Social Loafing in Electronic Brainstorming: Invoking Social Comparison Through Technology and Facilitation Techniques To Improve Group Productivity

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Abstract

This paper reports a study of electronic brainstorming that begins with field experience, moves through theory building and experimentation, and ends with practical guidance for facilitators and developers. The paper argues that social loafing impairs the productivity of electronic brainstorming groups, and that social comparison is a way to decrease the effect(s) of social loafing. By inducing social comparison with a graphical feedback tool we increased the output of EBS groups by 23%. By increasing the salience of the social comparison treatment with facilitation techniques we improved the output of EBS groups by an additional 33%.

1.0 Introduction

User experience and laboratory experiments with group support systems (GSS) can be closely linked to improve both. User experience informs experimentation by discovering phenomena and drawing inferences from them. Experimentation informs experience by demonstrating phenomena under controlled conditions to untangle confounds and separate superstition and myth from useful theory. This paper reports the results of a study of electronic brainstorming that begins with field experience, moves through theory building and experimentation, and ends with practical guidance for facilitators and developers in the field.

Some GSS facilitators in the field will tell electronic brainstorming groups about the performance of other groups. The facilitators believe a group will perform better when they compare themselves to other groups. These perceptions are not grounded in theory or data, rather, they are based on experience and intuition.

There are solid theoretical reasons to support the belief that electronic brainstorming can be improved. Nearly four decades ago, Osborn (1957) introduced brainstorming as a structured technique to improve group problem solving. He reasoned that his rules -- no criticism, quantity over quality, build on the ideas of others -- would increase the productivity of idea generation by reducing evaluation apprehension and by increasing synergy (Figure 1).

Figure 1.
Model of Group Idea Generation Productivity Implied by Osborn (1957)

More than 80 studies were subsequently published comparing Osborn’s brainstorming groups to nominal groups (the same number of individuals working alone, then combining their results) (See Diehl & Strobe, 1987; Valacich, et al, 1992; Jessup & Valacich, 1993 for reviews). None of these studies found the results Osborn expected. Despite Osborn’s rules, nominal groups tended to out-perform brainstorming groups.

On the other hand, electronic brainstorming groups tend to outperform both manual brainstorming groups and nominal groups (Dennis, Valacich, & Nunamaker, 1990; Connolly, Jessup, & Valacich, 1990, Gallupe, et al., 1992). This paper briefly examines the research leading up to and following the development of electronic brainstorming. It argues that social loafing may occur during electronic brainstorming, and presents the results of two experiments. The first examines the use of technology to induce social comparison as a means of reducing social loafing. The second experiment examines facilitation techniques to increase the salience of social comparison in an effort to further reduce social loafing. The paper concludes with a discussion of the implications of the findings for facilitators and developers, and with suggestions for future research into social loafing and social comparison in electronic brainstorming productivity.
2.0 Theory

Diehl & Stroebe (1987) demonstrated that production blocking was a significant inhibitor to idea generation for traditional brainstorming groups (Figure 2). Production blocking occurs when something prevents verbalization of ideas as they occur. One may forget an idea while waiting for a turn to speak, or may devote attention to remembering an idea, becoming too distracted to generate new ideas (Diehl & Stroebe, 1987; Nunamaker, et al., 1991).

Diehl & Stroebe (1987) found small but statistically significant losses in brainstorming productivity from evaluation apprehension and free riding (slacking off and letting others generate ideas), and Collaros & Anderson (1969) found that productivity varied inversely with evaluation apprehension (Figure 2). The losses from production blocking, free-riding, and evaluation apprehension appeared to outweigh any possible benefits from synergy in face-to-face brainstorming groups. While Osborn's rule proscribing open criticism of ideas may have reduced evaluation apprehension, it could not completely eliminate it. People still felt reluctant to disagree with those in authority or to risk the ridicule of their peers.

Figure 2.
Idea Generation Productivity
Implied by Diehl & Stroebe (1987)

The advent of Group Support Systems (GSS) offered ways to overcome production blocking and evaluation apprehension. With GSS all participants contribute simultaneously by typing their ideas into computers. The system immediately makes all contributions available to other participants on their terminals. Since nobody has to wait for a turn to speak, production blocking is eliminated.

