correlation with the task solutions suggested by the system on the basis of the groups' explicitly stated criteria. We find no differences in group influence, consensus, and satisfaction between groups using the two systems.

Categories and Subject Descriptors
H.4.2 [**Information Systems Applications**]: Types of Systems – *decision support (e.g., MIS)*, H.5.3 [**Information Interfaces and Presentation (e.g., HCI)**]: Group and Organization Interfaces – *computer-supported cooperative work, synchronous interaction.*

General Terms
Performance, Experimentation, Human Factors.

Keywords
Distance collaboration, structured decision making, anchoring, virtual group.

1. INTRODUCTION
Groups frequently collaborate across distance to reduce cost, gain access to expertise, shorten response time, and increase flexibility [2, 4, 10, 20]. One frequently discussed example of such distributed collaboration is outsourced development of information systems [e.g., 23], but distributed collaboration is central to activities as diverse as, for example, decision making in virtual teams, emergency response, government planning, group work in distance education, inter-organizational negotiations, management of multi-site projects, research, and telemedicine. Distributed collaboration presupposes communication technology, which has become a ubiquitous element of collaborative work – as exemplified by phone and email.

While many distributed groups suffer from ineffective communication and decision-making processes [15], technology that goes beyond providing a communication channel by also attempting to impose a structuring of the process has not reached nearly the same number of users [17]. This study investigates how the use of either a communication-only system or a system that structures the decision-making process affects decision making in physically distributed groups.

Reviews of decision making in small groups find that overall the use of group support systems (GSS) improves decision quality [12], in most cases leads to no improvements [3], and improves quality only when the GSS imposes a structuring of the decision-making process [1]. While these results are mixed, they suggest that a central contribution of GSS may be to impose a structuring of the decision-making process. For example, Huang et al. [6] find that embedding a goal-setting structure in a GSS for team-building resulted in the generation of more decision alternatives and helped the groups, which were virtual teams, foster better team cohesion and commitment. This positive effect is, however, moderated by the general finding across many studies that the use of GSS tends to increase the time taken to complete tasks [12].

The results of previous research are also mixed for decision makers' perception of the use of GSS in that reviews find that the use of GSS decreases decision makers' satisfaction [12], has no effect on satisfaction [18], and increases satisfaction with the process when it is facilitated by a human facilitator [1]. With specific respect to decision makers' perception of a structuring of the decision-making process, Kwok et al. [8] find that a GSS-imposed structuring increased participants' consensus and satisfaction with the group-decision outcome. Similarly, Hiltz et al. [5] find that an imposed structuring improves participants' satisfaction; in their study the improvement in satisfaction is however accompanied by improvements in neither process nor outcome. It is, at present, poorly understood why positive effects on decision makers' satisfaction co-occur with no effect on their

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decision-making process and its outcome. This discrepancy and the generally mixed results call for further research on how the use of GSS affects decision making in small groups.

Most of the previous research has investigated the use of GSS in co-located meetings. And, the studies comparing the use of GSS in distributed and co-located settings tend to find that decision quality is lower for distributed groups using GSS than for co-located groups using GSS [1]. This accords with Olson and Olson's [15] caution that distance matters. Dennis and Wixom [1] point to a lack of research on the use of GSS in distributed settings, because distributed groups may face challenges that are specific to their physical separation and therefore underrepresented in previous research.

In this study we specifically address distributed groups. Thus, face-to-face interaction is not an option. Rather, we compare the use of two different GSS with respect to how they facilitate distributed groups in reaching consensus on a preference task. We chose a preference task because they, like most real-world problems, have no one right solution but require that the participants in a group devise a solution on which they can agree. The groups' work is assessed by analysing the phases of their decision-making process, the outcome of their work, and the individual participants' satisfaction with the process. We find that the type of GSS affects the groups' decision-making process and its outcome but not the participants' satisfaction.

2. METHOD

To investigate how a structuring of the decision-making process affects decision making in distributed groups we conducted an experimental study. Two GSS were set up for the experiment. Each group of participants used either one or the other of these two systems.

2.1 Participants

Six groups of three persons participated in the study. Participants (5 female, 13 male) were between 25 and 32 years of age with an average of 29.8 years. All participants had a Danish cultural background, were proficient IT users, and had or were pursuing degrees at the bachelor or master level. The participants in a group had not worked together before.

