Human Versus Automated Facilitation in the GDSS Context

Moez Limayem
Information Systems Department
City University of Hong Kong
Tat Chee Avenue
Kowloon, Hong Kong
Tel. (852) 2788-8530
Fax. (852) 2788-8694
ismoez@is.cityu.edu.hk

Mohamed Khalifa
Information Systems Department
City University of Hong Kong
Tat Chee Avenue
Kowloon, Hong Kong
Tel. (852) 2788-7491
Fax. (852) 2788-8694
iskhal@is.cityu.edu.hk

Stephanie Ma
Management Science and Engineering Department
Stanford University
Stanford, CA 94305
USA
stma@stanford.edu

ABSTRACT

Many group decision support systems (GDSS) are currently being used with the help of a human facilitator who guides the group members through their use of the decision models. Another way to guide the use of these systems is to embed some facilitation mechanisms into the GDSS itself (i.e., automated facilitation). Using the Adaptive Structuration Theory (AST), this study investigated the tradeoffs associated with human facilitation and automated facilitation. Groups using a multicriteria decision model in the context of a resource allocation task were exposed to one of two experimental conditions: (1) human facilitation, or (2) automated facilitation. Results indicated that automated facilitation, embedded in the GDSS, was as effective as human facilitation in enhancing the faithfulness of appropriation of the technology.

Keywords: GDSS, facilitation, AST

I. INTRODUCTION

The performance of groups interacting with GDSS has been the subject of numerous studies (see Boonstra, et al. [3] Damian, et al. [7]; Gallupe and Yoong [18]; Gallupe, Bastianutti and Cooper [19]; Kwok, Ma and Vogel [21]; Dennis, Nunamaker, Valacich, and Vogel [9]; Hoffer, Mennecke, and Wynne [20]). A few studies have focused on the method used to interact with the GDSS, with emphasis on the use of human facilitators (e.g. Anson [1]; Dickson, Robinson, Lee and Heath [15]; Dickson, Lee and Robinson [14]). In general, it has been shown that facilitation enhances the effectiveness of groups using a GDSS, particularly in groups that lack experience in using the technology. For example, Anson [1], in his research examining the impact of GDSS support and human facilitation on meeting process and outcomes, found that the guidance provided by a facilitator can improve group performance. Similarly, Reagan-Cirincione [24] investigated the effects of an intervention procedure that combined human facilitation, decision modeling, and information technology. The procedure enabled groups to outperform their most capable members when performing two cognitive tasks.

Based on the Adaptive Structuration Theory (AST), this study takes the investigation of facilitation one step further. Groups, equipped with a GDSS that includes a multicriteria-modeling module, are given a resource allocation task on which they must achieve consensus. GDSS impact on the decision making process and outcomes is compared across two conditions:

(1) Group members using the GDSS are aided in performing the task and using the technology by a person acting as a facilitator.
(2) Group members used a version of GDSS that includes automated facilitation (the GDSS is the same as that used in condition (1) except that it includes features that simulate a human facilitator).

According to the framework introduced by DeSanctis and Gallupe [12], the first condition represents a "level 2" GDSS, while the second condition represents a "level 3" GDSS.

II. PRIOR RESEARCH

A considerable amount of research on GDSS facilitation has been carried out because it is considered among the most important critical success factors for effective GDSS application. However, as shown in Dickson, et al. study [15], facilitation is effective only if it is appropriate for the task at hand. Dickson, et al. [15] performed a pilot study of three user modes of interacting with a GDSS: (1) the user-driven mode (training followed by undirected use), (2) a chauffeured mode (interaction supported by someone who would "drive" the software, but would not become involved in the process used by the group) and (3) a facilitated mode (interaction supported by a person who facilitate the group process). It was found that the chauffeured mode achieved the best post-meeting consensus of the three treatments. Dickson, et al. [14] extended the pilot study, and using eighteen groups per experimental treatment, verified that chauffeured groups had higher levels of post-meeting consensus than did facilitated group. This somewhat surprising result is due to the fact that the type of facilitation used was very rigid in the sense that it was scripted and procedural in nature.