The anonymity of electronic brainstorming eliminates evaluation apprehension. Anonymous members feel free to offer novel-but-poorly-developed ideas, unpopular ideas, or politically risky ideas that might otherwise elicit negative responses or reprisals from peers or superiors (Nunamaker et al., 1991; Connolly, Routhieux, & Schneider, 1993; Connolly, Jessup, & Valacich, 1990; Valacich, Jessup, Dennis, & Nunamaker, 1992).

Studies show that groups using GSS for electronic brainstorming tend to generate more unique ideas, and higher quality ideas than groups doing manual brainstorming, and than either electronically-supported or manual nominal groups (Dennis & Valacich, 1991; Dennis, Valacich, & Nunamaker, 1990; Gallupe, Bastianutti, & Cooper, 1991; Valacich, Dennis, & Connolly, 1994). Apparently eliminating production blocking and evaluation apprehension permitted the benefits of synergy that Osborn posited (Figure 3).

Figure 3.
GSS Effects on Group Idea Generation

In 1990 Connolly, Jessup, & Valacich demonstrated that the anonymity effect is independent of the parallel contribution effect. They also demonstrated that anonymous contribution eliminated the need for Osborn's restriction on making critical comments about the ideas of others. Unlike identified brainstorming groups, anonymous electronic brainstorming groups were even more productive when permitted to make both critical and supportive statements than when only permitted to make supportive statements.

Although anonymous brainstorming is demonstrably superior to identified brainstorming, anonymity may be a mixed blessing. A large body of social loafing research shows that individuals tend to expend less effort in group tasks than they do in individual tasks, unless their contribution can be specifically identified, or unless they believe that their contribution is critical to the success of the task (Diehl & Stroebe, 1987; Harkins & Jackson, 1985; Harkins & Petty, 1982; Kerr & Bruan, 1981; Latané, Williams, & Harkins, 1979; Paulus & Dzindolet, 1993; Paulus, Dzindolet, Peoles & Camacho, 1993; Sanna, 1992; Tripplett, 1898). The social loafing phenomenon has been demonstrated in a variety of physical (Latané, Williams, & Harkins, 1979) and cognitive (Paulus & Dzindolet, 1993) tasks, ranging from tug of war to shouting to idea generation. Given that anonymity tends to promote social loafing in many tasks,

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one might expect individuals to exert less cognitive effort during anonymous electronic brainstorming than during identified electronic brainstorming. It may be that the demonstrated benefits of anonymous electronic brainstorming are actually the net of two opposing effects of anonymity. The benefits of reduced evaluation apprehension may outweigh the losses from social loafing, but social loafing may, nonetheless, occur (Figure 4). If social loafing occurs during electronic brainstorming, and if a way could be found to reduce it without sacrificing anonymity, it might be possible for electronic brainstorming groups to become even more productive.

There is little empirical research to show whether social loafing occurs during electronic brainstorming, and if it does occur, whether anything can be done to overcome it. However, social comparison has been shown to offset social loafing in studies of manual brainstorming sessions (Paulus & Dzindolet, 1993, Paulus, Dzindolet, Poletes, & Camacho, 1993). Social comparison is a phenomenon wherein people match their rate of performance to the rate of the people working around them. Subjects working in an environment where others are performing at a high level also tend to perform highly. Subjects working in an environment where others are performing at a low level match the inferior performance rate (Goethals & Darley, 1987). Paulus, Dzindolet, Poletes, & Camacho (1993) demonstrated that they could improve the productivity of manual brainstorming sessions by inducing the group members to compare their own performance to an absent and mythical "average group."

We reasoned that if subjects engaged in anonymous electronic brainstorming received real-time feedback about their performance compared with an imaginary "average group," the social comparison effect might reduce social loafing. This line of reasoning led us to our first hypothesis:

**H1:** Anonymous subjects with a basis for social comparison to an absent "average" group will produce more unique ideas during electronic brainstorming than subjects with no basis for social comparison.

### 3.0 Experiment 1. Social Comparison Vs. No Social Comparison

To establish a basis for social comparison, we developed an electronic graph to be projected on a wall during electronic brainstorming (Figure 5). The graph had three main features: real-time feedback, a reference baseline, and background-color changes. The real-time feedback feature displays the cumulative number of lines of text the group had produced over time.

