December 2005

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Abstract

Prior computer-mediated group idea generation research has concluded that social loafing is likely an important factor in reducing individual and group task performance. Group researchers—both focusing on non-technology and technology-mediated groups—have theorized that loafing could be minimized if individuals and groups were given either clear feedback on their task performance or if given clear and attainable performance goals. To examine the efficacy of these interventions on task performance, a computer-mediated idea generation environment was constructed that provided performance feedback for all group members where each member could view how many ideas every group member produced throughout an experimental session. In addition, this environment supported the ability to set a challenging, but attainable, performance goal for each group member (i.e., throughout a session, each member was able to track their performance toward a pre-set performance goal). Using this computer-mediated environment, a laboratory experiment was conducted with five-member groups that examined the influence of both goal setting (i.e., explicit–difficult versus do your best) and performance feedback (i.e., performance feedback versus no-performance feedback) in a 2 × 2 factorial design on group task performance. Providing performance feedback was found to significantly improve task performance. Additionally, performance feedback and goal setting interacted, such that groups in the performance feedback/explicit–difficult goal treatment had the highest performance. The implications of these results for future research, as well as the implications for the design of the human-computer interface in electronic group idea generation systems, are discussed.

Keywords: Computer-mediated idea generation, human-computer interaction, goal setting, performance feedback

Introduction

The idea generation performance of individuals and groups has a long history of investigation. Early work focused primarily on identifying methods of enhancing group creativity and performance using structured techniques such as brainstorming (Osborn 1957), Delphi (Dalkey 1969), and the nominal group technique (Van de Ven and Delbecq 1971, 1974). Empirical evaluations of these (and other) group-based methods have consistently found that non-interacting individuals (i.e., a nominal group) whose

ideas are pooled outperform interacting groups (McGrath 1984; Mullen et al. 1991). Diehl and Stroebe (1987) investigated various process losses (for a detailed list of procedural, social psychological, and economic factors, see Pinsonneault et al. 1999)—specifically, production blocking, evaluation apprehension, and free riding—and concluded that production blocking was the main cause of the poor performance in face-to-face groups.

Whereas other researchers have explored the potential of different factors such as the use of trained facilitators (Kramer et al. 2001), additional brainstorming rules (Putman 2001), or leadership style (Sosik et al. 1997), over the past several years, Information Systems researchers have investigated how computer-mediation could be used to overcome production blocking and other process losses in idea generation groups (e.g., Connolly et al. 1990; Dennis et al. 1997; Dennis, Valacich, Connolly, and Wynne 1996). The results of these studies have shown computer-based idea generation groups to outperform non-supported groups for a broad range of group sizes and a variety of tasks (Gallupe, Dennis et al. 1992). Also, larger computer-based groups (beyond seven to nine members) have been found to outperform nominal groups (Dennis and Valacich 1993, 1999; Valacich et al. 1994), with few or no differences found between nominal and computer-based groups for smaller group sizes (Gallupe, Bastianutti, and Cooper 1991; Gallupe, Cooper et al. 1994; Pinsonneault et al. 1999). This line of work has theorized that the superior performance of computer-based groups is the result of three factors (Dennis and Valacich 1993; Valacich et al. 1994). First, the computer-mediated communication allows all group members to simultaneously enter ideas, thus reducing production blocking. Second, the group members' ability to review the ideas of others results in a lower level of redundant submissions relative to non-interacting nominal groups. Third, as group members can easily review others' ideas, there exists an opportunity for cognitive stimulation (a.k.a. synergy or piggybacking) and enhanced performance. Valacich and his colleagues (1994, p. 463) concluded a series of studies with the observation, "The [computer-based] group appears to be a superior idea-generating technology for large groups, and no worse than the nominal procedure for small groups."