2.2 Task

The task required participants to imagine that they had become the trustees of a philanthropic foundation. In that capacity they are to allocate money to six projects that have requested funds from the foundation. A total of DKK 2500000 (approximately USD 500000) is available for the projects. Each project is in need of the total amount but can benefit from any contribution; the greater the contribution, the more likely the project is to succeed. Participants' task is to allocate money according to their personal assessment of the merit of the projects. While multiple factors may influence their decision about how to allocate the money, the most critical factor is the participants' individual assessment of how well the projects agree with their personal values.

The task, known as "The Foundation Task", is adopted from Watson et al. [22], which contains the full task description given to participants. The six projects are listed in the leftmost column of Table 1; participants received no other information about the projects. The six projects appeal to different personal values and, therefore, lead to discussion in the groups.

2.3 Group Support System

In all groups, participants communicated by means of audio, chat, and a shared spreadsheet. A Skype (www.skype.com) account was created for each participant, and a Skype session among the three participants in a group was open throughout the group's work, providing for audio and chat communication. A GoogleDocs (*docs.google.com*) account was also created for each participant and set up with a shared spreadsheet. All participants in a group could simultaneously read and modify the shared spreadsheet, and modifications were immediately visible to the entire group.

The *baseline GSS* comprised the abovementioned audio, chat, and shared-spreadsheet facilities. The only content of the spreadsheet was a list of the six projects with room for indicating the group's allocation of the money. A time limit of 60 minutes was set for the groups to reach a decision about the allocation of the money.

In the *structured GSS*, the abovementioned audio, chat, and

Table 1. Group allocation of money to projects (in thousands of DKK), *N* = 6 groups.

Project	Structured GSS		Baseline GSS	
	Mean	Std. dev.	Mean	Std. dev.
To purchase a new computer system for the county government in order to hold local taxes constant	200	346	0	0
To purchase additional volumes for the community's library	433	544	100	132
To create a tourist bureau to develop advertising and other methods of attracting tourism into the community	883	437	583	804
To establish a community arts program featuring art, music, and dance programs for children and adults	133	29	583	382
To establish an additional shelter for the homeless in the community	817	202	1167	1041
To purchase art for display in the community's art gallery	33	58	67	115

shared-spreadsheet facilities were augmented with an embedded structuring of the decision-making process. The structuring consisted of five sequential steps, each associated with a sheet in the spreadsheet. The spreadsheet contained instructions, fields for the information produced during the step, and a proposed time limit. The five steps were:

(1) *Selecting the criteria on which projects should be assessed* (15 minutes). The participants in each group collaborated on identifying and recording the criteria they considered relevant to the allocation of the money.

(2) *Individual weighing of criteria* (5 minutes). Participants individually indicated the importance of the criteria by assigning points to them. A participant had a total of 20 points available for distribution across the criteria.

(3) *Collective weighing of criteria* (15 minutes). During this step the participants in a group had access to each others' individual weighing and to their average, calculated by the GSS. On this basis, participants discussed the importance of the criteria and agreed on a collective weighing, expressed as a distribution of 20 points.

(4) *Determining which criteria applied to which projects* (10 minutes). This is the first time the groups directly discussed the projects. The outcome of this discussion was to record, for each criterion, the projects that satisfied the criterion.

(5) *Allocating money to the projects* (remaining time up to the total maximum of 60 minutes). To support this step the GSS calculated an allocation of the money proportional to participants' weighing of the criteria and assignment of projects to criteria. Participants were, however, free to allocate the money in any way they could agree on.

2.4 Procedure

The study consisted of a separate session for each group. On arriving to the lab the three participants in a group were led into different rooms, connected with the GSS to be used in the session. Three groups used the structured GSS; the three other groups used the baseline GSS. Then, participants were introduced to the task and the GSS. Participants using the baseline GSS received no instructions about how to go about the decision-making process. The rest of the session was divided into three parts. First, participants made an individual, pre-study assessment of the importance of the six projects by rating them on a six-point rating scale. We chose against having participants allocate money to the projects at this stage to avoid that they became too involved in comparing and contrasting the projects. Second, the participants in a group worked collaboratively on the task. The three groups using the structured GSS followed the structure it imposed. For the three baseline groups no structure was imposed. The groups had a maximum of one hour to reach consensus on their allocation of the money to the projects. Third, participants individually rated six questions about their experience of the group work and individually allocated money to the six projects. This post-study allocation of the money gives participants' individual preferences at the end of the study.