The reference baseline is a horizontal line in the middle of the graph. Subjects were told that the reference baseline represented the performance level of an "average" group working on the same task. The tool allowed the experimenters to set the baseline to any value. The rest of the graph would automatically scale to the value of the baseline so that all subjects were presented with nearly the same visual stimulus. Only the numbers varied. The graph displayed as a red area below the baseline, and as a green area above the baseline.

The background color of the graph provided the subjects with additional feedback about their performance. If they produced fewer than four lines of text in the previous minute, the background turned black. When they produced between four and eight lines of text in the previous minute, the background turned gray. If the group submitted more than eight lines of text, the background turned blue. The graph updated every 15 seconds.

Several other features were designed to encourage subjects to notice the graph while they were brainstorming. First, rather than simply adding another data point to the
graph every 15 seconds, the entire screen cleared and the
graph was redrawn, a process that took about one second.
Thus, every 15 seconds there was visible motion on the
front screen. Second, if the update included a color
change, the graph was redrawn twice to draw more
attention. Third, when the graph reached the baseline, the
tool produced a 5-second display to attract attention to the
event. In pilot studies the subjects glanced at the graph an
average of 15 times during a forty minute brainstorming
session.

3.1 Subjects

One hundred eighty male and female students in
four sections of an 'Introduction to Computer Technology'
course participated in the study for course credit. Subjects
were randomly assigned to groups of five, and each group
was randomly assigned to a treatment.

3.2 Task

In a moderate-ambiguity variation on the School
of Business task (Wheeler & Mennecke, 1997), subjects in
our study used electronic brainstorming to propose
solutions for wicked problems in an imaginary school of
business. Each subject was assigned to one of five roles:
Associate Dean, President of the Student Council,
President of the Alumni Association, Chairperson of the
Faculty Council, and Vice President of Undergraduate
Instruction. Each participant was given a packet of
information about their assigned role. Each role had
different information and each role had a vested interest in
a different outcome.

The group faced a total of 19 interrelated
problems, such as declining budgets, overcrowded
classrooms, declining reputation, and faculty resignations.
Solutions to any given problem tended to exacerbate other
problems, and solutions favorable to one role tended to be
unfavorable to another.

The School of Business task has several
advantages in brainstorming research. First, this task is not
controversial, nor does it require special knowledge not
generally available to the subjects, two factors identified as
potential inhibitors to brainstorming activity (Diehl &
Stroebe, 1987). Second, it is complex enough to simulate
real-world problem solving. Wood (1986) defines task
complexity in terms of three components: 1) products
(deliverables), 2) acts (behavior required to create
products), and 3) information cues (knowledge that allows
actors to make judgments), and three types of complexity:

1) component complexity (number of acts and information
cues needed to create products), 2) coordination
complexity (the frequency, timing and intensity of
sequencing interactions required to produce products), and
3) dynamic complexity (the degree to which required acts
and information cues change during the task). More
complex tasks require more information, more
coordination between activities, and involve more changes
in requirements, and so place higher demands on attention
resources than do simple tasks.

Task complexity should not be confused with
cognitive difficulty. For example, Harkins and Petty
(1982) found that the social loafing effect only occurred
during a cognitively easier idea generation task, and
disappeared when subjects were engaged in a cognitively
more difficult task. In their study, the difficult task
required students to generate uses for a detached doorknob,
and the easy task required students to generate uses for a
knife. Although one of these tasks is more difficult than
the other, both are low in complexity. Results of studies
with the School of Business task may be more
generalizable to the workplace because of the higher
degree of complexity.

3.3 Independent Variables

Social Comparison: The experiment compared
the performance of subjects with no basis for social
comparison to that of subjects viewing a graph-and-
baseline to induce social comparison. The experiment had
two control groups: a) no performance-feedback-graph;
and b) performance-feedback-graph with no baseline and
no background color changes, thus no basis for social
comparison. The second control group was necessary to
assure that results were not simply attributable to the
presence of a graph.