Boonstra, et al. [3] supported flexible facilitation in their study about participants' perceptions of effective GDSS facilitation. Based on transcripts of interviews with participants, they produced a comprehensive overview of tasks and behavior that participants felt were crucial for effective facilitation of GSS meetings. The characteristics of an effective facilitator were grouped under the headings of workshop design, required knowledge, setting the stage, being available, human qualities and attributes (relaxed, neutral, reserved and spontaneous), being sensitive/building rapport, intermediate results/ group output presentation, directing, guarding, script evaluation/modification and redesigning process, being sensitive to results and after-care.

Another study in the research stream, Dickson, DeSanctis, Poole and Limayem [13], compared the use of "level 1" and "level 2" GDSS features [12]. According to this framework, level 1 GDSS include only communication enhancing functions such as brainstorming and voting. Level 2 GDSS add decision aids such as stakeholder analysis and multicriteria decision models to assist the group's decision process. This study of level 1 and level 2 use conclude that, for the Foundation task, groups using a level 1 GDSS achieved higher levels of post-meeting consensus than did a level 2 GDSS. This conclusion can be explained by the fact that groups had difficulty in applying level 2 GDSS features after only one training session. The suggestion was strongly made that groups using level 2 features (with some complexity) needed assistance from a human facilitator or some aids (perhaps including facilitator-like functions) built into the system.

In another study, Dennis and Wixom [10] investigated the impact of the five moderators (task, tool, type of group, size of group and facilitation) on the effects of GSS. They found that process satisfaction is higher for idea-generation tasks than for decision-making tasks. Decision quality is higher but process satisfaction is lower when using level 2 tools instead of level 1 tools. Decision quality is lower for virtual teams, but there is no difference in the number of ideas generated between virtual teams and face-to-face teams using GSS. For larger groups, decision time is shorter and process satisfaction is higher. Finally, process facilitation leads to higher decision quality and higher satisfaction with the process.

The results of some of these prior studies are contradictory and after many years of research, we still do not know how facilitation affects the decision making process and the decision outcomes.

III. HUMAN FACILITATION VS. AUTOMATED FACILITATION AND GDSS APPROPRIATION

Based on studies in the GDSS field (e.g. Dennis and Gallupe [8]; Kwok et al [21]), facilitation in group decision settings leads to more faithful appropriation of structures and consequently result in better decisional outcomes and better perceptions of decision process and outcomes. Specifically, a human facilitator can help the group successfully appropriate these structures (i.e. guide the groups to use the GDSS as it was intended to be used by the technologists who built the GDSS system) by giving guidelines to encourage faithfulness, as well as encouraging positive attitudes and consensus over the GDSS [2]. Since automated facilitation was built into the GDSS system with the aim to simulate a human facilitator, we posit that the impact of a human facilitator on the decision making process and outcome is the same as that of an automated facilitator. Our research model (Figure 1) has been accordingly drawn up.

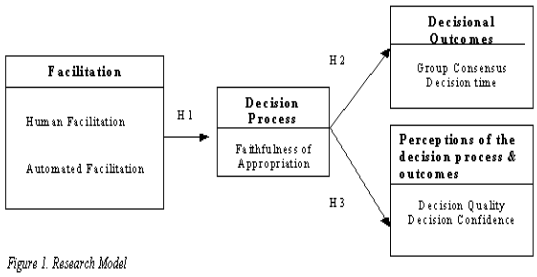

Figure 1. Research Model

IV. RESEARCH HYPOTHESES

Specifically, we enunciate the following hypotheses based on our research model.

Hypothesis 1. Groups receiving human facilitation will have the same faithfulness of appropriation as groups receiving automated facilitation.

Hypothesis 2a. Groups with higher faithfulness of appropriation will achieve higher

consensus on their solution decisions than groups with lower faithfulness of appropriation.

Hypothesis 2b. Groups with higher faithfulness of appropriation will take less time to reach their decision than groups with lower faithfulness of appropriation.

Hypothesis 3a. Groups with higher faithfulness of appropriation will have more positive perceptions of the group decision quality.

Hypothesis 3b. Groups with higher faithfulness of appropriation will have more positive perceptions of Decision Confidence.

V. METHOD

A total of 50 groups participated in this study. The groups were confronted with the "Foundation Task" developed by Watson et al. [29]. This task requires members to act as a philanthropic Foundation and allocate a sum of $500,000 among six competing projects fro the betterment of the local community. The six projects are based upon the six personality components, which are: theoretical, economic, aesthetic, social, political, and religious. This multi-criteria decision-making task is considered to be difficult because of its low analyzability and the ambiguity in the cause-effect relationships [28]. Specifically, the background information provided to the subjects about the task does not allow them to choose an evident best solution.

