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# Osborne Revisited: Is There No Such Thing as a Bad Idea? The Effects of Electronic Junk on Computer-Mediated Idea Generation Performance

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# OSBORNE REVISITED: IS THERE NO SUCH THING AS A BAD IDEA? THE EFFECTS OF ELECTRONIC JUNK ON COMPUTER-MEDIATED IDEA GENERATION PERFORMANCE

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## Abstract

*Conventional thought in idea generation suggests that there is no such thing as a bad idea. This paper challenges this assumption, arguing that task-irrelevant comments (electronic junk) can significantly influence the performance of computer-mediated idea generation groups. While the results of a controlled laboratory experiment using a group simulator show that electronic junk can create a downward spiral, leading to the creation of even more task-irrelevant comments, the results also support the hypothesis of an inverted-u-shaped relationship between the amount of junk comments and ideation performance, suggesting that moderate amounts of junk comments can aid performance, whereas large amounts of junk comments can be detrimental to performance. Further, the results show that members of groups producing no junk comments perceive their individual performances to be lower than members of groups with moderate or high amounts of junk comments. The implications of these results on the design of human-computer interfaces are discussed and avenues for future research are suggested.*

*Keywords: Idea generation, electronic junk, human-computer interaction, group simulator.*

# 1 INTRODUCTION

Over the past years, group-based collaboration and technologies to support such interaction have proliferated and increased in importance (Sarker, Sarker, Joshi, & Nicholson, 2005). At the same time, research on the usability of human-computer interfaces (HCI) has rapidly matured; however, much of this prior work has focused on the interplay of individuals and the interface (see Zhang & Galletta, 2006), spawning theories such as cognitive fit (Vessey, 1991), task-technology fit (Goodhue & Thompson, 1995), and cognitive complexity (Bovair, Kieras, & Polson, 1990). Research examining the HCI of group collaboration environments, however, has remained sparse, despite the widespread use of collaboration environments for asynchronous (e.g., user forums or wikis) and synchronous communication (e.g., chat applications for customer support or communication channels in virtual worlds).

A foundational collaboration environment that can inform the design of other types of group collaboration environments is computer-mediated idea generation (Nunamaker, Dennis, Valacich, Vogel, & George, 1991). Companies have used, and continue to use idea generation for a variety of tasks, including making strategic decisions or designing new products and marketing campaigns (Toubia, 2006). For example, Toubia provides recent examples of companies such as Colgate-Palmolive or large semiconductor manufacturers that are successfully using computer-mediated idea generation tools. However, although being a very effective tool, computer-mediated idea generation has some shortcomings, such as potentially negative effects due to unrelated, or junk, comments. This study examines these effects and suggests ways to modify the human-computer interface of computer-mediated idea generation and other group collaboration environments in order to address such shortcomings.

# 2 LITERATURE REVIEW

The idea generation performance of individuals and groups has a long history of investigation. Whereas early work focused on identifying various techniques to enhance group creativity and performance (e.g., Osborn, 1957), later studies attempted to empirically evaluate the efficacy of such methods, and found that non-interacting individuals whose ideas are pooled (i.e., individuals working as nominal groups) consistently outperformed interacting groups (McGrath, 1984). Process losses such as production blocking, evaluation apprehension, and free riding were identified as the main cause of poor performance in interacting groups (Diehl & Stroebe, 1987). Computer-mediated idea generation has been suggested to overcome some of these process losses by providing features such as parallel communication, group memory, and anonymity (e.g., Connolly, Jessup, & Valacich, 1990). Multiple 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 et al., 1992); further, larger computer-based groups have been found to outperform nominal groups (Dennis & Valacich, 1993), with few or no differences found between nominal and computer-based groups for smaller group sizes (Gallupe, Bastianutti, & Cooper, 1991). Thus, "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" (Valacich, Dennis, & Connolly, 1994, p. 463).

