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The deindividuating effects of anonymity on automated group idea generation

Jessup, Leonard Michael, Ph.D.

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U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

THE DEINDIVIDUATING EFFECTS OF ANONYMITY ON AUTOMATED GROUP IDEA GENERATION

by

Leonard Michael Jessup

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Leonard M. Jessup

entitled The deindividuating effects of anonymity on automated group idea generation

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

Terry Connolly	Date 7/19/89
Joey George	Date 7/17/89
Christina Shalley	Date 7/17/89
Dave Tansik	Date 7/17/89
Doug Vogel	Date 7/17/89

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Dissertation Director Terry Connolly   Date 7/19/89

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SIGNED: Leonard M. Jessup

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Recent developments in information systems technology have made it possible for individuals to work together anonymously using networked personal computers. In this dissertation, a theory of anonymous interaction is proposed. Evidence is provided to suggest that anonymity has deindividuating effects on group process and can, therefore, influence group outcomes in several ways. Two experiments on anonymity in idea generation are presented. In Study 1, where subjects could leave at their discretion, identification kept them longer and caused them to type more, though there were no differences in the quantity or quality of the ideas across experimental conditions. In Study 2, where subjects were forced to stay, identifiability lost importance. Responsibility, however, rose in importance. Subjects with sole responsibility for their task produced more output than did subjects who shared responsibility. Taken together, these results forced us to reject the hypothesis that anonymous subjects would produce more output than would identified subjects. These results show that we cannot speak simply of the effects of anonymity on idea generation in computer-supported groups. With a straightforward interpretation of previous experiments on GDSS anonymity, it was hypothesized that anonymous subjects would produce more than identified subjects. They did not. It is clear that anonymity will

lead to deindividuation, enabling participants to engage in uninhibited behavior. However, whether their behavior is productive or unproductive is determined, at least in part, by task, interaction, and technology.

1. INTRODUCTION

Automated Systems For Group Work

Managers spend a great deal of unproductive time in meetings (Mintzberg, 1983; Mosvick and Nelson, 1987: Hymowitz, 1988). As a result, there is now a rapidly growing interest in using information systems technology to support group meetings (Richman, 1987). The Electronic Meeting System (EMS), a recent development in information systems technology, has been developed as a tool to improve meeting effectiveness and efficiency. An EMS is defined as:

> "an information technology-based environment that supports group meetings, which may be distributed geographically and temporally. The information technology environment includes, but is not limited to, distributed facilities, computer hardware and software, audio and video technology, procedures, methodologies, facilitation, and applicable group data." (Dennis, George, Jessup, Nunamaker, and Vogel, 1988)

An EMS is designed to support a variety of meeting tasks: communication, planning, idea generation, problem solving, issue discussion, negotiation, conflict resolution, systems analysis and design, and group document preparation and sharing (Dennis, et al., 1988).

This is an investigation of one class of EMS, a Group Decision Support System. A GDSS is an interactive computer-based system which combines communication, computer, and decision technologies to support the formulation and solution of unstructured problems by a group (Sprague, 1980; DeSanctis and Gallupe, 1987). Further, this is a study of idea generation and evaluation tasks with a GDSS. The purpose of this investigation is to develop a theory of anonymous group idea generation with a GDSS. Relevant research in social psychology and management information systems is discussed below. Two experiments on anonymity in idea generation are then presented.

The experiments presented below were designed to simulate actual use of a GDSS as closely as possible. GDSS configurations and uses vary from system to system, but, typically, personal computers are linked by a data network to a central file server. Users are typically decision makers from a variety of areas. In addition to the many industry users, groups using the Arizona laboratory have come from the University of Arizona (e.g., student, professor, and administrative groups), the Arizona State Legislature, Tucson-based Davis Monthan Air Force Base, and Indian Health Services. System use has certainly not been limited to "executives." Group members work simultaneously using decision support software for idea generation and evaluation, setting goals and objectives, evaluating alternative strategies, stakeholder analysis and assumption surfacing, and voting. A group of planners, for example, might address the question, "What should be the goals of the company over the next five years?", by first interactively generating and evaluating relevant ideas from their terminals. They might then rank the ideas they have generated and select one for further discussion. If a particular goal is selected, group members may decide to generate a list of pertinent stakeholders and their respective assumptions regarding the goal. The group might then work together using a text editor to formulate a policy statement regarding the goal. Most GDSSs contain numerous planning tools that can be used in various combinations.

