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# An Investigation of the Effects of GDSS and Task Type on Group Influence Behavior

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**Executive Summary**

Groups rather than individuals become essential to organizational decision makings; but group work in organizations is often unproductive (Jessup and Valacich 1993). Group Decision Support System (GDSS) aims to resolve this problem to make group work more effective and efficient. In the last two decades, a lot of research have been conducted in GDSS field. In general, GDSS can increase group performance in terms of group decision quality, more participation in group meetings, more equal participation in group meetings, numbers of decision alternatives generated, and group creativity (e.g., Dennis, Haley and Vandenberg 1996).

However, most prior research mainly studied the impact of GDSS on group *outcomes* while group *processes* have been largely neglected; further, task type as an important variable to moderate the impact of GDSS on groups has been inadequately studied as if the impact of GDSS on groups would be the same when groups face different tasks. This research tried to bridge these gaps by investigating the joint effect of GDSS and task type on group influence *processes*. In this empirical experiment, support level was varied in GDSS-support and non-support, and task type was varied in intellective task and preference task. The GDSS system used in this study was SAMM system developed by University of Minnesota. The research findings showed that GDSS did have significant impact on group influence processes – it increased amount of influence behavior and caused influence distribution uneven in intellective task. But this effect of GDSS on group influence processes was not found in preference task. The findings suggest that task type could be an important factor in shaping group influence processes and GDSS use. Organizations should be careful when they adopt GDSS to support various tasks. GDSS users in organizations should carefully examine the characteristics of tasks that they face, before they choose suitable GDSS structures to support their task-performing activities. One implication for academicians is that the fit between specific GDSS structures and task types appears to be a very important issue for successful GDSS adoption and use. GDSS may have more beneficial effects for some task types than for others.

**Abstract**

Research on GDSS have been conducted in last two decades. In general, most prior research mainly studied the impact of GDSS on group *outcomes* while group *processes* have been largely neglected; further, task type as an important variable to moderate the impact of GDSS on groups has been inadequately studied, as if the impact of GDSS on groups would be the same when groups face different tasks. This research tried to bridge these gaps by investigating the joint effect of GDSS and task type on group influence *processes*. The independent variables were support level (GDSS support and no support) and task type (intellective task and preference task). The dependent variables were amount of influence behavior and influence distribution. Research findings showed that GDSS did have significant impact on group influence processes -- it increased amount of influence behavior and caused influence distribution uneven in intellective task. But this effect of GDSS on group influence processes was not found and supported in preference task. The findings suggest that task type could be an important factor in shaping group influence processes in GSS use.

**Keywords:** GDSS (Group Decision Support System), Group Influence Processes.

## 1. Introduction

Group as a decision maker is essential to organizations, but unfortunately, group work is often unproductive (Jessup and Valacich 1993). Group Decision Support System (GDSS) aims to resolve this important organizational problem.

Nunamaker et. al (1991) proposed a general group research model shown in Figure 1. According to this model, effects of GDSS use are contingent upon a myriad of group, task, context, and technology factors that differ from situation to situation. These factors influence group process, which in turn affects group outcome. This model recognizes the importance of group process to group outcome. Actually, group process is a central piece in group dynamics (McGrath 1984). Unfortunately, literature review shows that most prior GDSS research studied the effects of GDSS on group outcomes (Dennis, Haley and Vandenberg 1996; Kraemer and Pinsonneault 1990) while treating group process as a black box (Sambamurthy and Poole 1992; Zigurs, Poole and DeSanctis 1988). Some previous empirical studies have reported that GDSS improved group performance (e.g., Bui and Sivasankaran 1990; Easton 1989; Gallupe, DeSanctis and Disckson 1988; Jarvenpaa 1988; Nunamaker et al. 1991; Sharda, Barr and McDonnell 1988) while some other studies have indicated that such improvement of group performance was not supported (e.g., Gallupe and McKeen 1990; Gallupe 1990; George et al. 1990; Steeb and Johnston 1981). This inconsistency of GDSS research has still been one main concern in this field (McGrath and Hollingshead 1994). Research focusing on group processes may provide important and additional insights for explaining this inconsistency. Further, many GDSS researchers have studied group performance and outcome using a single task type as if the effect of GDSS on groups would be the same for different tasks. Research has shown that task type often contributes up to fifty percent of variations to group performance (Poole, Siebold and McPhee 1985). However, there is lack of systematic GDSS research to study the effect of task type on groups (McGrath and Hollingshead 1994). Therefore, this research tries to bridge these gaps to study how GDSS interacts with task type to influence group process.