Because the goal-setting literature suggests that
people with higher goals tend to outperform people with
lower goals (Earley, Northcraft, Lee, & Lituchy, 1990;
Locke & Latham, 1990) we used three different levels of
baseline to establish a basis of social comparison: Low,
Average, and High. In pilot studies we found that control
groups produced an average of 206 lines of text during a
40 minute brainstorming session. The most productive
group produced 304 lines, and the least productive group
produced 145 lines. Therefore one third of the treatment
received an "average baseline" treatment; they were told
that an "average group" would produce "about 210."
Another third of the treatment groups received a "low
baseline" treatment. They were told that an average group
would produce "about 140." The final third of the
treatment groups were given a "high baseline treatment.
They were told that an average group produced "about

1 We would be pleased to provide our task materials
to any interested person upon request.
Experimenters were deliberately vague about the meaning of the numbers. Although the graph displayed lines-of-text-generated, we did not want subjects to deliberately produce wordy ideas to inflate the graph. Only one subject questioned the meaning of the numbers, and that subject received an equivocal answer.

### 3.4 Procedure

Subjects signed an attendance sheet when they arrived, and then seated themselves at one of five computers. The computers were situated side-by-side facing the projection screen at the front of the room. One of three treatment-blind facilitators greeted the subjects and read them instructions from a script (Each facilitator ran an equal number of sessions in each cell to balance out facilitator-specific effects). Subjects then received a packet of information, and were given 10 minutes to read about their roles.

It was important for all the groups in the study to start with a similar understanding of the 19 problems and the five conflicting viewpoints they faced before they started to generate solutions (The task was not to be an exercise in problem identification, but an exercise in solution generation). Therefore the facilitator, still treatment-blind, conducted a structured interview with each subject in the presence of the others. Each subject was asked to explain to the other group members all the problems s/he had identified in the School of Business. During the interview an accomplice, seated at a word processor, pretended to record the problems the subjects identified. At the end of the interviews the accomplice printed and distributed a standard list of problems, to ensure that all groups started generating solutions to an identical problem set.

At this point the facilitator learned what treatment would be administered, and instructed subjects about how to use the electronic brainstorming tool and the feedback graph. If the graph was to be used. If the subjects were assigned to the Social Comparison treatment, the facilitator was to read the following instructions from the script:

> ... Do you see the line at the middle of the graph? Most groups generate about that many solutions during a problem solving session like this one. In effect, we’ve put you in competition with the rest of the world. So, try to push the graph above this line by generating as many different solutions as you can.

> ... the background color of the graph will give you an additional bit of information. If the background is black it means that no solutions are coming in. When few solutions are coming in, the background turns gray. When you are producing more solutions than the average group, the background turns blue. Try to keep the background blue, by generating as many unique solutions as quickly as you can.

Subjects were given 40 minutes to brainstorm solutions. During the 40 minutes the facilitator called the subjects attention to the graph at seven preplanned, randomly spaced intervals by stating the time and the cumulative number of lines generated, as in, “It’s been 11 minutes and you’ve got 57”. At the end of the brainstorming session the subjects responded to a questionnaire. After the questionnaire the subjects were given a printout of everything they had typed during the brainstorming session, and were sent to a conference room to write a recommendation to the imaginary Provost. Then they were debriefed, thanked and released. Each experimental session lasted approximately 90 minutes.

The design of this experiment precludes a Hawthorne effect because all subjects used electronic brainstorming, a new technology with which they were unfamiliar.

### 3.5 Dependent Variable

The dependent variable was the number of unique, or non-redundant, solutions the group generated for problems in the School of Business. Three different treatment blind coders analyzed the output from the brainstorming sessions for the number of unique ideas (inter-rater reliability = 0.84).

| Table 1. ANOVA Results of Differences in Number of Unique Ideas Generated |
|--------------------------|---|---|---|
|                         | df | F   | p  |
| Facilitator             | 2  | 3.71| ns |
| Cell Differences by Baseline Level | 3  | 1.70| ns |
| Linear Component by Baseline Level | 1  | 2.97| ns |

### 3.6 Results of Experiment 1.

There was no statistically significant overall effect on the number of unique ideas by facilitator. There was no difference in the number of unique ideas generated between the two control treatments so the results from both control groups were combined. (Table 2).
As we hypothesized, the subjects who had a basis for social comparison produced significantly more unique ideas than did the subjects who had no basis for social comparison (Table 2, 3).