One factor potentially limiting the effectiveness of computer-mediated group idea generation is social (or cognitive[1]) loafing, which refers to the reduction of individual effort in a collective setting (Kerr 1983; Latane et al. 1979; Szymanski and Harkins 1987; Williams and Karau 1991). In group idea generation, however, social loafing has been considered only a minor element contributing to productivity losses, as the task is viewed as "practically effortless"[2] (Diehl and Stroebe 1987, p. 502). The potentially negative impact of social loafing on performance has been largely ignored, in spite of several studies' findings which have documented the occurrence of social loafing in a broad range of tasks (Albanese and Van Fleet 1985; Parks and Sanna 1999) including idea generation (e.g., Harkins and Petty 1982; Jessup 1989; Shepherd et al. 1995-1996). Karau and Williams' (2001 p. 123) meta-analysis showed a "statistically reliable and moderately strong (a mean weighted effect size of d = .44) effect of social loafing" across 163 studies examined.

As even the use of procedural rules (Osborn 1957) to mitigate process losses cannot offset the tendency to engage in negative productivity matching, it has been hypothesized that stronger interventions are needed (Hackman and Morris 1975); researchers have called for external interventions (Jessup and George 1997; Paulus and Brown 2003) in the form of performance feedback and/or goal setting (Parks and Sanna 1999). Although it has been suggested that either strategy alone has a less powerful effect on performance due to certain limitations (see Kanfer 1990), studies have thus far only investigated the effect of either performance feedback (e.g., Paulus et al. 1996) or goal setting (e.g., Larey and Paulus 1995) on performance, but not both. Whereas performance feedback alone only establishes vague and general performance targets, goal setting establishes specific targets, which help individuals to evaluate their performance more accurately (McGregor 1957; Nelson and Quick 1996). Yet, without clear feedback, goal setting is less effective, as there is no objective mechanism to guide the individuals' progress of their attempts to reach the goal (Luthans 2002).

In order to address this shortcoming of prior studies, we combine both goal setting and performance feedback using a visual performance feedback mechanism, and empirically examine "a complete 2 × 2 design with Feedback/No Feedback and Explicit–Difficult Goals/Do Best Goals as the independent variables" (Cusella 1987, p. 644) using a computer-mediated idea generation environment. In the next section, we delineate our theoretical rationale and present our research hypotheses. This is followed by a brief description of the experimental methods and results. The paper concludes with a discussion of the findings and the implications for future research.

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[1]*Cognitive loafing*, a form of social loafing, refers to the reduction of efforts in a cognitive task (Weldon and Gargano 1988). In this paper, we use the more general term *social loafing* to refer to both tendencies.

[2]The goal of idea generation is typically to generate as many quality ideas as possible. In this regard, group idea generation does require a great deal of cognitive effort to assimilate others' ideas and to associate close (i.e., familiar) and, in particular, distant (i.e., unfamiliar) meanings to produce quality ideas (Cohen and Levinthal 1990; Hender et al. 2002; Jessup and George 1997).

Theoretical Framework

The rationale behind the combination of performance feedback and goal setting within a computer-mediated idea generation environment is to increase task performance by creating a mechanism to induce upward social comparison (i.e., the matching of one's own performance to that of better performing group members). Inducing upward social comparison especially helps to increase lower performing group members' performance, as they will attempt to close the gap to higher performing group members. Providing a visual performance feedback mechanism should, therefore, help to improve a group's idea generation performance in two ways. First, setting a clearly articulated goal, which induces the Pygmalion effect[3] (Merton 1957), tunes an individual's behavior in the direction of an expectation. Second, performance feedback visually reveals an individual's performance and encourages social comparison in the interaction process before and after reaching the goal. As a result, self-improvement (the extent to which people compare themselves to others that are perceived to be performing better) induces upward social comparison to match the performance of the best group members before and after reaching the goal. The essence of the goal setting/performance feedback mechanism is to combat motivation losses for higher and lower performers simultaneously. For high performers, it corrects any (mis)perceptions of performance (baseline fallacy), satisfies their innate feedback-seeking behavior (Ashford and Cummings 1983), and strengthens their intrinsic and extrinsic motivation through social recognition. For lower performers, it reduces the tendency to hide in the crowd (Ashford and Cummings 1983). For all members, the goal setting/performance feedback mechanism should also remove the dispensability of their efforts, making all members less likely to loaf (see Diehl and Stroebe 1987; Weldon and Mustari 1988). Below, we review the relevant literature to motivate our hypotheses.