One factor potentially limiting the effectiveness of both traditional and computer-mediated group idea generation is the influence of non-task relevant comments (i.e., electronic junk – Hiltz and Turoff 1985 – e.g., I am hungry; I am gonna to go and have a drink)[1]. Such frivolous comments often have a

[1] The conventional assumption that "there is no such thing as a bad idea" appears to be a double-edged sword. On the one hand, because one's garbage can be another's treasure, one participant's low quality ideas could stimulate other participants'

negative contagion effect on other participants, thus negatively influencing task performance. For example, transcripts of idea generation studies provide ample evidence of the emergence of frivolous comments, albeit at different degrees. Many of these comments appear to spur reactions by other group members, moving the groups off their primary task. Jessup and George (1997) suggest that in minimally interdependent groups without specific social controls (such as in anonymous computer-based groups), negative or dysfunctional outcomes (e.g., junk comments) are likely to occur. As such comments arise due to a lack of social controls in groups' interactions, such junk comments 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" (Hiltz & Turoff, 1985, p. 685).

Unlike in face-to-face groups where the spoken words are transient and quickly disappear as soon as they are verbalized, in computer-mediated groups all contributions (including junk comments) are preserved and displayed on the human-computer interface for the duration of an idea generation session. Therefore, sporadically occurring junk comments may appear next (or close) to thought-stimulating ideas (Dennis, Valacich, Connolly, & Wynne, 1996; Dennis et al., 1997). As individuals need to exert extra effort to discern and process stimulating ideas if information is presented in an unorganized way (as in computer-based groups, see Hilmer & Dennis, 2001), junk comments may significantly interrupt or distract participants form their primary task of generating as many quality ideas as possible. Additionally, being confronted with a high volume of contributions, participants in computer-based groups may experience information overload, (Nagasundaram & Dennis, 1993; Grisé & Gallupe, 2000), which may be further increased by the presence of junk comments (Denning, 1982; Hiltz & Turoff, 1985).

This study empirically examines the effects of various degrees of random or stochastic noise (i.e., frivolous comments) on the performance of computer-mediated idea generation groups, and suggests avenues for designing the human-computer interface in order to combat negative effects. Using a group simulator, individuals are presented with idea streams containing different levels of junk comments and the effects of these junk comments on the quantity and quality of ideas are evaluated.

In the next section, we delineate our theoretical rationale and present our research hypotheses, 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.

# 3 HYPOTHESES

Studies in group and social psychology have repeatedly shown that individuals' behavior in groups is strongly influenced by the behavior of other group members (Levy & Nail, 1993; Marsden, 1998). Such contagion effects have been demonstrated in a variety of settings, such as investors' irrational behavior on stock markets (Orlean, 1992; Temzelides, 1997; Lux, 1998) or the spread of consumer fads and fashions (e.g., Bass, Mahajan, & Muller, 1990; Rogers, 1995). Further, deviant behaviors such as teenage smoking (Ritter & Holmes, 1969; Rowe, Chassin, Presson, Edwards, & Sherman, 1992) or speeding (Connolly & Aberg, 1993) have been linked to social contagion. In the context of idea generation groups, individual group members observe the group's behavior and thus learn (perceived) acceptable behavior. In other words, the group's (positive or negative) behavior can exert a contagion effect on individual group members, who tend to adopt the group's behavior.

In an idea generation setting, this behavior translates into the creation of upward or downward spirals, in that participants follow what appears to be acceptable behavior in the group. Unlike in nominal groups, where participants work separately, "the performance of group members [i.e., the quantity and

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creativity (Anderson, 1983). On the other hand, Valacich et al.'s (2006) simulation study demonstrates that low quality stimuli significantly reduce motivation and overall task performance. Rather than focusing on low quality (but otherwise feasible) ideas, this study focuses on task-irrelevant (i.e., junk) comments only.

quality of contributions in interacting groups] can provide both social and cognitive stimulation" (Paulus, Larey, & Dzindolet, 2001, p. 331), which in turn induces performance comparison and adjustment. In interacting groups, the members tend to adjust their performance to the level of the least proficient member (Paulus & Dzindolet, 1993). In case the group drifts off topic due to the generation of junk comments, individual group members are less likely to exert effort to help the group stay on topic.