Table 2.
T-tests of Differences in Number of Unique Ideas Generated

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Treatment 1 vs. Control Treatment 2</td>
<td>12</td>
<td>1.45</td>
<td>ns</td>
</tr>
<tr>
<td>Social comparison vs. No Social Comparison</td>
<td>33</td>
<td>2.22</td>
<td>0.03</td>
</tr>
<tr>
<td>Facilitator two vs. Other Facilitators, only in the Social Comparison Treatments</td>
<td>32</td>
<td>2.26</td>
<td>0.03</td>
</tr>
</tbody>
</table>

There was no statistically significant difference in number-of-unique-ideas by baseline level (Low, Medium, or High). Nor was there a statistically significant linear trend by level of baseline (Table 1). There were no statistically significant differences by gender, age, years of work experience, typing ability, or time-of-day.

3.7 Discussion of Experiment 1

The results supported our hypothesis: subjects given the graph-and-baseline as a basis for social comparison were more productive than subjects who had no basis for social comparison. This suggests that social loafing may actually occur in anonymous electronic brainstorming sessions, and that invoking social comparison with a mythical "average group" reduces the social loafing phenomena.

The goal-setting literature suggests that people will be more productive if they are given a high goal than if they are given a low goal. However, we found no effect by goal level. The baseline was necessary to establish a basis for social comparison, but the baseline setting did not seem to matter. All social-comparison subjects were approximately equally productive. It may be that the social comparison effect overwhelmed any goal setting effect. It may also be that goal-setting effects do not occur as readily in a very complex task as they do in tasks of lower complexity. Further research into this question is warranted.

Because there was no difference in the performance of the two control groups, one can rule out the possibility that the results were due to the presence of a graph rather than a social comparison effect. Subjects viewing a graph with no baseline did not perform differently than subjects with no graph.

4.0 Experiment 2. Facilitation and the Salience of Social Comparison.

Although there were no overall differences by facilitator in the first study, a detailed examination of the data revealed that subjects working with a particular facilitator in the social-comparison treatments consistently produced about 50% more ideas than the subjects working with the other two facilitators (Table 3). This rather startling effect did not occur in either control group, only in the social comparison groups. This suggested that something in the facilitation style of the one facilitator might be dramatically increasing the effect of the social comparison manipulation.

There is little written about facilitation style and its impact on productivity (Clawson, Bostrom, & Anson, 1993). There is little empirical literature to explain the effect we had uncovered, although there are several prescriptive and descriptive papers about the role of the facilitator (Beise, Niederman, & Beranek, 1992; Clawson, Bostrom, & Anson, 1993; Nunamaker, et al., 1991; McGoff, et al., 1990; Kraemer & King, 1988; Dickson, Partridge, & Robinson, 1993). Bostrom, Anson, & Clawson (1993) argue that a facilitator can improve group performance by encouraging effective task and relational behaviors. Deise, Niederman, & Dearnaley (1992) have identified several facilitation variables that they believe...
could have an impact on groups, but empirical support for those variables does not yet exist. Dickson, Partridge, & Robinson posit that one key role of the facilitator is to "reduce the mystique associated with the GDSS technology." However, in our study all facilitator interactions with subjects were scripted, and virtually identical for all subjects.

We could not simply attribute the observed differences to the "star quality" of the one facilitator because the effect only occurred in the social comparison treatments; the performance of that facilitator's subjects in the control treatments was unremarkable. Nor could we attribute the effect to mere random fluctuations in the data because subjects under this facilitator had produced the top 10 scores among the 35 groups in the study, and the difference was substantial.

An experimenter who had attended all of the sessions reported that the high-performing facilitator had routinely adopted a mildly jocular tone during participant instructions, while the other facilitators maintained a neutral tone. The high-performing facilitator also deviated from the script in a seemingly minor way when instructing the subjects about the feedback graph. Instead of reading the routine instructions given above, he said the following:

...the background color of the graph will give you an additional bit of information. When the background is black like this, it means you're brain-dead! If the background turns gray, it means you are doing a little bit, but you are still below average. If the background turns blue, it means you are really smoking! Try to keep the background blue, by generating as many unique solutions as quickly as you can...