2.5 Coding of Communication

The groups' audio and chat communication was recorded, and merged based on their time stamps. We adopted Poole and Roth's [16] typology and procedure for coding the communication. Each communicative turn was classified according to the nine categories in Poole and Roth [16], supplemented with two additional categories: *Technology* (statements about the GSS) and *Individual* (periods during which the participants in a group worked individually). The categories are listed in the leftmost column of Table 2 [see 16, for the full category definitions]. To

Table 2. Percentage of time the six groups spent in the eleven categories of activity.

Category of activity	Structured GSS			Baseline GSS		
	Group A	Group B	Group C	Group X	Group Y	Group Z
Orientation	9%	5%	10%	5%	10%	22%
Problem analysis	1%	1%	4%	4%	6%	2%
Problem critique	0%	0%	0%	0%	0%	0%
Solution analysis	59%	54%	44%	6%	9%	3%
Solution development and elaboration	8%	13%	10%	17%	14%	25%
Solution critique	7%	6%	2%	5%	21%	22%
Confirmation	0%	1%	0%	2%	1%	0%
Tangent	1%	2%	1%	29%	5%	4%
Disorganized periods	9%	8%	6%	28%	21%	22%
Technology	2%	4%	3%	5%	10%	1%
Individual	4%	7%	21%	0%	2%	0%
Total	100%	100%	100%	100%	100%	100%

make the coding less susceptible to noise, the classified turns were merged into sequences defined by three rules [16]: (1) Three consecutive turns from the same category mark the start of a sequence, labelled by the category. (2) Three consecutive turns from three different categories mark the start of a disorganized sequence. (3) A sequence continues until the start of another sequence. The duration of each sequence was determined on the basis of the time stamps of the audio and chat recordings.

3. RESULTS

In the following, we report results about the phases of the groups' decision-making process, the outcome of their work, and the individual participants' satisfaction with the process and its outcome.

3.1 Process

The groups using the structured GSS spent on average 52:03 minutes (range: 48:22-58:58 minutes) on the task, whereas the groups using the baseline GSS spent on average 32:22 minutes (range: 29:43-34:38 minutes). This difference is significant, $F(1, 4) = 27.67$, $p < 0.01$. Thus, the imposed structure prolonged the decision-making process. To avoid that the difference in duration biases the analysis of the distribution of the groups' activity, we report the percentage of time the groups spent on the different categories of activity, see Table 2.

Four findings stand out. First, the groups using the structured GSS spent substantially more time on solution analysis (44-59%) than the groups using the baseline GSS (3-9%). That is, the groups using the structured GSS spent more time defining how they would go about reaching a solution of their task. Second, the groups using the baseline GSS spent a considerable part of their time on solution development and elaboration and on solution critique. The groups often alternated between these two activities, which together occupied 22-47% of the baseline groups' time. The groups using the structured GSS spent 12-19% of their time on these two activities, but as these groups spent more time in total this amounts to about the same number of minutes as for the baseline groups. Third, tangents and disorganized periods occupied 7-10% of the time of the groups using the structured GSS but 26-57% of the time of the groups using the baseline GSS. As tangents and disorganized periods do not contribute much to solving a task, the time spent on these activities is largely wasted. This suggests that the groups using the structured GSS not only spent more time completing the task but also maintained a focus on the task for a larger part of this time. Fourth, the groups did not spend much time communicating about the technology, suggesting that both GSS were reasonably easy to understand and use.

The three groups using the structured GSS followed the imposed structuring of their decision-making process, and they mostly experienced tangents and disorganized periods when they were transitioning from one of the five steps to the next. Of the three groups using the baseline GSS, group X focused on one project at a time and allocated money to this project before proceeding to the next. They did not decide on the sequence in which they discussed the projects, and they hardly discussed their criteria for allocating money to a project but mostly exchanged suggestions for allocations. All the money was allocated before they had discussed all projects. This remained the case even though one of the undiscussed projects was rated highly by one participant in the pre-study rating.