The Role of Performance Feedback in Group Idea Generation

The absence of individual performance information within group idea generation creates two major motivational problems (Weldon and Mustari 1988). First, social control of behavior by rewarding an appropriate performance behavior (using monetary or nonmonetary rewards such as social recognition or attention) is lost when ideas and contributions are not distinguishable. Second, the equality principle is used in distributing rewards after pooling contributions. Since performance information can provide not only appraisal information (i.e., information about how performances are being identified and evaluated), but also referent information (information that guides which behaviors are most appropriate for achieving the desired goal; Ashford and Cummings 1983), it can serve as a cue to regulate appropriate behavior and as a (social) reward to motivate performance (Ashford 1986; Payne and Hauty 1955). Thus, the absence of performance information undermines the critical effort-to-performance and performance-to-reward linkages, which are important components of an individual's motivation (see Porter and Lawler 1968; Vroom 1964). Although prior research has consistently suggested intrinsic rather than extrinsic motivation to be a key element in creativity (e.g., Amabile 1983; 1988; Cacioppo and Petty 1982), extrinsic motivational factors (e.g., performance information) may also play an important role in short-term settings such as group idea generation (Paulus and Brown 2003).

The absence of performance information creates an inaccurate and even erroneous performance perception, in particular for high performers, and may in turn lead to social loafing (see Luthans 1998), lowering overall task performance. The presence of performance information as an extrinsic motivational factor, however, provides social recognition or approval to higher performers within a group based on fair rewards (i.e., positive reinforcement). Additionally, lower performers will more likely attempt to get rid of the unpleasant feelings or uneasiness induced by performance information (i.e., negative reinforcement) and at the same time try to catch up with higher performers. This strengthens the positive behavior of both higher and lower performers and encourages the repetition of desirable behavior (Luthans 2002).

H1: *Groups in the performance feedback treatment will outperform groups in the no-performance feedback treatment.*

The Role of Goal Setting in Group Idea Generation

Although Hackman and Morris (1975) pointed out that for tasks that utilize member knowledge and skills and do not require complex social processes (such as group idea generation), member competencies are the greatest predictor of group effectiveness, "knowledge by itself does not have the power to initiate [purposeful] action [i.e., task performance]" (Locke, Cartledge, and

[3]The self-fulfilling prophecy that occurs when a true (or false) expectation arouses a new behavior in a way that confirms the original expectation.

Koeppel 1968, p. 475). Rather, a goal, which is "what an individual is trying to accomplish" (Locke et al. 1981, p. 126) can help to motivate group members to perform. Locke and Latham (1990) conclude that goals or intentions can facilitate task performance as they motivate people to exert effort, encourage people to persist, guide people's attitudes, and direct their behavior to focus on the outcome. In other words, goals as a motivational technique provide standards for systematic self-evaluation, serving as a cue to regulate action by strengthening the linkage between effort (or motivation) and performance (see Locke and Latham 1990). Extensive meta-analyses conducted by Locke et al. (1981) and Mento et al. (1987) confirmed this theoretical argument by demonstrating that specific and challenging (but attainable) goals result in better performance than "do your best" or no goals. Thus, goals appear to set up a self-fulfilling prophecy, preconditioning better performance. Recent studies, however, report little or no effect of goal setting on performance in the context of group idea generation (e.g., Hinsz 1991; Larey and Paulus 1995). As Weldon et al. (1991) propose performance monitoring as a possible mediator (see also Aiello and Kolb 1995; White et al. 1995), it is reasoned that in prior studies, individual goals based on self-evaluation in interacting groups did not seem to induce enough motivation or commitment due to the lack of explicit performance information. Thus, prior insignificant effects of goal setting on performance may be due to the lack of a clear basis for social comparisons. Based on this, we speculate that without clear explicit performance feedback, goal setting will at best have a neutral outcome on group idea generation performance; if the group members (absent explicit performance feedback) erroneously conclude that they have already reached or exceeded the performance goal, there might even be a negative impact of goal setting on group idea generation.