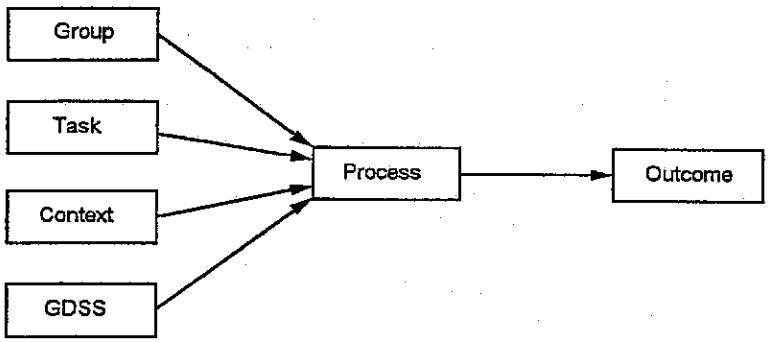


**Figure 1. General Research Model**

The remaining parts of this paper are organized as follows. Section 2 reviews the relevant literature that form the conceptual foundations for this research; followed by defining dependent variables, formulating research hypotheses, and describing research methodology. The last two sections provide experimental results and present the discussion and implications of the research findings.

## 2. Literature Review

A brief review on relevant prior research in GSS literature forms a basis for the further analysis and hypothesis formulation.

GDSS includes many tools and structures to facilitate group work. The five basic and commonly used structures are (Bostrom and Anson 1992): (1) anonymity – group members do not know the owner of an expressed idea in communication; (2) simultaneity – group members can input their ideas simultaneously via keyboards; (3) electronic recording and display – all exchanged messages are captured and saved in group memory or group databases which can be retrieved and displayed on screen anytime in group meetings; (4) structured interaction process – such as electronic meeting agenda for groups; (5) enhanced information processing – data processing or electronic voting. Hence, a GDSS provides an equal opportunity for members to participate in group activities, enables all members to work simultaneously, and discourages behavior that can negatively impact meeting productivity (Nunamaker et al. 1991). As a result, GDSS likely influences group processes.

A few prior research have studies the effect of GDSS on group processes. Zigurs, Poole and DeSanctis (1988) studied the effects of GDSS and group size on group process in terms of amount of influence behavior and influence distribution while groups performed an intellective task. They found that there was no difference for support level in terms of amount of influence behavior. The finding of influence distribution, however, was inconsistent by using two different interments. Lim, Raman and Wei (1994)

studied the effects of GDSS and leadership on group decision making process in a preference task. The main findings were that GDSS groups generated a larger amount of influence behavior than manual groups (with the same meeting agenda as GDSS groups), and had a more equal distribution of influence behavior than manual groups under the condition of no elected leader.

A task refers to the set of problems and issues confronting a decision making group which aims to seek a solution agreeable to the group members (Hare 1976). Task is a major determinant of information exchange pattern in a group (Tan, Wei and Raman 1991). Task characteristics determine what the requirement and type of information must be exchanged by a group (Poole 1978). Hence, task type and its characteristics exert much influence on group decision process and outcome (Poole, Siebold and McPhee 1985). But task type has been inadequately studied by researchers in GDSS field, specially in a systematic way (McGrath and Hollingshead 1994). Systematic study of task type should be based on a good task classification; otherwise, it is very difficult to study because there are simply too many different tasks (hundreds of tasks) facing organizations.