Group Y started with a round in which the participants stated their individual view of the projects; then they discussed, one after the other, the four projects on which they disagreed. After that they allocated 80% of the money to one of the two projects on which they initially agreed, without at any point discussing this project. The other project on which they initially agreed (considered unimportant by all participants) also remained undiscussed. The participants' criteria for considering a project important or unimportant remained largely implicit, and the group's final allocation of the money was suggested by one participant and accepted by the two others without changes or critique.

Group Z started by selecting a chairperson and proceeded with a round in which participants stated their individual view of the projects. Based on this round two projects were excluded without discussion. Then each participant made a case for her/his favourite project, leading to the exclusion of two more projects. The two remaining projects received all the money. Criteria remained largely implicit in that the group's discussion mostly consisted of participants stating their preference for one project over another.

3.2 Outcome

The groups' allocation of money to projects differed in that the groups using the structured GSS appeared to allocate the money more evenly across projects compared to the baseline groups, see Table 1. The maximum amount of money allocated to a project differed significantly between groups using the structured GSS and baseline GSS, $F(1, 4) = 9.55$, $p < 0.05$. On average, the project to which a group allocated most money received DKK 1100 thousands ($SD = 132$) from groups using the structured GSS and DKK 1667 thousands ($SD = 289$) from groups using the baseline GSS. Moreover, the groups using the structured GSS

Table 3. Outcome measures.

Outcome	Structured GSS		Baseline GSS	
	Mean	Std. dev.	Mean	Std. dev.
Group influence ($N = 18$ participants)	0.74	0.42	0.78	0.54
Consensus ($N = 18$ participants)	0.95	0.62	0.92	0.86
"Rationality" ($N = 3$ groups)	0.32	0.30	-	-

Note: Means were calculated by using Fisher r-to-z transformation and converting the average z-score back to a correlation.

allocated no money to an average of 1.33 projects, whereas the baseline groups on average allocated no money to 2.67 projects.

In addition to the allocation of money to projects, outcome was assessed by three measures, see Table 3. *Group influence* was measured by calculating, for each participant, the Spearman correlation between the individual, pre-study rating of the projects and the individual, post-study allocation of the money. Note that lower values for this correlation indicate higher group influence. This measure of group influence was significant ($p < 0.05$) for six participants, evenly distributed between groups using the structured GSS and baseline GSS. To calculate the average social influence across participants we used the standard practice of converting the correlations to z-scores by means of Fisher r-to-z transformation, averaging the z-scores, and converting the mean z-score back to a correlation. For the structured GSS and baseline GSS, the participants' individual, pre-study rating of the projects accounted for an average of (r^2) 54% and 60%, respectively, of the variation in their individual, post-study allocation of the money. Thus, social influence was moderate, but present, for both GSS in that the group work led to moderate changes in participants' individual assessment of the projects. We found no difference in group influence between participants in groups using the structured GSS and the baseline GSS, $F(1, 16) = 0.13$, $p = 0.7$ (using Fisher r-to-z transformation of the correlations).

Consensus was measured by calculating, for each participant, the Pearson correlation between the group's allocation of the money to the projects and the participant's individual, post-study allocation of the money. This measure of consensus was significant ($p < 0.05$) for seven participants in groups using the structured GSS and four participants in groups using the baseline GSS. To calculate the average consensus across participants we, again, used Fisher r-to-z transformation. For groups using the structured GSS, the group allocation of the money accounted for an average of (r^2) 89% of the variation in participants' post-study allocation of the money. For groups using the baseline GSS, the percentage was 84%. This suggests substantial consensus for both GSS. There was no difference in consensus between participants in groups using the structured GSS and the baseline GSS, $F(1, 16) = 0.21$, $p = 0.7$ (using Fisher r-to-z transformation).

For the three groups using the structured GSS, *"rationality"* was measured as the Pearson correlation between the groups' allocation of the money and the GSS's suggestion for allocating the money (based on participants' weighing of the criteria and assignment of projects to criteria). The average correlation across the three groups was weak, indicating that in their allocation of the money the groups drew considerably on issues not expressed in their criteria and weights.