The Role of Goal Setting and Performance Feedback in Group Idea Generation

Stroebe et al. (1992) argued that even in small groups, individual group members are unable to differentiate their ideas from other group members' ideas. Thus, group members lacking explicit performance feedback are likely to use readily available cues to anchor their own performance perceptions (Tversky and Kahneman 1974; see also Bandura and Locke 2003). In a computer-mediated idea generation session, individual group members may view the total number of ideas displayed on the screen and erroneously conclude that they have reached or even exceeded the performance goal. When provided with explicit performance feedback, however, individual group members do not have to rely on potentially incorrect guesses to evaluate their progress toward reaching the performance goal; rather, they know their performance as compared to the goal with relative certainty. Based on this performance feedback, individuals can self-regulate their behavior in order to close the gap between their present performance and the performance goal (Carver 2004). Further, if individual goals are made public (Hollenbeck et al. 1989; Robbins 1998; Salancik 1977) and performance feedback is provided, the groups members' commitment to their goals will be enhanced, and upward social comparison will be facilitated by creating a competitive environment. These effects should be greatest when the goal is challenging but attainable.

In other words, having a challenging and attainable goal for individuals as well as providing public feedback of actual performance and progress toward this goal for all group members should interact and significantly enhance performance. Thus, it is hypothesized that:

H2: *Groups in the performance feedback/explicit–difficult goal treatment will outperform all other groups.*

Methods

Research Design

A 2 × 2 factorial design was used, crossing performance feedback (i.e., performance feedback versus no-performance feedback) and goal setting (i.e., explicit–difficult versus do your best) with group size five.

Subjects

A total of 205 business students (41 groups) from a large state university in the United States served as subjects in exchange for course credit. The average age of the students was 20.6 years and 64 percent were male. Subjects were randomly assigned to one of the four experimental conditions.

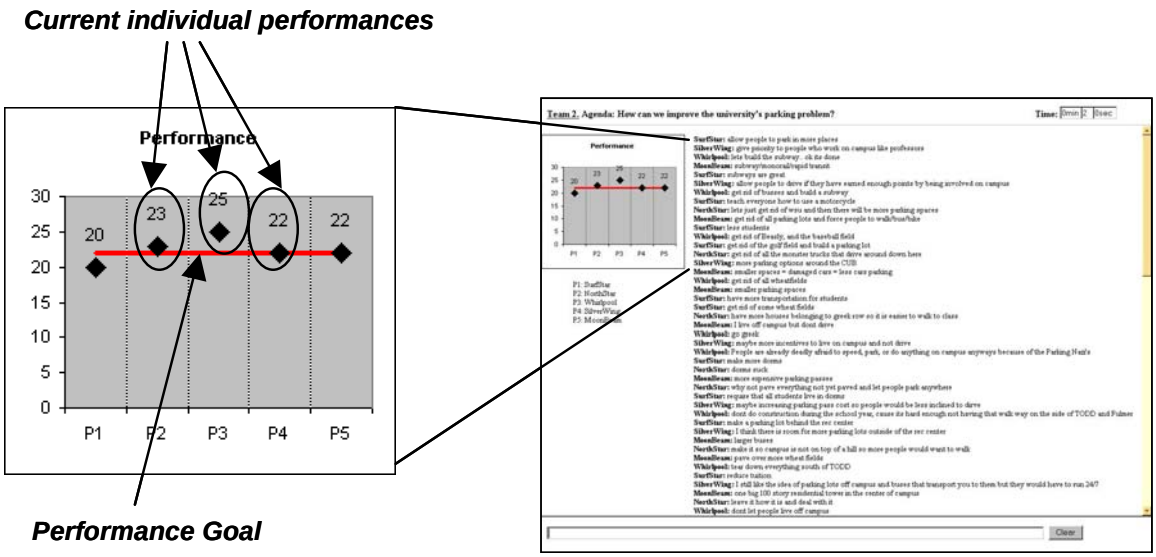

Figure 1. Goal/Performance Graph

Tasks

Subjects were asked to generate ideas on "How can we improve the university's parking problem?" Following prior studies (e.g., Connolly et al. 1990), this task was chosen for its high relevance to the subjects, as it stimulates participants to draw on their personal knowledge and experience (Garfield et al. 2001; Jessup et al. 1990).