Prior researchers in social psychology have proposed a number of task categorization schemes (e.g., Hackman 1968; Laughlin 1980; McGrath 1984; Shaw 1973; Steiner 1966). Shaw (1973) has studied 104 tasks using factor analysis and offered six empirically derived task dimensions: Difficulty, Solution Multiplicity, Cooperation Requirements, Intellectual-Manipulative Requirements, Population Familiarity, and Intrinsic Interest. McGrath (1984) summarized the work of these prior researchers, and developed a group task circumplex consisting of *four* quadrants and eight task types (see Figure 2). These eight categories of task types are mutually exclusive and collectively exhaustive. Each category of task type is logically related to the categories adjacent to it. Further, the circumplex indicates the differences between, and describes the relations among, the different categories of task types. Hence, this task type classification system has been widely used in GDSS research (e.g., DeSanctis and Gallupe 1987; Nunamaker, Vogel and Konsynski 1989; Zigurs, Poole and DeSanctis 1988). This study will also adopt this task circumplex as a basis for systematic research on task type. In this way, only four studies are required to cover all task types if each study focuses on two task types in one quadrant. Further, prior and future studies on the same task type can be easily compared and related knowledge about the task type can be accumulated.

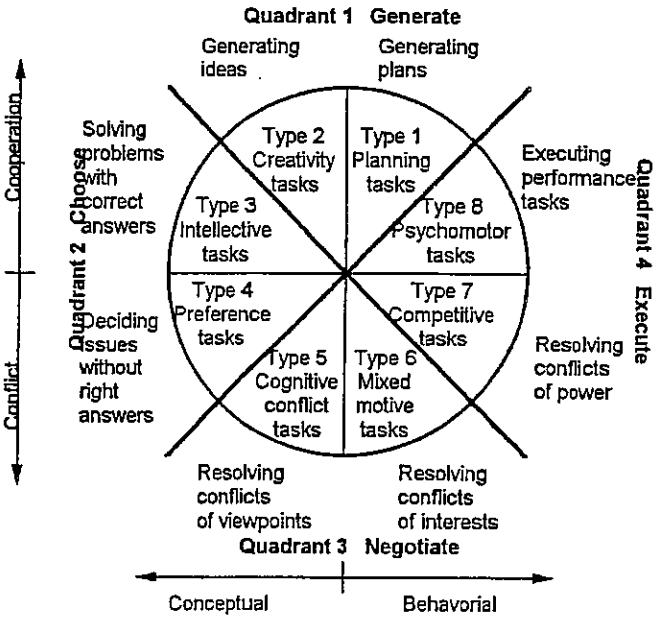


**Figure 2 The Group Task Circumplex**

Therefore, the two task types chosen for this study are intellective task and preference task, which locate in second quadrant in Figure 2. Further, groups normally perform intellective task because they can offer the possibility of more accurate judgments (McGrath 1984). Preference task is often encountered in organizations (Daft and Lengel 1986) because the preferences of decision makers dominate many important decisions (Brehmer 1976). There is a correct answer existing in intellective task and the task solution depends on more factual information exchange whereas there is not a correct answer in preference task and the task solution depends on members' preferences and values (McGrath 1984).

## 3. Variables and Hypotheses

In this study, group processes are examined from influence perspective because influence has been regarded as a long and standing interest in group research literature (Zigurs, Poole and DeSanctis 1988). Further, one practical approach to study group processes is to examine them as interpersonal influence processes (Stasser, Kerr and Davis 1989). Therefore, two dependent variables are chosen as dependent variables: amount of influence behavior and influence distribution, which have been commonly adopted in the few group process studies in GDSS literature (Lim, Raman and Wei 1994; Zigurs, Poole and DeSanctis 1988). **Amount of Influence Behavior** is defined as those actions that attempt to affect or determine the course of group behavior, and **Influence Distribution** is the variance of the amount of influence behavior in a group (Zigurs, Poole and DeSanctis 1988). The following hypotheses are mainly to examine how the effect of GDSS on group influence processes differs in the two task types.