GDSS use is growing quickly. Recent special issues of the Journal of Decision Support Systems and Management Information Systems Quarterly, devoted to GDSS, indicate that there is a strong interest in developing GDSS technology. Much previous work in the area has been directed toward systems design. As a result, several university and industry research teams are using such systems to support group work for executives (e.g., University of Arizona, University of Minnesota, EDS, MCC, Xerox Parc). The Arizona group, for example, has had over two hundred executive groups use their GDSS laboratories for a variety of strategic planning tasks (cf. Dennis, George, Jessup, Nunamaker, Vogel, 1988). Working with the Arizona group, one large multinational organization has implemented its own GDSS and uses it extensively for executive group work (Martz, 1989; Nunamaker, Vogel, Heminger, Martz, Grohowski, and McGoff, 1989; Heminger, 1988; Vogel and Nunamaker, 1988). Careful empirical research on the impact of the system on decision making processes is only now emerging (see DeSanctis & Gallupe, 1987; Jessup, 1987; Kraemer & King, 1988).

Claims of GDSS Advantages

Throughout the GDSS literature are claims that the technology will help groups become more efficient (see for instance, Huber, 1982; DeSanctis and Gallupe, 1987; Dennis, George, Jessup, Nunamaker, and Vogel, 1988). Basically, the tools provide a structure for a group's work process. The GDSS keeps the group on track, helping them to avoid the diversions that plague traditional meetings. Most software tools also provide parallel processing of inputs, thus enabling many users to interact simultaneously, which is impossible in a face-to-face meeting. The technology, by providing structure and parallel processing, thus allows more efficient interaction. Further, all ideas, comments, votes, everything typed in during the group's session, is automatically recorded by the computer system, thus providing a complete written record of the process.

Such technological efficiencies, however, may not be the most important GDSS advantage. GDSS use may change the interpersonal interaction itself. For example, GDSS interaction can be anonymous, so that a group of executive planners could begin their strategic planning by generating and evaluating ideas, each knowing that s/he will not be ridiculed for contributing what others might feel is a silly idea. Further, when evaluating other group members' ideas, the executive can do so freely, without deference to a powerful player's bad idea. In principle, the merit of others' ideas can be judged solely on the inherent worth of the idea, not on the reputation or rank of its proposer.

In this chapter, a new technology for group work was described. Examples of system use, and the advantages of such a system, were discussed. One system advantage, anonymity, is the subject of the next chapter. Literature from social psychology and management information systems are presented. Taken together, this research shows that the influence of anonymity on automated idea generation is not always helpful.

2. RELEVANT RESEARCH

The first chapter presented a new technology for group work, but stopped short of saying what we have learned through research about such systems. This chapter reviews relevant research, which, surprisingly, spans various disciplines. We begin with studies of non-automated group work. This research highlights the problems in group work, and the non-automated solutions offered to help groups work more efficiently. We then look to investigations of automated group problem solving. Unfortunately, a coherent theory of automated group work does not emerge. Finally, we turn to social psychological research on deindividuation. This research helps us to explain the effects of anonymity on automated group idea generation.