These 50 groups were randomly distributed to one of the two treatment conditions: human facilitation (25 groups), and automated facilitation (25 groups). The students involved in this study were upper undergraduate students enrolled in several sections of an introductory course in information systems and decision sciences. Teams formed for class purposes were used for the experiments. The experiment took place approximately half way through the participants' academic term, after each group had met several times to work on other class assignments. Most groups met about three times prior to the experiment, ensuring that differences in group members' familiarity with each other did not confound the results. All groups consisted of 5 students.

The teams were scheduled into two-hour (human facilitation groups) and two-and-a-half hour (for automated facilitation) experimental sessions in the GDSS laboratory. For each experimental session, individual members first filled out a pre-experimental questionnaire and allocated funds to the six projects in the Foundation Task. This initial allocation was used to calculate pre-meeting consensus. Next, the members of the group were told to decide, as a group, the allocation of funds to the projects. For the next 1.5 to 2.0 hours, decision making as a group was undertaken with the GDSS in one of the two treatments: (1) with assistance from human facilitator, (2) with assistance from facilitation mechanisms built within the GDSS. Groups receiving each treatment had up to two hours to perform the task. This time limit was not a constraint for the groups, although the various treatment groups did take different amounts of times. For your interest, the average time taken by each group to complete the task was: Human facilitation (81 minutes); automated facilitation (70 minutes). The procedures employed in each experimental conditions are described below.

A. HUMAN FACILITATION

A human facilitator guided the group through the process. Instead of using a warm up task, the facilitator first ran through the SAMM software features, focusing on important keys that would be used during the group session. Following this introduction, the facilitator guided he group through the agenda: first, to define a list of criteria the group wanted to use to evaluate the projects; second, to weigh the criteria in order of importance; third, to evaluate the alternatives against the criteria; fourth, to calculate scoring based on the criteria weights and ratings; fifth, to allocate dollar amounts to the projects. In addition, the facilitator also helped to initiate discussion within the group to (1) clarify the meaning of criteria, eliminate any duplicates, or add new ides as the group saw fit, (2) reach agreement on the criteria weights listed by the group, (3) examine the ranges in the alternative ratings and obtain closer agreement if the group so desired, (4) explain the scoring process and how dollar amounts were allocated to the projects based on the alternative scores, (5) identify group decision on the final allocation of funds to the projects.

The facilitator was aided by a chauffeur who was responsible for performing the editing, deleting and scoring functions for the group at the request of the facilitator or the group members.

To control for possible effects due to the individual characteristics of the facilitator, four people served as facilitators. With one exception, the facilitators were not researchers either for this or other studies. They were selected for their excellent communication skills and ability to work with groups for the task at hand. Each facilitated approximately a quarter of the groups in this experimental condition. There were no significant differences in group outcomes as a function of who served as the facilitator.

B. AUTOMATED FACILITATION

The allocated/ multicriteria model was enhanced with several built-in facilitation mechanisms aimed at emulating a human facilitator in guiding groups through the decision making process. These mechanisms were designed based on principles of decisional guidance put forth by Silver [26] and specific guidelines for multicriteria modeling support developed by Limayem [22]. The following features were embedded into the multicriteria module of the SAMM GDSS:

1. When the group members initially started the allocate/ multicriteria model, a screen was automatically evoked to explain the overall purpose of the model as well as its major steps.
2. Each time an option was chosen from the allocate/ multicriteria model menus, a screen was invoked to summarize the previous steps, explain the purpose of the option being selected, and clarify how it related to the overall decision making process. Users could, at any

time, request these screens by pressing on e of the function keys.