However, following Osborn's (1957) work, wild or divergent ideas are believed to stimulate idea generation, opening up avenues for divergent thinking. Thus, unrelated ideas may create synergies, leading to more (and potentially more high quality) ideas. On the other hand, clearly unrelated junk comments act as distractions in an individual group member's idea generation process, as additional effort is needed to filter out junk comments in an idea generation context. Distraction-conflict theory (Sanders & Baron, 1987; Speier, Vessey, & Valacich, 2003) posits that some amount of distraction can actually aid performance on simple tasks. This facilitation may be due to overcompensation on the part of the participant, in that the person works harder to overcome the distraction, resulting in a net performance gain (see also Allport, 1924). However, larger amounts of junk comments will create additional cognitive load for participants in idea generation settings. Thus the beneficial effect of such junk comments (both in terms of synergies and distractions) is likely to be reduced. Further, larger amounts of junk comments within an idea generation setting are likely to reduce perceived performance expectations.

Together, this suggests an inverted U-shaped relationship of the existence of junk comments on ideation performance, such that moderate amounts of junk comments stimulate, whereas large amounts hinder ideation performance. Thus, Hypothesis 1 follows:

> *Hypothesis 1: The presence of junk comments in idea generation settings will influence idea generation performance, such that participants in groups with moderate amounts of junk comments will outperform participants in groups with no junk or large amounts of junk.*

In computer-based interaction, performance tends to regress toward the mean (Roy, Gauvin, & Limayem, 1996), primarily due to the combined effect of random group composition and anonymity (Pinsonneault & Heppel, 1997-1998; see also Paulus, Larey, Putman, Leggett, & Roland, 1996). Specifically, low performers tend to engage in upward social comparisons when interacting with higher performers, whereas high performers tend to engage in downward social comparisons when interacting with lower performers (see Valacich, Jung, & Looney, 2006), leading to performance equalization. Roy et al. (1996) stress that such equalization effects can result from the constant displaying of all contributions on the computer screen. Valacich et al.'s simulation study that separates high and low quality stimuli further supports Roy et al.'s view that higher-quality stimuli can socially facilitate group members, whereas lower-quality stimuli can serve to substantially reduce motivation, leading to reduced performance in terms of idea quality.

In a computer-mediated group idea generation setting, a group's total output typically consists of a mixture of high-quality ideas, low-quality ideas, and task-irrelevant comments. Group members of highly task focused groups (i.e., groups that produce only limited amounts of electronic junk) may perceive that other group members are performing at equal or higher levels. Thus, individual group members may discount their own efforts as compared to other group members. In contrast, when interacting with group members producing larger amounts of junk comments, individuals may perceive that they need to "pull their weight" in order to help the group's performance. This, in turn, would reduce feelings of dispensability. As Weldon and Mustari (1988) suggest that "feelings of dispensability may be the primary cause of social loafing" (p. 330), this leads to:

> *Hypothesis 2: Participants in groups with moderate or high amounts of junk comments will have higher perceptions of their individual performance than participants in groups with no junk comments.*

In the following section, we will describe the research methods and experimental design.

# 4 METHODS

## 4.1 Research Design

A controlled experiment was designed to test the influence of junk comments on ideation performance and perceived individual performance. To test the hypotheses, subjects interacted with a group simulator presenting idea streams containing different levels of electronic junk. Each participant interacted individually with the simulator; in other words, there was no interaction between individual participants.[2] Participants were randomly assigned to one of three treatment conditions.

## 4.2 The Group Simulator

A simulator was designed to accurately control the presentation of ideas in order to control error variance that inevitably occurs in interacting groups (Brown & Paulus, 1996; Garfield, Taylor, Dennis, & Satzinger, 2001). Thus, a simulator can yield a more accurate and controlled measure of individual performance. Garfield et al. describe a group simulator as an electronic environment that "looks and acts like a groupware system, but instead of sharing ideas among participants, the simulator presents participants with comments that appear to be from other participants but which are, in fact, drawn from a database of preset ideas" (p. 327).