Previous Group Research

The claims of GDSS effectiveness discussed above are consistent with traditional thinking about group performance. For example, Steiner (1972) argued that group productivity can be reduced by faulty group process. Pressures to conform (e.g. Vroom, Grant, and Cotten, 1969; Maier and Solem, 1952; Asch, 1956), individual domination (e.g., Maier, 1950), status incongruities (e.g. Bridges, Doyle, and Mahan, 1968), excessive concurrence seeking (Janis, 1973), the mismanagement of agreement (Harvey, 1974), and a host of other potential process problems can adversely affect group outcomes. In GDSS design and implementation it has been implicitly assumed (see for instance, Nunamaker, Applegate, and Konsynski, 1987; DeSanctis and Gallupe, 1987) that the depersonalization offered by the system will help to combat these process losses. Anonymity, and in some configurations reduced proximity, will thus promote a free-flowing exchange of ideas and opinions. Similar arguments were presented for Nominal Group Technique (Delbecq, Van de Van, and Gustafson, 1975). With NGT ideas are listed on a chalkboard or flipchart in front of the group. Members are forced to cognitively separate authors from specific ideas and thus judge ideas on their merit, not on the influence of their authors. NGT also promotes idea generation through a structured sharing process where members take turns freely submitting an idea. Anonymous GDSS interaction provides the electronic analog to this.

GDSS Empirical Research

Hiltz and Turoff (1978) reviewed early computer-mediated communication research and suggested that such mediation produces a sense of impersonality. They proposed that anonymity and physical separation contribute to this depersonalization. The important question for GDSS researchers is whether the depersonalization found in computer-mediated communication systems in general will also be found in automated group problem solving.

A small number of GDSS laboratory and field studies have been conducted in recent years, most of them comparing the process and outcomes of groups using computer support with those of unaided groups. Laboratory experiments and field observations of groups using GDSS technology have found that use of a GDSS leads to more equal participation across group members (G. Easton, 1988; Zigurs, Poole, DeSanctis, 1988), higher levels of group member satisfaction (Steeb and Johnston, 1981; Adelman, 1984; Nunamaker, Applegate, and Konsynski, 1987; Vogel and Nunamaker, 1988) and higher quality group products (Steeb and Johnston, 1981; Adelman, 1984; Nunamaker, Applegate, and Konsynski, 1987; Gallupe, DeSanctis and Dickson, 1988; Vogel and Nunamaker, 1988). Gallupe et al., (1988), on the other hand, found that group members using a GDSS were less satisfied with the process than those using manual, face-to-face problem solving methods, perhaps because the groups using GDSSs generated more conflict during their sessions. Similarly, Hiltz, Johnson, and Turoff (1986) found that groups using automated technology were less likely to reach agreement on a problem solution.

This research suggests that GDSSs can in some cases improve group performance. The systems have been used for a variety of tasks (e.g., idea generation and evaluation, stakeholder analysis and assumption surfacing, voting) and have been reported to reduce meeting time in field settings (see, for example, Nunamaker, Grohowski, Heminger, Martz, and Vogel, 1988; Vogel and Nunamaker, 1988). However, the systems are not helpful in all situations or for all problems (see, for example, recent empirical investigations by A. Easton, 1988; Watson, DeSanctis, and Poole, 1988, and Jarvenpaa, Rao, and Huber, 1988, which provide mixed support for the usefulness of the technology). Turoff and Hiltz (1982), for example, found no difference in decision quality between computer aided and unaided groups, and Watson, DeSanctis, and Poole (1988) found that computer aided groups performed worse than unaided groups. Further, group member satisfaction results are similarly mixed. It is thus not clear what specific system features influence group interaction and outcome, and in what directions. Thus, it may be more productive to move beyond what Gutek (1989) referred to as a simple, first generation research strategy for automated systems, and now manipulate specific aspects of the system and observe subsequent effects on group process and outcome.

A Theory of Anonymous Interaction

Our own experiences with anonymity show that this investigation is useful. One can readily think of examples of anonymous interaction - confidential surveys, anonymous crime reporting phone numbers, formal religious confessions, and the blind review process for academic journals. Even as early as 1514, Nicholas Copernicus, a Polish priest, circulated his cosmological model anonymously for fear of being branded a heretic by his church. These examples suggest that anonymity has a powerful influence on interaction process and outcomes.