3.3 Satisfaction

Satisfaction was assessed by participants' post-study rating of their experience of the group work, see Table 4. A multivariate analysis of variance of the six questions indicated that there was no difference in satisfaction between participants using the structured GSS and baseline GSS, $F(6, 11) = 0.78$, $p = 0.6$. Thus, in spite of the differences in process and outcome, participants experienced their group work similarly. For both GSS, participants did not find it difficult to reach agreement within the 60-minute time limit, and they largely agreed to the five other questions.

4. DISCUSSION

The main finding of this study is that the type of GSS used by the groups changed not only their decision-making process but also its outcome. The lowest maximum allocation of money to a project among the groups using the baseline GSS was 20% higher than the highest maximum allocation among the groups using the structured GSS. In addition, the groups using the baseline GSS allocated, on average, no money to twice as many projects as the groups using the structured GSS. One explanation for the more even distribution of money across projects among the groups using the structured GSS may be that the process of identifying criteria and assigning projects to these criteria made it apparent to the participants that all projects satisfied at least some criteria. This may not have been apparent to the participants in the groups using the baseline GSS because they did not discuss all projects. Following this explanation, a structuring of the decision-making

Table 4. Post-study satisfaction, $N = 18$ participants.

Question	Structured GSS		Baseline GSS	
	Mean	Std. dev.	Mean	Std. dev.
It was difficult to reach agreement within the time limit	1.67	1.12	1.00	0.00
All three members of the group were satisfied with the final allocation of the money	3.56	0.73	3.89	0.33
You are yourself satisfied with the final allocation of the money	3.44	0.53	3.78	0.44
In the final allocation of the money no one person's preferences were given higher priority than those of the others	3.56	0.73	3.44	0.53
As a group you solved the task in a well-structured manner	3.67	0.50	3.11	0.93
The group support system you used was appropriate for the task	3.67	0.50	3.78	0.44

Note: Questions were rated on a 4-point scale (1: disagree - 4: agree).

process may, partially, counter the risky-shift phenomenon [7], according to which groups tend to make more extreme decisions than the average member of the groups. This may be attractive because Siegel et al. [19] have previously found that the shift toward more extreme decisions is larger for groups that communicate by means of a GSS than for face-to-face groups.

Another explanation for the more even distribution of money across projects among the groups using the structured GSS might be that the groups were influenced by the allocation of money calculated by this GSS. The structured GSS allocated the money proportionally to the groups' explicit criteria, weights, and assignments of project to criteria. Because the groups had assigned all projects to some criteria, the structured GSS allocated some money to all projects. Participants may have perceived the allocation calculated by the structured GSS as an accurate representation of the two other group members' preferences and, therefore, seen any personal disagreement with this allocation as a minority view. Faced with a perceived majority view, participants may have argued less forcefully for their individual preferences or they may have scaled down their suggestions for changes to the allocation calculated by the GSS [14]. This may happen even if all group members are misrepresented by the allocation calculated by the GSS, especially in a distributed setting where the communication channels are restricted and group members consequently may not realize that the allocation calculated by the GSS does not represent a majority view. This explanation is, however, weakened by the absence of a difference in consensus between the groups using the structured GSS and the baseline GSS. Alternatively, the allocation of money calculated by the structured GSS may have influenced the groups simply through its presence. In many situations of judgement under uncertainty, people have been found to be affected by the presence of an initial value or starting point, even when it is known to be arbitrary [21]. This phenomenon, known as anchoring, consists in an undue bias toward the initial value. An explanation in terms of anchoring is supported by the data in that the groups using the structured GSS allocated the money less evenly across projects than the allocation calculated by this GSS but more evenly than the baseline groups. It may enhance the anchoring effect that the groups have themselves provided the data on which the structured GSS's calculation is based.