### 3.1 Amount of Influence Behavior

The solution of an *intellective task* depends on more factual information exchange among group members to find out the existed correct answer. GDSS with the structured meeting agenda can improve interpersonal influence behavior through an intervention into the information exchange process (DeSanctis, Sambamurthy and Watson 1987). Further, a GDSS with anonymity and simultaneity enables participants to give their opinions simultaneously through the electronic communication channel without fear of social offensiveness and status differences (Jablin and Seibold 1978). Therefore, there will be more factual information exchange and uninhibited communication behavior in GDSS groups.

H1 In intellective task, amount of influence behavior will be greater in GDSS groups than in unsupported groups.

In *preference task*, there is not a correct answer. The task requires more information exchanges of different values and preferences among group members in order to arrive at consensus on group final decision (McGrath 1984). On the one hand, exchange of different personal values and preferences could be dampened in GDSS electronic communication because only textual message can be transmitted and much social cues can be reduced or even eliminated (Sproull and Kiesler 1986). In other words, influence behavior that attempts to increase understanding of members' different values and preferences will be dampened by GDSS. On the other hand, GDSS offers anonymity and simultaneity that promote more open communication and uninhibited communication behavior among group members. Consequently, influence behavior could be enhanced. In sum, it is difficult to predict the net effect of GDSS and further, there is not prior empirical research findings as the basis for logical judgment. We thereby posit that:

H2 In preference task, amount of influence behavior will not be greater in GDSS groups than in unsupported groups.

### 3.2 Influence Distribution

In intellective task, a correct answer or solution to the task exists. Some group members may have more knowledge about the task and its solution than others, because different people possess different cognitive abilities. Though GDSS with simultaneity provides equal communication channel for every group member, more knowledgeable members are likely to contribute more to group discussion. And further, they do not need to worry about the problem of "air-time allocation" existed in face-to-face discussion (Nunamaker et al. 1991), in which one people is talking while others have to wait for "air-time" to talk. As a result, more contribution from these more knowledgeable members likely cause influence distribution uneven.

H3 In intellective task, influence distribution will be more even in unsupported groups than in GDSS groups.

In preference task, though information exchanges of values and preferences are likely dampened by GDSS, GDSS with simultaneity provides an open and equal access to electronic communication channel to all group members. Therefore, communication thus influence behavior through this communication channel is likely more equally distributed among group members.

H4 In preference task, influence distribution will be more even in GDSS groups than in unsupported groups.

## 4. Research Methodology

### 4.1 Interaction Analysis Method

Interaction analysis for capturing group process interactions has become increasingly important in GDSS research (e.g., DeSanctis, Sambamurthy and Watson 1987; Sambamurthy and Poole 1992). Many schemes for coding group processes are available in group research literature. But many of them aim to study group leaderships, and therefore some schemes are more suitable for some studying needs than for others. In this study, Putnam's interaction analysis method and coding scheme (1981) was adopted with the modifications suggested by Zigurs, Poole and DeSanctis (1988). Putnam's ten category coding scheme is intended to capture verbal procedural messages in group interactions, These procedural messages occupy a substantial portion of group talking time, perform vital meta-message functions, and serve as indices of leadership emergence and decision making processes (Putnam 1981). The first five categories of the coding scheme which form the basis for measuring influence are: initiation messages, goal-oriented messages, integrative messages, implementation messages, and process messages.

### 4.2 Measurement of Dependent Variables

Influence behavior was measured by viewing the videotapes (for unsupported groups) that recorded whole group meeting sessions using video camera, and by examining computer log files (for GDSS groups). Each verbal act emitted by one group member was coded (Zigurs, Poole and DeSanctis 1988) using Putnam's coding scheme (1981). Here, as an initial research on group influence behavior, there is no attempt to conduct an in-depth analysis of nonverbal influence behaviors such as eye gaze, hand gestures, facial expressions, and so on. The amount of influence behavior in a group is the sum of coded scores for all group members. Two coders worked together on the coding scheme initially until they achieved mutual reliability. Then, they finished coding all the videotapes and computer log files separately. The over-all inter-rater reliability was 90%. More detailed description of Putnam's coding scheme and coding tips please refer to the paper of Zigurs, Poole and DeSanctis (1988).