3. A status window was added to each screen of the allocate/ multicriteria model in order to display the current step being performed by the group as well as the next step to be performed.
4. A message was displayed on the public screen each time some inconsistencies were detected. For instance, after the group members entered their ratings of how each alternative meets the specified criteria, a warning message was displayed on the public screen pointing to the criteria, and alternatives that exhibited a disagreement among the group members. These criteria and alternatives were most likely problematic because members' rating of the alternatives should be objective and should not be significantly different from one member to another. Thus, any wide discrepancy was most likely the result of a misunderstanding of the criterion and/or the alternative. Accordingly, the system recommended that the group members clarify the meaning of the criteria and the alternatives that showed high disagreement among group members.
5. A key role of a human facilitator was to explain the system output to the group members. To emulate this function, several graphs and tables were added to the allocate/ multicriteria model to help the group members better understand the model recommendations. For example, a bar graph of the frequency distribution of the group members' ratings of any alternative on any given criterion was implemented to display the number of times an alternative was given a certain rating value by the group members. This add-on feature allows decision makers to closely examine the merit of the alternatives of interest to them. As in the control condition, groups in this treatment were provided with training in the enhanced version of the allocate/ multicriteria model. A warm up task was used to illustrate the system features. A chauffeur was also available to perform editing, deleting, and scoring functions at the request of the group.

. Results

VI. MEASUREMENT

Facilitation - was the independent variable manipulated in this study. Groups performing a multicriteria task using the GDSS with human facilitation were compared to groups undertaking the same task but using the GDSS with automated facilitation.

Faithfulness of Appropriation – it was measured by the 5-item scale developed by Chin et al. [6].

Decisional outcomes - Group consensus was measured using Spillman, Bezdek and Spillman 's [27] formula as described by Watson et al. [29]. The elapsed time in minutes between start of task and the announcement of reaching group decision was a measure of the Decision time.

Perceptions of the decision outcomes - measured as self-reported scales; (1) Perceived decision quality was based on an 8-item scale developed by Brown, Gouran, and Henry [4] and used in earlier studies of group decision making and GDSS (DeSanctis et al. [11], Easton et al. [16], Niederman and DeSanctis [23], Sambamurthy [25], Watson et al. [29], Zigurs et al. [30]). (2) Decision confidence was measured using an 8-item scale developed and validated by Sambamurthy [28] and indicates how confident group members were in their group's decision and their beliefs about its appropriateness given the problem at hand. For these perceived variables, individual scores were averaged to create a group score. The data analyses described in the following section are based on these group scores.

VII. RESULTS

As a test of our main theoretical proposition that decision improvements from system explanation systems should be attributable to the FOA of GDSS, we used a Partial Least Squares procedure to estimate the path relationships among the major constructs in our research model (Figure 1). PLS-Graph version 3.0 [5] was used to perform the analysis. Tests of significance for all paths were conducted using the bootstrap resampling procedure (Efron and Tibshirani [17]).

Findings confirmed all our hypotheses that the effects of human and automated facilitation on the decision making process are the same. Both human and automated facilitation led to the same level of faithfulness of appropriation. Furthermore, high faithfulness of appropriation resulted in better decision outcomes.

The main conjecture of AST - that the way groups use the GDSS determines how much they benefit from it, is supported by the study. The paths linking FOA to the decisional outcome and perceptions of the decision process and outcome are all significant, providing support for our hypotheses that higher FOA leads to better decisional outcomes and better perceptions of decisional process and decision outcomes. In other terms, it is really the way groups use the technology that makes a difference in outcomes. Therefore, since both human and automated facilitation have the same function of guiding groups to properly use the GDSS technology, their effect on the faithfulness of appropriation is the same.

VIII. CONCLUSION

Although this study cannot be generalized and applied to all situations, it raises two important points. First, it goes beyond the simple causal effect of technology on behavior i.e., the 'black box' approach. By leveraging the AST theory, we open up the 'black box' to explain 'how' a GDSS affects group interactions and outcomes, and 'why' groups have different outcomes and perceptions of the outcomes and decision process. Most importantly, our findings suggest that automated facilitation enhances group performance just as much as a human facilitator. This encouraging result suggests that it may be worthwhile to explore the possibility of using automated facilitation rather than depending on a human facilitator. This is because human facilitation is quite expensive to deliver, is less convenient (e.g., when the facilitator is unavailable or when group members are physically dispersed) and prone to inconsistent performance (e.g., the facilitator may have

"good" days and "bad days", or all facilitators may not behave in the same manner). Our result is especially encouraging given that it was our early attempt at automated facilitation. Undoubtedly, with continued work, the automated facilitation could be further improved. Thus, work on systems with "expert" facilitators appears quite promising.

Of course, our results and conclusions are based on this one study involving a particular type of task, a "one-shot" GDSS session, and use of one type of GDSS technology. Still, the fact that this study is part of an ongoing stream of research and produced such heartening results leads us to promote more GDSS research and development in the areas of human and automated facilitation.

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