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Mindstorms: Using Software that Simulates Group Processes for Efficient Study of Certain GDSS Variables

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The efficiency and effectiveness of the group vs the individual has been a long-standing topic of interest among academicians, with the goal of discovering when a group is preferred to an individual. Group Decision Support systems have added a new dimension to the study of group processes and effectiveness. Much of the GDSS research has focused on the conditions that affect the performance of GDSSs, and very little of the research has been aimed explaining why GDSSs can improve group performance.

Consequently, we know a great deal about what conditions influence GDSS behavior -- anonymity (Connolly, et al 1990), status (Dubrovsky et. al. 1991), evaluative tone (Connolly et. al. 1990), group size (Hwang and Guynes 1994), proximity within group (Jessup and Tansik 1991), nature of decision making task (McGuire 1987), task type (Staus and McGarth 1994), physical proximity (Valacich 1994), influence behavior (Zigurs, Poole and DeSanctis 1988), multilingual subjects (Aiken et. al. 1994), and group leadership (Lim et. al. 1994) - but little that can theoretically explain when and why GDSSs can improve group performance.

The literature does postulate that several rather unique features of GDSS can help explain improvements in group performance through their use (Kraemer and King 1988). Anonymity and parallel processing are two of the features most cited to explain improvements in groups using GDSSs versus more tradition face-to-face means. The positive effects of anonymity are usually tied to the removal of barriers due to status or power (Jessup and Tansik 1991). It is hypothesized that individuals will be more likely to be more creative when they are anonymous. However, anonymity can have negative side effects. The most commonly investigated one is the notion of deindividuated behavior. By deindividuated behavior it is meant "a complex, hypothesized process in which a series of antecedent social conditions lead to changes in perception of self and others, and thereby to a lowered threshold of normally restrained behavior" (Zimbardo 1973). The GDSS research to date has shown mixed support for the creation of deindividuated behavior within a GDSS context. Several studies support the existence of deindividuated behavior (Kiesler 1988, Lea 1991) while other studies have failed to find support for such behavior (Hiltz 1989, Mathieson 1988, 1990).

Because more than one person can communicate at the same time with a GDSS this ability for parallel communications is thought to break the bottleneck of sequential communication present in face-to-face groups (Hwang and Guynes 1994). Consequently, the ability to present more than one idea at a time is felt to lead to increased production of ideas (Easton, Vogel and Nunamaker 1992). GDSS research supports the increased production of ideas using a GDSS versus a face-to-face group (Hwang and Guynes 1994, Valacich and Dennis 1994).

Because most research in GDSS has concentrated on only a few of the above mentioned variables at a time it is very difficult to inductively develop a general theory of GDSS. Until now the need to form groups (the unit of observation) using 3 or more subjects has greatly reduced the ability of researchers to test more than a few factors at one time. For example, assuming a group size of 5 subjects and a minimum of 10 groups per cell every factor tested increases the number of subjects required by at least 50. Consequently, before more factors can be tried together some way must be found to reduce the required number of subjects. One potential way to do this is to create a simulated GDSS where all but one of the participants is simulated using a predetermined script. In this way the number of subjects required could be reduced about 80 percent (from 5 subjects per group to 1 subject per "group"). In addition, this approach effectively controls for within-group variations by using a common script for the simulated group members. This study takes such an approach.

The "Mindstorms" Program

A simulated GDSS called "Mindstorms" was written by the first author, and used in an experiment with graduate business students. Mindstorms was a program written in GWBASIC that displayed each line from a common script and scrolled them up on the screen to display them all. When the subject thought of a comment to add to the "discussion," he or she pressed a function key and typed the comment. Items captured by the program included the full text of each comment, the place in the script at which each comment was interjected, the overall starting time, the overall ending time, and the results of a typing speed test.

To make the situation as realistic as possible, the experimenter pretended to synchronize the other non-existent "participants" at one time using a non-working cordless phone. The program also included several beeps and synchronization messages after displaying a title screen, to add to the realism (see Figure 1 for an excerpt of the start of the Problem Identification Phase).

To make the script as realistic as possible, informal language was used, and typos and spelling errors were liberally sprinkled throughout (see the comment from Student 5 in Figure 1). There was also a "warm-up" phase, where the script began with comments such as "We just type stuff here?" and "It's hard to get started." The third comment finally began to discuss real issues: "One problem is profesors (sic) who only care about research." Finally, the subject appeared to be addressed by the script comments 9 and 19 of the first half of the 86-item script; this was accomplished by interjecting the subject's name or code number (see below) into the script: "Student 1, I was just going to say that...actually makes me madder than you!"

To make the program system-independent, the program began by estimating the speed of the computer on which it was running. To compute the speed index, the program sampled the current time, performed a loop a given number of times, and sampled the time once again. The speed index was used to delay the display of each comment on faster machines.

Subjects and Task

Subjects were solicited by canvassing a required Business Policy course in the last semester of their full-time MBA program. Forty subjects (about 40% of those asked) volunteered to participate in the study.