Research on GDSS anonymity is important, but where would this research lead? More appropriately, where would such a research program begin? A comprehensive theory of GDSS should at least include those technological aspects touted as GDSS advantages: structuring, parallel processing, and provision of a complete written record. Anonymity of interaction in a GDSS is, so far, the least studied aspect of the technology. Only recently has a theoretical model of anonymity in automated group work been proposed (Valacich and Jessup, 1989; see Figure 1). This theory describes the factors (e.g., group member proximity) that create anonymity, but it says little about the motivation of the participants. Are they motivated? Are they committed to the task? Knowing this would help us to predict their behavior when they interact anonymously. The model thus does not help us predict the effects of anonymity on group process and outcome.

For a better explanation of the effects of anonymity on behavior we must turn to social psychological research. In the following section, research on deindividuation and social loafing is reviewed, and three experiments involving anonymity in automated groups are summarized.

Festinger, Pepitone, and Newcomb (1952) suggested that in some situations individuals in groups act as if they were "submerged in the group" (p. 382). They stop thinking of other members as individuals and feel that they can not be singled out by others. This "deindividuation" results in a reduction of normal inner restraints and enables group members to engage in behavior that they would not ordinarily display. Latane's social impact theory (1981) and Milgram's studies of obedience to authority (1965) provide evidence that the lack of close social contact can lead to deindividuation. Social impact theory tells us that the immediacy of others will influence our behavior. Milgram's studies highlight the negative effects of immediacy, or lack of immediacy, in prompting abnormal behavior.

Zimbardo (1970) showed that anonymity can contribute to deindividuation. He found that subjects who were made to feel anonymous (by wearing identical white coats and hoods) delivered longer electric shocks to others than did subjects who were visible and wore large name tags. Diener, Fraser, Beaman, and Kelem (1976) secretly observed over thirteen hundred Seattle children trick-or-treating. Experimenters greeted children, invited them to "take one of the candies," and then left the room. Anonymous children were more than twice as likely to take extra candies than were those who had been asked their name and address.

Studies of social loafing (Williams, Harkins, and Latane, 1981; Kerr & Bruun, 1981) suggest that identified group members generally exert greater physical effort than those working anonymously. Weldon and her associates (Weldon & Mustari, 1988; Weldon, Mustari, & Brett, 1989) found that anonymity reduced cognitive effort in a parallel "cognitive loafing" paradigm. These studies suggests that anonymity is an important antecedent to deindividuation, but highlight only its negative aspects. Deindividuation can also produce positive group effects. Festinger, et al., (1952) noted that deindividuation lessens inner restraints and thus permits group members to satisfy needs that they cannot satisfy otherwise. Gergen, Gergen, and Barton (1973) provide further evidence of the positive impact of deindividuation in encouraging openness, in this case seen as intimacy and playfulness. The common examples of anonymous interaction provided above - confidential surveys, anonymous crime reporting phone numbers, formal religious confessions - corroborate the potential.

Anonymity helps to reduce inner restraints on behavior by weakening immediate external social controls. For a work group using an automated decision support system, anonymity may thus enable members to engage in behavior that they might not display under ordinary "identified" circumstances. Such reduction of control may be positive or negative. For example, a member may, when anonymous, contribute a risky but good idea or key comment that s/he would not otherwise contribute. On the other hand, anonymous group members might be overly caustic in their evaluations or "free ride" on the efforts of others. The general prediction, then, is that anonymity will foster deindividuated behavior since the system buffers group members from each other and detaches individuals from their contributions. The subsequent effects on group outcome are uncertain, however, since group member behavior may be either positive, negative, or both. The model proposed by Valacich and Jessup (1989; see Figure 1) describes the factors that will influence anonymity, but it does not help us predict whether outcomes will be positive or negative. Whether anonymity's influence is, in total, positive or negative is an open empirical question. Three experiments addressing it will be summarized below.