Performance Feedback and Goal Setting Operationalization

We developed a real-time goal/performance (G/P) graph (see Figure 1) that summarizes the cumulative contributions of each subject and allows performance comparisons with others in an assigned group, in addition to displaying the performance goal. The chart is redrawn every 15 seconds to reflect the subjects' accumulated contributions. Subjects are able to link performance information to individual contributions by the use of pseudonyms.

Prior goal setting studies (Ivancevich 1976, 1977; Latham and Marshall 1982; Latham and Yukl 1975) found no differences in performance between assigned and participative goals; thus we used an assigned goal (explicit–difficult) for the present study. In order to set a challenging but achievable goal, it was decided to use the mean number of ideas generated in a pilot study plus 2 standard deviations. In the pilot study, each group member in the performance condition generated on average 14 ideas (*SD* = 4) in 15 minutes; thus, the performance goal was set at 22 ideas. In the explicit–difficult goal conditions, the groups were verbally informed of this goal. Furthermore, in the performance feedback/explicit–difficult goal condition, the goal was presented in the form of a horizontal line in the G/P graph (see Figure 1). The remaining conditions were instructed to generate as many ideas as possible (i.e., to "do your best").

Dependent Variables

The dependent variables were quantity and quality of ideas after removing redundant ideas. The manner by which these performance measures were operationalized is consistent with many prior studies (Connolly et al. 1990; Diehl and Stroebe 1987). As this study is part of a program of research, the unique ideas could be compared to a master list compiled during prior studies in order to assess idea quality. The quality of the ideas on this master list has been rated by three senior parking experts on a seven-point Likert type scale; overall, the reliability of the quality ratings of the ideas on the master list was high ($\alpha = .92$). The master list (containing 457 ideas) proved to be very inclusive, as no novel ideas were generated during the experimental sessions;

all ideas could be matched to the master list. Some researchers advocate the use of average idea quality to account for the difference in idea quantity. However, this measure punishes groups that primarily produce low quality ideas (Dennis, Aronson et al. 1999). Further, the sum of the quality rating has been found to be the most reliable measure of idea quality across a number of studies (Diehl and Stroebe 1987). Thus, the idea quality score was calculated by summing the quality scores of the ideas after removing any redundant or frivolous ideas.

Procedures

On reporting to the experimental site, participants were randomly assigned to 1 of 50 workstations in a computer classroom. The number of subjects that participated in each session ranged from 35 to 45. Subjects were told that they would work with other team members who were located randomly throughout the room using a groupware system that would allow them to generate and exchange ideas (i.e., every group member could see all of the other group members' ideas). All subjects were told that they could identify their own ideas by the assigned pseudonyms. Thus, other members would also be able to identify the origin of the ideas by the pseudonyms, but would not be able to know who the other participants were. The subjects in the performance feedback/explicit–difficult Goal condition were informed that they could evaluate each group member's performance real-time. Furthermore, they were told that in prior studies, each group member had generated between 8 and 22 ideas, and they were asked to generate 22 ideas (as indicated by a line in the G/P graph). The subjects in the no-performance feedback/explicit–difficult goal condition were also told that they should try to generate 22 ideas per person; however, the subjects could not view each group member's cumulative performance, and thus did not know whether or not they had reached or exceeded the performance goal. The participants in the performance feedback/do your best condition were told that they would be able to evaluate each group member's performance, but were not provided with a specific performance goal. Subjects in the no-performance feedback/do your best condition were neither provided with a performance goal, nor with the possibility to evaluate each group member's performance. Prior to beginning the main task, all subjects were allowed to become familiar with the operation of the system using a practice task. The experimenter then read aloud the experimental instructions while the participants followed along on their own screens. Specifically, participants were provided with a version of Osborn's (1957) brainstorming rules and were instructed to follow them. The rules directed students to generate as many ideas as possible, to withhold criticism, to include wild ideas, and to build on the ideas of others. They were also told that their contributions would be used to improve the campus-parking problem. The system was programmed to stop automatically after 15 minutes, after which the subjects completed a brief questionnaire and were then released.