### 4.3 Tasks

The two tasks adopted in this study are an intellective task and a preference task. The intellective task (an international studies program task) was adopted from Zigurs, Poole and DeSanctis (1988). This task asked group members to score a list of competing applicants based on six attributes of the applicants. The six attributes were gender, expectations for social success, self concept, expectations for independence, attitudes about pre-marriage sex, and prior travel abroad. The preference task (a personal trust foundation task) was adopted from Watson, DeSanctis and Poole (1988). This task asked group members to allocate funds to a list of competing projects based on their personal values. The projects were based on the personality components scheme described by Spranger (1928) who asserted that the six basic interests or motives in personality were theoretical, economic, aesthetic, social, political, and religious.

### 4.4 Experimental Design and Setting

The experiment was a two-by-two factorial design. The two independent variables were task type and support level. The two support levels were GDSS support and no support (baseline groups). The two dependent variables were amount of influence behavior and influence distribution. A group size of five was chosen because the average number of participants in an organizational meeting is five persons (Datamation 1986).

The GDSS used in this experiment was SAMM (Software Aided Meeting Management system) which was run on an AT & T 3B2-4000 minicomputer under Unix operating system. GDSS groups were provided with SAMM for communication. For unsupported groups, members have normal face-to-face talk without any technological facility.

One hundred and sixty first year students from a large university participated in the experiment. They were randomly assigned to thirty two groups with five members each. The average age of the chosen students was twenty and nearly half of them were male. All the subjects were course mates. Every subject was given course credit for participation in the experiment. They have never used GDSS system before the experiment.

### 4.4 Experimental Procedure

The experimental steps of both tasks are briefly stated here: (1) for both tasks, group members were asked to do warm-up tasks, (2) for intellective task groups, individual members were asked to learn task criteria, (3) for both tasks, individual members were asked to perform the tasks before the meeting, (4)

for both tasks, members in GDSS groups were asked to learn the structured meeting agenda and the operations of GDSS system, (5) for both tasks, groups were asked to perform the tasks. The meeting sessions were recorded using video camera.

## 5. Research Results

Analysis of variance (ANOVA) was used to detect significant main and interaction effects. If a significant interaction effect was detected, an analysis of simple effects was performed to reveal the nature of result (Kepple 1982). A five percent level of significance was adopted for all tests.

### 5.1 Amount of Influence Behavior

Table 1 shows the details of ANOVA test on amount of influence behavior. In the last-column of Table 1, an asterisk indicates a significant effect. This table shows that support level and task type had insignificant main effects on amount of influence behavior. However, there was a significant interaction effect between GDSS and task type on amount of influence behavior. An analysis of simple effects (Kepple 1982) was used to analyze the interaction effect.

| | DF | SS | F | Pr > F |
|---|---|---|---|---|
| Support Level | 1 | 445.51 | 1.3380 | 0.2572 |
| Task Type | 1 | 47.53 | 0.1428 | 0.7084 |
| Support Level * Task Type | 1 | 1714.05 | 5.1478 | 0.0312* |
| Error | 28 | 9323.12 | - | |
| Total | 31 | 11530.21 | - | |

Table 1 ANOVA Test for Amount of Influence Behavior

An analysis of simple effect showed that in *intellective task*, amount of influence behavior was significantly greater in GDSS groups than in unsupported groups (F=6.4579, P=0.0235*). H1 was supported. In *preference task*, no significant difference in amount of influence behavior between GDSS groups and unsupported groups was found (F=0.5666, P=0.4641), i.e. H2 was not rejected.