The second important finding of this study is the weak correlation between the allocation of the money calculated by the structured GSS and the final allocation of the money decided by the groups using this GSS. While the allocation calculated by the GSS may, as discussed above, have influenced the participants, its weak correlation with their final allocation of the money suggests that the contribution of criteria and weights to decision making is mostly indirect and consists more of creating a richer appreciation for the task than of simulating reasoning. It may, thus, be unclear to users what multi-criteria decision-making models, such as the one imposed by the structured GSS, contribute to their decision-making process, especially for preference tasks. The absence of a difference in participants' rating of the appropriateness of the structured GSS and baseline GSS to their task lends some support for this interpretation. Hiltz et al. [5] provide further support that an imposed structuring of the decision-making process according to multi-criteria decision-making models may not be the optimal way of designing GSS. In their research, attempts at imposing a mechanistic structuring of the decision-making process have rarely had a positive effect; in contrast, providing tools that can be used by a decision-making group at the group members' discretion seems to positively affect satisfaction, process, as well as outcome [5]. In contrast, Limayem and DeSanctis [9] argue that the limited adoption of systems that incorporate multi-criteria decision-making models owes to the complexity of the models, rather than to their appropriateness. The complexity of the models possibly makes decision problems appear harder than they might otherwise. Apart from the increase in time compared to the baseline GSS, the present study does not support this explanation. On the contrary, participants found both GSS reasonably easy to use. Possibly, people in distributed groups are less sensitive to technological complexity because they are, in the first place, sufficiently comfortable with technology to engage in distributed collaboration, which is mediated by technology. Alternatively, the structured GSS may impose a rather straightforward decision-making model.

Previous work on how the use of GSS affects decision-making processes employs a distinction between GSS at levels 1 and 2 [e.g., 1, 3]. In that terminology the baseline GSS in this study is a level 1 tool and the structured GSS is a level 2 tool. GSS at level 2 have been found to produce a slightly larger improvement than GSS at level 1 in studies that compare groups using a GSS with groups that make decisions without the use of GSS [3]. Direct comparisons of GSS at levels 1 and 2 are far fewer but suggest that GSS at level 2 may be more effective [3] and lead to higher decision quality [1] than GSS at level 1. These direct comparisons have, however, mainly concerned brainstorming and intellectual tasks, not preference tasks. Hiltz et al. [5] explicitly state that preference tasks, such as the task used in this study, do not have decisions that can be rated on quality and effectiveness. This study shows that it is, nevertheless, important to study the decision outcome for preference tasks because the type of GSS may affect the decision outcome in ways beyond the level of consensus.

Further work is required to support or refute the findings of this study because it has the usual limitations of laboratory experiments [see, 11]. These limitations include that the participants were ad hoc groups with little intrinsic motivation and that the task could be completed within a brief period of time. In addition, the number of groups was small. Mintzberg et al. [13] stress that in strategic, real-world decision making the process of formulating the decision problem is of crucial importance. The formulation of the decision problem was, however, not part of this study, which instead investigated the process of solving a set decision problem. In practice, the process of formulating the decision problem often proceeds in parallel with the process of solving the problem. It is unclear whether this makes it less beneficial to impose a structuring of the decision-making process, because for example the criteria may dynamically become obsolete, or whether it increases the value of such a structuring, because the criteria, weights, and so forth help clarify the way in which the problem is currently being formulated. In their field study, Mintzberg et al. [13] also find that interruptions are common in real-world decision processes. We speculate that a structuring of the decision-making process makes it easier to resume the process after an interruption, because more information has been recorded about the considerations made prior to the interruption. The value of this information will depend on the kind of structuring imposed on the decision-making

process. Future work should investigate how differences in the structuring imposed by a GSS affect the decision-making processes, specifically in distributed groups.

5. CONCLUSION

Groups using a GSS that imposed a structuring of their decision-making process spent more time solving the task, spent a larger part of their time on solution analysis, and allocated the money more evenly across projects than baseline groups, which spent a larger part of their time on disorganized activity and failed to discuss all projects. There were no differences in group influence, consensus, and satisfaction between groups using the structured GSS and the baseline GSS; in particular, consensus was substantial for both GSS. Thus, while the structured GSS appeared to benefit the groups' process, the extra time spent using the structured GSS improved neither consensus nor satisfaction. The groups' decisions were, however, affected by the type of GSS. On the one hand, groups using the structured GSS appear to be biased toward the allocation of money calculated by the GSS, suggesting an anchoring effect. On the other hand, the way in which these groups allocated the money shows limited correlation with an allocation proportional to their explicit criteria, weights, and assignments of projects to criteria. This suggests that the contribution of criteria and weights to decision making is more indirect and that there may be other, equally effective ways of supporting distributed groups in creating a rich appreciation of their task.

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