Further, rather than delivering the straight time-and-line-count verbal cues, this facilitator made mildly jocular comments about the background color of the graph, as in, "It's been 11 minutes and the background is black. I guess your fingers fell asleep," or "It's been 16 minutes and the background is blue. You are doing great!"

We reasoned that these differences in facilitation style might be increasing the salience of the social comparison for the subjects and further reducing the effects of social loafing. This line of reasoning led to the hypothesis for Experiment 2:

H2. As the salience of social comparison increases, the number of unique ideas produced during anonymous electronic brainstorming will also increase.

We extended the original study to examine this hypothesis.

4.1 Subjects

Two hundred eighty five male and female students from several sections of an Introduction to Computer Technology course participated for course credit. Subjects were randomly assigned to groups of five, and each group was randomly assigned to a treatment.

4.2 Task

Subjects used the same moderate-ambiguity version of the School of Business task used during the first study.

4.3 Independent Variables

Social comparison: There were three levels of social comparison: no-comparison, low-salience comparison, and high salience comparison. As before, there were two no-comparison control groups, one with no graph, the other with a graph that had no baseline and no background-color-changes for social comparison. All facilitators adopted a neutral tone, and adhered strictly to the original script when instructing the low-salience social comparison treatment subjects on how to use the graph. For the high-salience social comparison all facilitators adopted a jocular tone, used the colorful metaphors described above to explain the meaning of the color changes in the background of the graph, and used colorful, jocular verbal cues to call the subjects attention to the graph at predetermined, randomly spaced intervals during the EBS session.

As in the first study, to control for goal setting effects, subjects in the two social-comparison treatments were exposed to one of three baseline levels: 140, 210, or 310.

4.4 Dependent Variable

We measured the number of unique solutions generated by each group for the problems of the imaginary school of business.

4.5 Procedures

Other than the changes required to manipulate the salience for social comparison, the procedures were identical to those in Experiment 1.

4.6 Results of Experiment 2

There was no difference between the control
treatments (Table 4), and no difference in unique-ideas-generated by facilitator (Table 5). There were not any statistically significant differences by gender, age, years of work experience, typing ability, or time-of-day.

Table 4.
T-tests of Differences in Number of Unique Ideas Generated

<table>
<thead>
<tr>
<th></th>
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<th>t</th>
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<tr>
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<td>12</td>
<td>1.45</td>
<td>ns</td>
</tr>
<tr>
<td>Control Treatment 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Comparison vs. No</td>
<td>1</td>
<td>2.28</td>
<td>.027</td>
</tr>
<tr>
<td>Social Comparison</td>
<td></td>
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As in the first experiment, a t-test revealed those groups with a basis for social comparison outperformed groups with no basis for social comparison (Table 4). ANOVA tests revealed statistically significant differences by level of salience of comparison (Table 5).

Table 5.
ANOVA Results of Differences in Number of Unique Ideas Generated

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salience of Social Comparison</td>
<td>2</td>
<td>5.57</td>
<td>0.0006</td>
</tr>
<tr>
<td>Linear trend for Salience of</td>
<td>1</td>
<td>10.16</td>
<td>0.002</td>
</tr>
<tr>
<td>Comparison</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitator</td>
<td>2</td>
<td>1.25</td>
<td>ns</td>
</tr>
<tr>
<td>Baseline Level</td>
<td>2</td>
<td>2.24</td>
<td>ns</td>
</tr>
<tr>
<td>1 df linear trend for Baseline</td>
<td>1</td>
<td>0.97</td>
<td>ns</td>
</tr>
</tbody>
</table>

A Scheffé test revealed that subjects in the high-salience treatment produced significantly more unique ideas than subjects in the low salience and no-comparison treatments. A 1 df contrast revealed a statistically significant linear trend in the number-of-unique-ideas by the level of social comparison. Thus, the results support Hypothesis 2, that as the salience of social comparison rises, the productivity of electronic groups rises (Table 6).