Three Studies of Anonymous Idea Generation Using a GDSS

What is the impact of GDSS technology on the way that group members work together and on the outcomes that they achieve? Specifically, what are the effects of anonymous GDSS interaction on group process and outcome? Very little empirical research has been conducted addressing this issue. Three exceptions are research by Jessup and his colleagues (Jessup, Connolly, and Galegher, 1989; Jessup, Tansik, and Laase, 1989; Connolly, Jessup, and Valacich, 1989). These studies are discussed below. The first and second studies will be summarized briefly. The third study, an integral part of this investigation, will be discussed in greater detail. Detailed discussions of each of the laboratory experiments summarized here can be found in the original papers. For these studies, Jessup and colleagues assumed that, given a task of interest and importance, anonymity would have a positive impact on group process and outcome. They reasoned that anonymity would promote deindividuation and enable group members to interact freely and honestly.

Study 1 and 2: Anonymity and Proximity

The GDSS used for the first and second experiment was the PlexCenter, one of two systems available through the University of Arizona, Department of Management Information Systems (Applegate, Chen, Konsynski, and Nunamaker, 1987; McIntyre, Konsynski, and Nunamaker, 1986). The system hardware at the PlexCenter includes sixteen interactive workstations in a U-shaped configuration, plus four others, each in a private room. The system is managed by a group facilitator stationed at the front of the room using a separate workstation and a file server. Software includes IBM PCNetwork and an electronic brainstorming program which enabled group members to electronically generate and evaluate ideas and comments simultaneously and anonymously.

Students from an upper-division, core business school Organizational Behavior course served as subjects for these experiments. They were primarily seniors in their early - to mid-twenties. They worked in groups of four members and used the electronic brainstorming program to generate and evaluate workable solutions to the university's parking problem. Anonymity was manipulated through a system program that either attached user names to each comment or left comments unidentified. Subjects in the identified condition could clearly see that their names would be attached to every comment they typed in, and seen with their comments by other group members. Subjects in the anonymous condition could clearly see that all contributions were completely anonymous. Subjects worked on a sample problem for ten minutes to familiarize them with the system. They then worked for 30 minutes on the parking problem task, completed the post-experimental questionnaire, were debriefed and released.

The electronic brainstorming program merges and saves all comments in a text file. Group output was measured by content coding the group's text file after the session, a process-tracing method similar to that proposed by Todd and Benbasat (1987). Raters reviewed a hard copy of the text file, coding each comment as a proposed solution, critical argument, supportive argument, question about solution, or one of the other comment categories (see Appendix A). Two independent codings were generated and compared as a test of coding reliability.

In the first study (Jessup, Connolly, and Galegher 1988), work groups interacted in either an anonymous or identified condition. Group members working anonymously generated more solution clarifications, more critical comments, more questions about solutions, and more total comments than groups working under identified conditions. Though there was no significant difference in the number of ideas generated, a central performance measure, this study suggested that anonymous interaction with automated group support may be beneficial in promoting a free-flowing exchange of ideas and opinions.

In the second study (Jessup, Tansik, and Laase 1988), a 2 X 2 factorial design was used. The first factor was anonymity: group members were either unidentified or identified. The second factor was proximity; group members were either face-to-face in the same room or dispersed to separate private rooms out of sight of each other.

Group members working anonymously, and those working under dispersed conditions, generated more total comments and more critical comments than those working either identified or in the same room. Members working in the same room were generally more satisfied with the session than those working in separate rooms; those working anonymously thought their problem solving session was more effective than did members working in the identified condition.

As in the first experiment, this study suggests that different configurations of the system promote different problem solving approaches. Group members buffered from each other by either anonymity or physical separation tend to be more critical and generate more comments. Further, groups working under anonymous and dispersed conditions generated the most, and shortest, comments, while groups working under identified and face-to-face conditions generated the fewest, and longest, comments.

Conclusions and Implications

There is some convergence among these experiments. They indicate that when group members interact anonymously using automated decision support they tend to be more critical, more probing, and more likely to generate comments and embellish ideas then individuals whose contributions are identified. This is consistent with the "deindividuation" explanation presented above. The second study indicates that proximity operates much like identification; as with anonymous group members, those who are physically separated tend to be more expressive than those working in the same room. Anonymity appears to be a significant variable in idea generating GDSS groups.