The simulator closely mimicked the sequence of a real, interacting group idea generation session in a way that idea seeds were presented sequentially to the subjects (however, there were no "responses" to the subjects' input). We typically see a downward linear relationship between the numbers of ideas generated over time within real, interacting group idea generation sessions (Brown & Paulus, 1996; Connolly & Aberg, 1993). This relationship is represented by many ideas in the early stage and fewer responses toward the later stages, as participants are running out of ideas in the end. This pattern of idea presentation was simulated via programming within the simulator. Pilot testing confirmed that the simulator accurately reproduced the sequence and interactions of a real, interacting group idea generation session.

## 4.3 Idea Stimulation Manipulation

For the idea stimulation manipulation, participants were exposed to a stream of simulated high quality stimuli into which different amounts of junk comments were injected. During a pilot study, a pool of 457 ideas for the experimental task was generated. The ideas were rated by three domain experts representing senior employees from the Department of Parking Services of a large public university using a 7-point Likert scale anchored by 1 (A Very Poor Solution) and 7 (A Very Good Solution). Prior research has operationalized "high quality ideas" as those with a quality rating of 3 or higher on a 5-point Likert scale (Diehl & Stroebe, 1987; Dennis, Aronson, Heninger, & Walker II, 1999). Since a 7-point scale was utilized to evaluate idea quality, ideas with an average rating of 4 or higher were considered high quality, whereas the remaining items were categorized as low quality.

In pilot studies, five-person groups produced on average approximately 50 distinct ideas; thus, 50 high quality ($M$ = 4.85, $SD$ = .63) ideas were randomly selected from the pool to serve as stimuli to simulate interacting group members. During the experimental sessions, all participants received the same high quality stimuli (in the same order).

[2] A manipulation check question revealed that on average, participants in the different conditions perceived that they were working with 5.97 – 6.72 other people, indicating that the participants believed they were indeed working in interactive groups.

Different amounts of junk comments were injected into this idea stream to manipulate the amount of junk comments in the different conditions. In prior studies, interacting (non-simulated) groups produced on average 34% (*SD* = 13%) junk comments. This average, +/- 1 standard deviation was used to create two distinct conditions, one containing 20% junk, and the other containing 45% junk. Thus the 45% junk condition contained more than twice the amount of junk than the 20% junk condition, ensuring a sufficiently strong manipulation. In order to ensure that the participants received the same stimuli in the same order, high quality stimuli and junk comments were randomly mixed prior to running the experiment. A condition containing high quality ideas only (with no junk) was used as a baseline condition. The timing of the presentation of the high quality ideas was kept consistent across conditions; thus, participants in the 20% and 45% junk conditions received stimuli (high quality ideas and junk) more rapidly. Each participant's contributions and idea seeds from the system appeared as anonymous contributions on the participants' screens.

### 4.4 Participants

103 upper-division business students from a large state university in the United States participated in the study in return for course credit. The average participant age was 20.72 years (*SD* = 2.92) and 59.2 percent were male.

### 4.5 Task

Participants were asked to generate ideas on "How can we improve the university's parking situation?" This task was chosen for its high relevance to the subjects – since it stimulates participants to draw on their personal knowledge and experience – and because it has been used in many prior studies (e.g., Connolly et al., 1990; Garfield et al., 2001; Jessup, Connolly, & Galegher, 1990).

### 4.6 Dependent Variables

The dependent variables were the quantity and quality score of ideas. The manner by which these performance measures were operationalized is consistent with many prior studies (Connolly et al., 1990). In order to measure idea quality, the unique ideas were compared to a master list compiled during earlier studies. In those studies, idea quality had been rated by three senior parking experts. All ideas generated during the experimental sessions could be matched to the master list. As the sum of the quality rating has been found to be the most reliable measure of idea quality (Diehl & Stroebe, 1987), the idea quality score was calculated by summing the quality scores of the ideas.

Perceived performance was measured using two items used in Dennis and Valacich (1993). Specifically, the subjects were asked 1) how much do you feel you participated in this idea generation session, and 2) how satisfied are you with your own performance on this task.