Results

Table 1 presents a summary of the means and standard deviations of the groups' performance. Hypothesis 1, which stated that the groups in the performance feedback treatment would outperform (operationalized as idea quality and quantity) the groups in the no-performance feedback conditions, was supported. The main effect of performance feedback was significant for idea quantity ($F(1, 38) = 41.17$, $p < .001$) as well as idea quality ($F(1, 38) = 47.38$, $p < .001$).

Table 1. Means and Standard Deviations for Number of Ideas and Idea Quality

Dependent variable	Goal Setting	Performance Feedback	
		Yes	No
Idea Quantity	Explicit–Difficult		
	M	49.20	24.27
	SD	10.37	5.66
	"Do Your Best"		
	M	43.30	31.10
	SD	10.70	9.72
Idea Quality	Explicit–Difficult		
	M	152.32	68.95
	SD	37.49	20.53
	"Do Your Best"		
	M	127.67	91.41
	SD	23.58	27.34

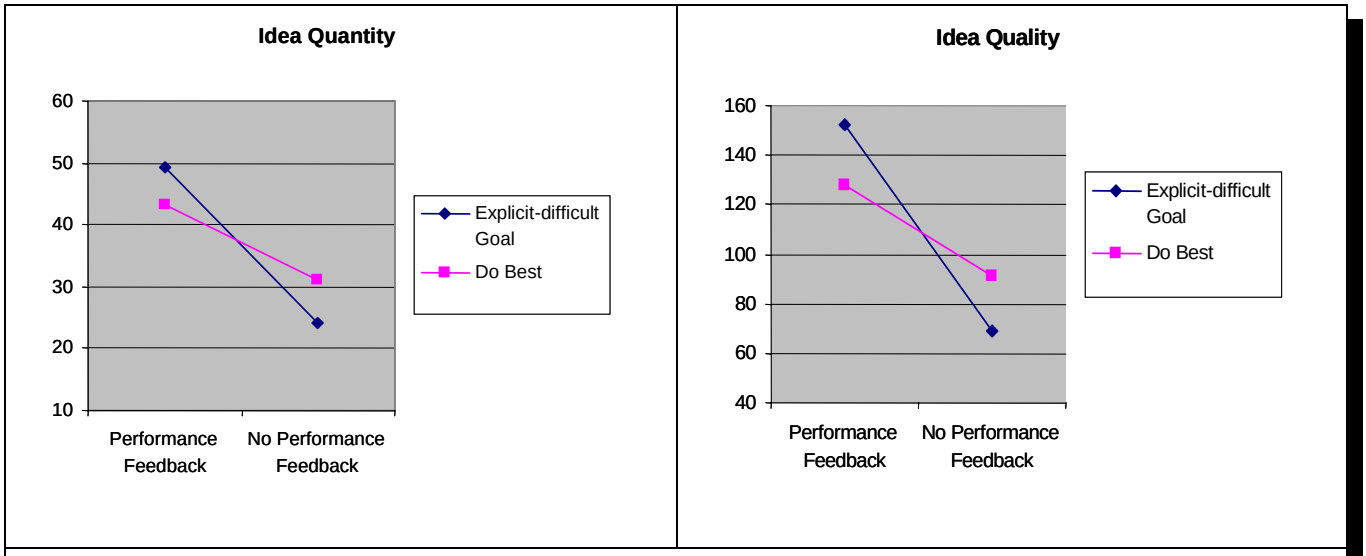

Figure 2. Means of Idea Quality and Idea Quantity

Hypothesis 2, which stated that the groups in the performance feedback/explicit–difficult goal treatment would outperform the groups in all other conditions, was also supported. The interaction effect between the two factors was significant for idea quantity ($F(1, 38) = 4.84$, $p = .034$) as well as idea quality ($F(1, 38) = 7.35$, $p = .010$). See Figure 2 for the means for idea quantity and idea quality. No other significant differences were found.