The experimental task was designed to permit the examination of the effects of the group's task, group makeup, and anonymity. Each will be described in turn.

The group's task was broken into two main phases. The first phase concentrated on problem identification, drawing from a script of problems, and the second on solution generation, drawing from a script of possible solutions. As subjects read the scripted problems and solutions, they were inspired to add their own to the list.

Group makeup was also assigned randomly through the assigned subject number. Half of the subjects saw the full or disguised names of only students (see below), and the other half saw that two of the subjects were professors.

Anonymity was controlled by randomly assigning a subject number that was entered by the subject at a prompt furnished by Mindstorms at the beginning of the task. Half of the subject numbers triggered the program to disguise the names of the simulated members as "Subject 1," "Subject 2," "Professor 1," etc. The other half used fictitious student names, but the names of real professors, including the professor of the Business Policy class. Half of the subjects went from an anonymous condition in the first task to a non-anonymous condition in the second task, and the other half moved in the reverse direction (from non-anonymous to anonymous). See Figure 2 for a partial transcript of the non-anonymous peer condition The order was alternated to isolate any order effects. Before the experiment, the professors were shown the comments, and were asked for their permission to use their names with the caveat that the comments might subsequently be attributed to them in error. After data collection took place, all subjects were told that the study was indeed a simulation, and that all comments were fictitious.

Dependent Variables and Coding

Subjects' responses were identified only by subject number to enable double-blind coding of the subject-level and message-level dependent variables. The list of subject-level variables included items such as number of comments, number of unique comments, overall tone of the set of responses, overall typing speed, and total time taken. Message-level variables included items such as the message tone, novelty, feasibility, usefulness, and the locus of the identified issue.

Including all possible combinations of anonymity, group makeup, and group task will permit us to assess their main and interaction effects on each of the dependent variables. We are testing several hypotheses in our study. Stating the hypotheses in more compact form, we posit that students in the problem-solving phase will, in general, suppress the quantity and seriousness of their criticisms when their identity is known to their current faculty member whom they believe is a participant. On the other hand, anonymous subjects, or others who believe that no faculty members are participating, will be particularly harsh to "show off" to the other students. In the creative solution phase, non-anonymous students will attempt to "show off" to their faculty member or peers more often than will anonymous students, and will generate more and better solutions. Our design will also enable us to investigate other theory-based and exploratory hypotheses.

To test these hypotheses, we are nearly finished coding the dependent variables. We developed detailed guidelines for scoring each dependent variable, and the unadjusted scores assigned by the two judges so far appear to correlate very highly (r=.90 to .95). When the coders deviate from each other by more than two points on the Likert scale, or by any amount on objective scales, a third coder served as a tie-breaker. Final scores on subjective scales will be derived by averaging the adjusted scores of the two raters.

Results

By the time of the conference, a limited set of tentative results should be available. We will engage the use of 3-way ANOVA to examine the impact of each factor and interaction on each dependent variable.

We will also make available our "Mindstorms" program to any other researcher who wishes to use it in their research.

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                      PROBLEM IDENTIFICATION PHASE

This phase involves you and the others typing brief messages to
identify problems in your organization. Please keep in mind these tips:

1. Don't criticize ideas of others. You're all on the same team.
2. Avoid excessive words. Come right to the point.
3. Don't worry about minor typos, as long as your idea is there.
4. You are not being timed, but the system will stop by itself after a
while.
5. Don't worry about solutions in this phase. Just concentrate on
problems.
6. Don't worry if some comments scroll by too quickly. Just use what
you
do see to lead you to new ideas.

You will be known as STUDENT #3 in this ANONYMOUS session.
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```
Press ENTER when you are ready to begin PHASE 1 -->?
= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
= =
Now awaiting notification that the others are ready.
This might take a while...
STUDENT #2 is ready.
STUDENT #4 is ready.
STUDENT #1 is ready.
STUDENT #5 is ready.

Everyone is now ready.

The mind-storming session will now begin.

Synchronizing...
......

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- -
Comment from --> STUDENT #4

We just type stuff here?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- -
Comment from --> STUDENT #1

It's hard to get started
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- -
Comment from --> STUDENT #5
One problem is profesors who only care about research
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- -

PROBLEM IDENTIFICATION PHASE -- Press F1 to enter a problem you think
exists
```

Figure 1 - Excerpt From Start of Anonymous Peer Problem Identification Phase

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                              SOLUTION PHASE

This phase allows you and the others to type suggestions for solving
your organization's problems.  Please remember the tips:

1. Don't criticize ideas of others.
2. Be brief.
3. Don't worry about minor typos.
4. You are not being timed.
5. Focus on SOLUTIONS in this phase.
6. You might not be able to read every comment made by others.

Press ENTER when you are ready to begin PHASE  2 -->?
===============================================-------------============
Now awaiting notification that the others are ready.
This might take a while...
Richard Langley is ready.
John Stallings is ready.
Christy Niedzwecki is ready.
Lauren Winters is ready.
```

Figure 2 - Excerpt from Transcript of Non-Anonymous Peer Solution Phase Session