### 5.2 Influence Distribution

Table 2 shows details of the ANOVA test on influence distribution. Similarly, support level and task type had insignificant main effects but there was a significant interaction effect between support level and task type. The analysis of simple effects was again used to analyze the interaction effect.

| | DF | SS | F | Pr > F |
|---|---|---|---|---|
| Support Level | 1 | 139.09 | 0.2643 | 0.6112 |
| Task Type | 1 | 14.24 | 0.0271 | 0.8705 |
| Support Level * Task Type | 1 | 3757.58 | 7.1390 | 0.0124* |
| Error | 28 | 14737.71 | - | |
| Total | 31 | 18648.63 | - | |

Table 2 ANOVA Test for Influence Distribution

An analysis of simple effect showed that in *intellective task*, influence distribution was significantly more even in unsupported groups than in GDSS groups (F=5.4025, P=0.0357*). H3 was thus supported. In *preference task*, no significant difference in influence distribution between GDSS groups and unsupported groups was found (F=2.1951, P=0.1606), namely, H4 was not supported.

## 6. Discussion and Implications

GDSS increased amount of influence behavior for intellective task (H1 supported) but not for preference task (H2 not rejected). Actually, in preference task, GDSS tended to dampen amount of influence behavior because the average score of amount of influence behavior (40.70) in unsupported groups was greater than the one (33.53) in GDSS groups. Hence, the effect of GDSS on amount of influence behavior seems to differ in different tasks, in other words, task type may be a moderator for impact of GDSS on amount of influence behavior.

The above findings provide additional insights to influence processes in groups. Literature on small group research shows that informational influence predominates in intellective task and normative influence[1] predominates in preference task (e.g., Kaplan and Miller 1987). Hence, the finding that GDSS increased amount of influence behavior in *intellective task* in this study could mean that GDSS tended to increase informational influence which prevails in this task; the finding that GDSS appeared to decrease amount of influence behavior in *preference task* in this study could mean that GDSS tended to dampen normative influence which prevails in this task. This conclusion was named as "amplifying (informational influence) and attenuating (normative influence) effect of GDSS" and tested in the study done by Huang, Raman and Wei (in press). Our study was therefore in line with this conclusion.

Further, GDSS caused uneven influence distribution in *intellective task* (H3 supported). ThoughH4 was not supported for *preference task*, the average score of influence distribution in GDSS groups (39.47) was less than the one in unsupported groups (56.98). Hence, in preference task, GDSS tended to generate more even influence distribution, which is in line with the prior research done by Lim, Raman and Wei (1994). In sum, the findings again supported the conclusion that GDSS tends to have different effects on influence processes for different task type.

The insignificant H4 at 5% level could be explained using power analysis (Cohen 1976). The sample size of 16 in this study was not big enough to detect the significant effect because the power of the test (Cohen 1976) was as low as 0.28 and the least significant number was 31. Hence, sample size should be increased to at least 31 in order to detect the significant effect of GDSS and task type on group influence behavior in preference task in future's research.

Cautious-ness should be taken when applying the research findings into GSS practices. First, external validity of all controlled experimental research is relatively low though its internal validity is high. Second, the effect of GSS here actually refers to the effect of the specific structures of GSS used in this study, such as the GSS structures of anonymity, simultaneity, meeting agenda, and electronic ranking discussed in section 2. As a result, our findings should be generated in terms of these GSS structures rather than GSS as a whole.

## Conclusion

This research focused on group processes, which has been largely neglected in GSS literature. The research findings indicate that task type is a critical factor in group influence process. Different tasks resulted in different findings when using the same GDSS system (SAMM). This suggests that task type may moderate the effect of GDSS on group influence processes. An important practical implication of this finding is that organizations should be careful when they use GDSS to support a variety of tasks. Organizational GDSS users should carefully examine the characteristics of tasks that they face, before they choose suitable GDSS structures to support their task-performing activities. One implication for academicians is that the fit between specific GDSS structures and task types would be a very important issue for successful GDSS adoption and use, which few research has been conducted. Hence, more research should be done in this aspect. A GDSS with certain specific structures may have more beneficial effects for certain task types than for others.

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[1] Informational influence is based on acceptance of information from others as evidence about reality whereas normative influence is based on the desire to conform to the expectations of other group members (Deutsch and Gerard 1955).

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