Discussion

In this study, we argued that, due to the disjunctive nature of group idea generation, the groups' performance depends largely on the competencies of high performers (Devine and Philips 2001; Hackman and Morris 1975). In the absence of objective performance information in traditional anonymous computer-mediated idea-generation environments, individual efforts are not rewarded, which induces loafing, negative social comparison, and matching to a perceived baseline, leading to the reduction of overall performance. Additionally, since low performers are not identified, the motivation of high performers is likely diminished. In order to optimally motivate higher as well as lower performers, we incorporated a performance feedback mechanism into a computer-mediated idea generation environment, and examined its potential in an effort to mitigate process losses (i.e., loafing) and in turn to enhance the performance of computer-mediated group idea generation.

Our results clearly show that the groups in the performance feedback conditions outperformed the groups in the no-performance feedback conditions in both quantity and quality of ideas. Further, the groups in the performance feedback/explicit–difficult goal condition outperformed all other groups in terms of idea quantity and quality. In other words, providing a performance goal without explicit performance feedback has no effect on performance (and may even be detrimental), whereas the mere provision of performance feedback can significantly enhance performance. Providing the group members with a (challenging but attainable) goal and performance feedback ultimately leads to even higher levels of performance.

We attribute the central finding of this study (superior performance of groups in the performance feedback/explicit–difficult goal conditions) to the provision of real time information about who is contributing and who is reaching the goal, creating momentum for upward social comparison. Specifically, the performance feedback mechanism increased high performers' intrinsic motivation (by fulfilling their desire for feedback), as well as extrinsic motivation (by providing fair rewards in the form of social recognition and attention); further, as contributions could clearly be differentiated, illusory perceptions of productivity were corrected. In prior research, it has been found that lower performers have a tendency to hide in the crowd (Ashford and Cummings 1983) and exert less effort under disjunctive task demands (Albanese and Van Fleet 1985; Diehl and Stroebe 1987; Steiner 1972; Szymanski and Harkins 1987). In contrast, in this study, lower performers were induced to exert a higher degree of effort and to keep up with higher performers, as the performance feedback mechanism removed the dispensability of their efforts (see Diehl and Stroebe 1987) and induced unpleasant or uneasy feelings (Kerr and Bruun 1983). Thus, this finding empirically confirms the view that

although intrinsic motivation is critical in creative ideation, external interventions (e.g., performance goals and performance information) can play an important role in enhancing performance in short-term settings (Shepperd 1993; see also Parks and Sanna 1999; Paulus and Brown 2003).

In sum, this study supports our theoretical argument regarding the motivational effects of clear performance goals in combination with performance feedback. In other words, it shows that external intervention in the form of real-time performance feedback can help to promote social facilitation (i.e., upward social comparison). Further, it shows that explicit performance feedback redirects the tendency of interacting during idea generation (i.e., a conjunctive task) to its goal (i.e., to generate as many quality as possible). Finally the present study addresses the issue posed by Pinsonneault et al. (1999, p. 112): "Past research is less clear on how EBS may reduce productivity losses due to social loafing and negative social comparison. Few or no theoretical explanations are offered….Similarly, explanations concerning how or why EBS should influence the extent of negative social comparison exercised by the participants are also lacking."

Implications for Research

Following the recommendations of prior research (e.g., Seijts and Latham 2001), we chose a challenging but attainable goal based on the performances of groups in pilot studies. Although the current study has demonstrated a significant interaction effect between goal setting and performance feedback, future research should attempt to explore the effects of different levels of goal difficulty; specifically, exploring the shape of the performance curve as the difficulty of the goal increases to identify whether there is a sharp drop in performance at a certain level of goal difficulty, or there is a gradual decline once the goal is perceived too difficult.

Future research should also attempt to test the robustness of the current findings across different settings, including factors such as other idea generation problems (e.g., product development, systems development, etc.), other group tasks (e.g., negotiation or decision making tasks), or different types of groups (e.g., established versus *ad hoc*). Here, for example, we examined the role of individual group member feedback within *ad hoc* groups. A clear opportunity with important theoretical and practical implications would be to examine the role of individual-level versus group-level performance feedback within *ad hoc* versus established groups. In essence, would group cohesiveness be enough to motivate all group members to perform their best without individual-level performance feedback?