The management of anonymity offers some interesting strategies for the practitioner. A manager could, for example, treat anonymity as an on/off switch, switching it on for problems requiring the identity of the individuals (e.g., a panel whose members have expertise in disparate areas) and switching it off for problems where anonymity is better (e.g., open brainstorming in mixed status groups or delicate problems where anonymity would promote openness).

These experiments have limitations. They have used only student subjects and replications with other groups and problems are needed. These investigations could be conducted in the same GDSS facilities or, better yet, with similar facilities constructed in existing organizations. New studies are needed to answer questions such as why anonymity leads to higher levels of group effort under GDSS conditions but decreased effort in social loafing studies. Is, perhaps, task commitment the key moderating influence? Further, if different configurations of the system lead to different problem solving approaches, under what task and group conditions would we want which configurations? Can we develop a contingency theory of appropriate task, group, and system configurations? Finally, though anonymity promoted expressiveness and, in effect, had a positive effect on group interaction, anonymous groups did not generate significantly more ideas than identified groups. Perhaps the anonymity manipulation in these two studies, though it led to significant effects on group process, was not strong enough to influence idea generation. It is difficult to get a strong sense of anonymity in the intimate, "boardroom" GDSS facility, where these relatively small (four person) groups worked by themselves.

Study 3: Anonymity and Evaluative Tone

The third study (Connolly, Jessup and Valacich, 1989) investigated the joint effects of anonymity and evaluative tone on group process and outcome. A different, larger, GDSS facility was used, allowing four, four-person groups to work simultaneously.

Observations of executive groups using GDSS technology, and of on-going non-automated work groups, suggested that anonymity would be most important in the context of the group's evaluative atmosphere. Connolly, et al., proposed a "Balance of Forces Model" (see Figure 2) to explain the balance of creativity enhancing and creativity stifling forces that act upon an individual presenting ideas to a group. When working with others, an individual receives encouragement, stimulation, reward, and other such forces which enhance creativity. However, interruptions, critical evaluation and conformity pressures, other artifacts of group work, can stifle creativity. Further, a group member may loaf and let the others do the work. Guided by the social psychological literature on deindividuation, and by research suggesting that a positive evaluative atmosphere would enhance group problem solving (see for instance, Osborn, 1953; Rogers, 1954; Haefele, 1962; and Guilford, 1975), Connolly, et al., hypothesized that groups working anonymously, and those working with a supportive evaluative tone, would generate more ideas than would identified groups, or groups with a critical evaluative tone.

Methods

Subjects

Seventy-two upper-division business students satisfying a course requirement served as subjects. They were drawn from a very large (300 plus) class, so few of them were acquainted with each other before the experiment. They were randomly assigned into one of four conditions in a 2 (anonymity) x 2 (evaluative tone) design.

Task and Equipment

As in the two experiments described above, subjects generated and evaluated solutions for the campus parking problems using an electronic brainstorming program. Subjects worked in groups of four (three naive subjects plus one confederate, see discussion below). The GDSS used was the Enterprise Classroom, one of two systems available through the University of Arizona, Department of Management

Information Systems (see McIntyre, et al., 1986; Applegate, et al., 1987; and Dennis et al., 1988). The installation includes twenty-four workstations set up in two arcs, one of ten workstations and one of fourteen, each facing the facilitator's station at the front of the room. A Novell data network is used.

Manipulations

The anonymity manipulation was identical to that used in the two experiments described above, except that in this experiment the GDSS was logically partitioned into four independent networks so that four separate groups could work simultaneously. Though group members were identified and initially introduced to each other in this experiment, the environment was much less intimate than that in the first two studies. In those studies, only one four-person group worked at a time, and in a much smaller room. In this sense, anonymity may have been slightly different. Evaluative tone, either critical or supportive, was manipulated with the aid of confederates who posed as regular subjects. In the "Supportive" conditions confederates typed in standardized comments such as "Good idea," and "I think that would work." In the "Critical" conditions, the list contained such remarks as "Bad idea," and "This is a terrible alternative."