### 4.7 Procedures

On reporting to the experimental site, each participant was assigned to a workstation within a computer classroom that contained 50 separate workstations. The number of participants in each experimental session ranged from 9 to 12. Participants 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 anonymously. The experimenter then read aloud the experimental instructions to generate as many high quality ideas as possible while the participants followed along on their screens. The instructions further stated that the results of the idea generation session would be used to improve the university's parking situation. The subjects then interacted with the simulator until the session terminated automatically after 15 minutes. Following the interaction with the simulator, the subjects completed a brief questionnaire, were debriefed, and released.

# 5 RESULTS

Table 1 presents a summary of the means and standard deviations for the dependent variables. Hypothesis 1, which predicted an inverted-u-shaped relationship between the number of junk comments and idea generation performance, was supported. Two one-way ANOVAs showed significant effects for the degree of junk comments on idea quantity ($F(2,100) = 5.581$, $p = .005$) and quality ($F(2,100) = 4.740$, $p = .011$). Tukey tests revealed that in terms of both quantity and quality, individuals in the 20% junk condition outperformed individuals in the other conditions. Hypothesis 2, stating that individuals in groups with larger amounts of junk comments would have higher perceptions of their individual performances than individuals in groups where no junk comments would surface, was supported. A one-way ANOVA showed a significant effect of the degree of junk ratio on perceived performance ($F(2, 100) = 4.151$, $p = 0.019$).

| Dependent variable | | Manipulation: Amount of Junk Comments | | |
|---|---|---|---|---|
| | | 0% | 20% | 45% |
| Idea Quantity | M<br>SD | 5.06<br>3.40 | 7.85<br>3.91 | 5.58<br>3.57 |
| Idea Quality | M<br>SD | 17.91<br>13.35 | 27.56<br>15.47 | 19.41<br>12.54 |
| Perceived Performance | M<br>SD | 4.88<br>1.26 | 5.64<br>1.17 | 5.47<br>.96 |

*Table 1 Descriptive Statistics*

# 6 DISCUSSION

In this study, we used simulated systematic artificial groups to measure the influence of electronic junk on individual-level performance. We argued that electronic junk can create a downward spiral, reducing overall task performance. Further, we argued that there would be an inverted-u-shaped relationship between electronic junk and idea generation performance, such that some amounts of electronic junk could actually aid creativity and aid a group's performance, whereas large amounts of junk would be detrimental. Finally, we argued that individuals working in groups producing higher amounts of junk would be more satisfied with their own performance, and perceive that they had contributed more to the group's efforts.

A key result of the current study is that individuals in the 20% junk condition outperformed individuals in the 0% and 45% junk conditions in terms of both idea quantity and quality. It appears that while a high degree of noise (task-irrelevant comments) can be detrimental to task performance, some degrees of noise can help to enhance performance. This finding resembles the Yerkes-Dodson Effect, which states performance tends to increase as arousal (or in this case, electronic junk) increases up to an optimal point and further increases in arousal beyond this point tend to decrease performance (Anderson, Revelle, & Lynch, 1989).

Further, our results show that group members in groups that produced moderate or large amounts of junk comments perceived their own performance to be better than group members in groups that produced no junk comments. These higher performance perceptions may have led to a self-fulfilling prophecy, stimulating performance of group members in groups producing junk comments. However, this self-fulfilling prophecy may not have been sufficiently strong to counteract the negative effects of electronic junk in groups with high amounts of junk comments, which would further explain the inverted-u-shaped relationship between the amount of task-irrelevant comments and performance.

# 7 IMPLICATIONS

Together, these results suggest that group interaction environments (such as idea generation environments or online discussion forums) should be carefully monitored to influence the effects of electronic junk. Whereas this study suggested that moderate amounts of junk can enhance performance, the results also showed that under the presence of junk comments, groups' interactions can easily spin out of control, leading to excessive amounts of junk, which, in turn, appears to be detrimental to performance. Thus, (electronic or human) moderators should be carefully trained to maximize the beneficial effects of task-irrelevant comments to release the groups' full potential.