Another avenue for research is to examine the influence of idea quality (rather than quantity) when using performance feedback and goal setting (see Austin and Bobko 1985). Given that idea quality is a fundamental part of assessing idea generation performance, differentiating ideas on quality within the goal setting and feedback process is an exciting opportunity (e.g., contrast groups where only ideas of adequate quality are counted toward reaching their goal). Examining the role of idea quality feedback could be pursued in a variety of ways. One option would be to simply inform group members that only ideas of adequate quality would be counted. However, prior research has suggested that procedural guidance (e.g., brainstorming rules) can only have modest success in offsetting or preventing negative behavior in groups that results in the generation of low quality or even frivolous comments (Wheeler and Valacich 1996). These frivolous comments often have a negative "contagion" effect on task performance. For example, when examining the transcripts of the groups within this study, all groups produced some number of comments that were not task relevant (i.e., electronic junk—Hiltz and Turoff 1985—e.g., I am hungry; I am gonna go and have a drink). Many of these comments spurred reactions by other group members, moving the group off its primary task. Hiltz and Turoff (1985) suggest that the lack of social controls in the interaction process can lead to junk comments, which are considered "a human problem more than…a computer problem, the side effect of an on-line social system, rather than of any particular computer system" (p. 685).

A second, but stronger, intervention would be to design interface features that could remind participants to follow rules in computer-mediated idea generation environments. Such features could be periodical time-based pop-up announcements or artificial intelligence based techniques that recognize specific words as cues to trigger specific reminders (Wheeler and Valacich 1996). Alternatively, it may be most efficacious to actively filter any "off the topic" comments from the group—either through a human or electronic agent that would moderate submissions. Such a filter would challenge the long-standing idea generation belief that "there is no such thing as a bad idea" (Osborn 1957).

When only providing quantity feedback, the group members might be tempted to sacrifice quality for quantity. Thus, when providing quality feedback, future research should explore the potential tradeoffs between idea quality and quantity. Further, the level of analysis of the current research was the group; future research could explore whether similar results can be obtained when

providing goals and performance feedback to individuals working on an idea generation or other type of task. Finally, future research could empirically examine how interacting groups compare to nominals when provided with a goal and performance feedback.

Implications for Practice

The findings of the current study have important implications for designers of idea generation environments as well as for managers in general. With regard to systems development, this study provides a useful way of enhancing computer-mediated idea generation performance by demonstrating how a simple graph providing both a performance goal and clear performance feedback in a computer-mediated idea generation interface can significantly enhance performance. As future research identifies other empirically supported mechanisms to overcome group process losses, designers can further fine-tune the human-computer interface in these group idea generation environments. Based on this research, for example, fine-tuning could be aimed at making the individual performance information more explicit, highlighting lower or higher performers, or providing warnings if a group member is likely to fail to reach the performance goal. Of course, additional research is needed to examine the efficacy of any specific implementation of the performance feedback/goal setting mechanisms examined in this research.

For managers, the results of the current study clearly show the importance of providing performance feedback when setting performance goals. This is especially important, as the current study has shown that setting performance goals without providing clear feedback might even be detrimental to performance. However, managers should carefully decide on the performance goals; especially for novel tasks, this might be a difficult decision to make. Future studies could aim at finding a "magic number" that maximizes group performance across different tasks.

Limitations

There are obvious limitations to the external validity of this study, as we employed a laboratory experiment with student subjects; these subjects also had no significant stake in the outcome of the task. Although they understood the task and appeared to participate adequately, the subjects were not typical decision makers for this task domain. Yet, the task was germane to their situation as university students. Nevertheless, while we may not be able to generalize our findings to all forms of group idea generation and all types of groups, we can probably generalize to groups of concerned participants asked to generate ideas on an issue that directly concerns them. Another limitation is our operationalization of idea quality. Although our operationalization followed prior studies, it should be further examined in how far the results hold if other measures of idea quality (e.g., counting only "high quality" ideas) are used. Finally, the fact that 45 subjects were together in a single room during each session might have affected social comparison. However, we do not regard this as a limitation; as this was true for all conditions, we have no reason to believe that this might affect the conditions differentially. While it might have raised the overall means of the idea quality and quantity, there is no *a priori* reason to believe that it might influence the differences between the means.

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