4.7 Discussion of Experiments 1 and 2

As hypothesized, electronic brainstorming productivity increased as the salience of social comparison increased. We observed that the subjects in the low-baseline treatment appeared to enjoy "blasting past" the goal at about mid-meeting (We inferred their enjoyment from vocalic, kinesic, haptic, and verbal cues). However, having passed the goal, they did not slow their effort. This suggests that two different social comparison effects may have been at work. First, subjects may have begun their work quickly in response to being compared with an "average group." Having begun their work quickly, individuals may then have compared their own efforts to the efforts of those around them, and so continued high production even after reaching the baseline. This is consistent with the effort-matching hypothesis of social comparison theory discussed earlier in this paper. It may be that any opening ploy that encourages them to work quickly at the beginning of a session will lead to high productivity throughout the session.

Clearly there is an effect for facilitation style in addition to the effect for the technology. The groups with low-salience instructions produced 23% more unique ideas than the control subjects. The groups who received high-salience instructions produced 33% more than the low-salience groups, or 63% more ideas than the control groups produced. Thus, it appears that real-time feedback for social comparison and facilitation techniques to enhance the salience of comparison are both useful for improving the use of electronic brainstorming technology.

Neither experiment found an effect for level-of-goal. Contrary to the literature, those with a higher goal
did not outperform those with a lower goal. It was important to have some goal in order to establish a basis for social comparison, but the level of the goal did not seem to matter. It may be that the goal-setting effect only occurs with certain tasks, or that the social comparison effect overwhelmed the goal-setting effect.

The results of this study suggest facilitators must be aware that social loafing occurs during anonymous group work, and take steps to deal with it. Social comparison appears to be a useful and inoffensive method for reducing the effects of social loafing. Facilitators can develop a repertoire of techniques for invoking social comparison, thereby increasing group productivity. There may well be other methods for reducing social loafing. These should be explored. We discovered that seemingly minor improvements in facilitation techniques caused major increases in group productivity during electronic brainstorming. It may also be that seemingly minor deficiencies could cause equally large decreases in productivity. This highlights the need for more extensive investigation into the effects of facilitation techniques on GSS use. It also emphasizes the value of using multiple facilitators for GSS research to assure that the findings are not the result of idiosyncratic facilitation techniques.

Developers of Group Support Systems must also attend to social loafing issues when designing new technologies. As demonstrated in this study, minor variations in the technology interventions can make large differences in group productivity.

The generalizability of these studies is limited in several ways. First, subjects were all students. More work with subjects from other populations will help establish how widely this effect occurs. Second, these experiments were all conducted with a single task. Further work with tasks of differing complexity and difficulty will be illuminating. Finally, these experiments took place in a laboratory setting with a realistic, but nonetheless imaginary task. Subsequent research in the field will help determine whether social loafing and social comparison occur in the same way when people have more of a vested interest in the outcome.

5.0 Conclusions and Future Directions

The results of these studies provide support for the argument that the productivity of anonymous electronic brainstorming can be diminished by social loafing, and that social comparison is a useful means of reducing social loafing. The results also offer empirical support to the notion that facilitation techniques are an important variable in the successful use of GSS technology.

Our results were different from those of Harkins & Petty (1982) who found that social loafing only occurred with cognitively easy tasks, not with cognitively difficult tasks. The task we used required subjects to grapple with five competing constituencies and 19 interrelated problems, and yet we found a large social loafing effect. It may be that the effects they observed only hold for tasks of low complexity. It may also be that besides being more complex, our task was more difficult than Harkins & Petty's difficult task, and that social loafing occurs with very easy and very difficult tasks, but not with tasks of moderate difficulty. Subjects may find moderately difficult tasks interesting enough to be engaging, but not so taxing as to cause them to give up.

There are many other ways to invoke social comparison for subjects besides the tools and techniques we used. For example one could create a tug-of-war graph pitting one group of subjects against another in real time. Or one might eliminate the graph entirely and simply change the background color of the electronic brainstorming tool. Further study is needed to understand the efficacy of differing approaches.

Problem-solving is more than just idea generation, and GSS is more than just electronic brainstorming. Much empirical work is needed to explore and explain social loafing, social comparison, and facilitation effects in all aspects of the electronic meeting process.

References


Dennis, A.R., Valacich, J.S., & Nunamaker, J.F., An experimental investigation of small, medium and large