One potential avenue would be to employ performance feedback based on idea quality, to limit the emergence of junk comments. A second, but stronger intervention would be to design interface features that could remind participants to follow rules in computer-mediated collaboration environments. Such features could be periodical time-based popup announcements or artificial intelligence based techniques that recognize specific words as cues to trigger specific reminders (Wheeler & Valacich, 1996). Alternatively, it may be most efficacious, to selectively 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).

# 8 DIRECTIONS FOR FUTURE RESEARCH

These results suggest several avenues for future research. One opportunity is to extend this study by incorporating the degree of identifiability: anonymity, pseudonymity, and total-identification (i.e., the participant's real name). A higher degree of identifiability can help to direct the person's attention towards his/her role as an individual in a social setting (e.g., Mouton, Blake, & Olmstead, 1956; see also Duval &Wicklund, 1972). Identified submissions in a computer-mediated idea generation setting are directly related to a person's identity and reveal the participants' levels of input (i.e., high quality ideas or low quality ideas or plain junk). Thus, the group members can perceive and judge each member's performance behavior according to his/her faults (e.g., low quality ideas and/or junk comments) and merits (high quality ideas). Michener and DeLamater (1999) point out that as the degree of identification increases, individuals become more self-conscious or self-aware; thus, mainly out of concern about what others expect of them and how others will evaluate their behavior, individuals will self-monitor the appropriateness of their own actions and thoughts. Under conditions of higher identifiability, individuals can monitor their own and others' performance behaviors, exposing each other's target areas for self-improvement (Sedikides & Strube, 1997).

Future studies can also employ a filtering mechanism to identify and sanction deviant behavior. When people are faced with sanctions in the form of filtering, they are likely to take steps to assure a positive outcome of the evaluation, or at the very least attempt to forestall frivolous comments. This increases social pressure to accomplish the task (Pinsonneault & Heppel, 1997-1998). Under such conditions, human cooperation will be the greatest because a strong performance norm toward higher-quality ideas would emerge, leading individuals to regulate their efforts to meet or exceed appropriate public behavioral standards (Carver & Scheier, 1981; Mullen, 1983).

Finally, future research could test and compare the creation and effects of electronic junk in asynchronous settings. Whereas this study employed synchronous group interaction, many group collaboration environments (such as wikis, blogs, or online forums) use asynchronous modes of interaction. Although electronic junk is easier to control in such situations, it poses an additional burden on moderators of such collaboration environments.

# 9 LIMITATIONS

Like any research undertaking, this study is limited in certain respects. There are obvious issues related to external validity. We employed a laboratory experiment with student subjects in a simulated group idea generation environment. These participants also had no significant stake in the outcome. Although they understood the task and appeared to participate adequately, these individuals are not typical decision makers for this task domain. Yet, the task was germane to their situation as university students. In addition, the use of a group simulator moves away from a natural group setting. 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. Additional research is needed to understand the extent to which these findings may generalize to different environments, tasks, subject configurations, and contexts. Another limitation may be related to the unequal gender distribution of participants. Prior studies (Herschel, Cooper, Smith, & Arrington, 1994; Klein & Dologite, 2000) that investigated the influence of varying gender compositions, however, found no gender effect in idea generation tasks.

# 10 CONCLUSION

Prior idea generation studies have put much interest on how to utilize process gains, overlooking how to mitigate process losses. However, studies suggest that "avoiding or eliminating the process losses that undermine creativity may be more effective in enhancing group productivity than reinforcing the process gains." (Pinsonneault, Barki, Gallupe, & Hoppen, 1999 , p. 378; Amabile, 1996), and there are many remaining crucial process losses that impede the performance of computer-based groups. In this study, we identified one such overlooked process loss (i.e., task-irrelevant comments – the side effect of an on-line social system) and empirically demonstrated the influence of task-irrelevant comments on ideational performance. Thus, this study has laid an important foundation, establishing the need to design interventions in the human-computer interface to combat these process losses and to improve the productivity of computer-mediated idea generation.

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