Data Collection and Analysis

After completing the parking problem task, subjects answered questions designed to gauge their understanding of the manipulations and determine their perceptions of the GDSS session. As in the first two experiments, two independent judges evaluated the solutions and other comments evaluated by the group members, coding for comments such as unique, workable ideas, questions about the problem, questions about proposed solutions, and critical comments. Inter-rater reliabilities were found to be adequate. Analysis of variance was used to test the hypotheses.

Findings and Discussion

Group members generated the most output (whether measured by total file size, number of identifiable comments, or number of goal-directed proposals) when anonymous to one another, and when the evaluative tone of the group was critical rather than supportive. However, subjects reported themselves as more satisfied with the group's process and outcomes when the evaluative tone was supportive rather than critical, and tended to report in the same direction when they were identified rather than anonymous. Self ratings of effectiveness tended to follow the pattern of the satisfaction measures, leading to a very marked inverse relationship between objective and subjective measures of output.

These results corroborate those of the first two experiments; when group members interact anonymously using automated decision support they tend to be more critical, more probing, and more likely to generate comments and embellish ideas than individuals whose contributions are identified. Further, in contrast with the earlier studies, anonymous groups produced more unique, workable ideas than did identified groups.

These data support Huber's warning (1988: 331) that subtle differences in GDSS technologies may have important effects. The anonymity manipulation in the first two experiments had modest effects on process, and no significant effects on output, compared to Experiment Three. Experiment Three used the same software used in the earlier experiments, but in a larger room in which multiple groups ran simultaneously. This change of setting apparently allowed a more complete anonymity than was achieved in the smaller lab, where only four subjects participated at a time. Strict anonymity may not be achievable in systems such as those studied by Gallupe, DeSanctis & Dickson (1988), which rely on face-to-face groups supplemented by computer support, or in real-world groups where members might know each other well enough to be able to identify contributions even without labeling. The effect of such partial anonymity offers interesting research questions.

An important theoretical issue raised by the findings of Experiment Three is the relative role of motivational and cognitive processes in determining group outcomes. It is difficult to construct a purely motivational explanation for the finding of highest output (and thus, presumably, highest effort) in the anonymous/critical condition. It is plausible that critical feedback stimulated further idea generation and evaluation while supportive feedback implied acceptance and signaled task completion. In any event, a hybrid model involving mutual stimulation and other cognitive processes as well as simple effort will be required. The issues raised thus tap central issues in modern social psychology (e.g. Nisbett & Ross, 1980) as well as more immediate technological issues.

An important measurement issue is raised by Experiment Three, where objective and subjective measures of system performance were clearly contradictory. This calls into question the common use of self-report measures to evaluate system performance (see for example, Lucas, Stern, Walton, and Ginzberg, 1988; Magal, Carr, and Watson, 1988; DeLone, 1988; White and Christy, 1987; Necco, Gordon, and Tsai, 1987; Millman, and Hartwick, 1987; Nelson, and Cheney, 1987; Mahood, 1987). This apparent dilemma parallels the common finding that self-report measures of job satisfaction are rarely correlated to hard measures of job performance. In an extensive meta-analysis of relevant studies, Iaffaldano and Muchinsky (1985) found the relationship between job satisfaction and job performance, aggregated across studies, to be relatively low (+.17). If the finding within the present experiment - that subjective and objective measures of system performance are contradictory - is indeed representative of systems at large, it suggests that managers and organizational scientists may be erroneously investing in bad systems and bad theory. Given the potentially dire implications of this finding, subsequent replications are necessary.

Though measures of quality were used in the third experiment, statistically significant differences between groups were found for quantity measures only. The investigators postulated that quantity of unique, workable ideas (total number of ideas less redundancies and frivolous ideas) generated by the groups was an adequate measure of group performance. This seems appropriate given the implicit purpose of the brainstorming tool to help groups generate as many usable alternatives as possible. This focus on quantity does not necessarily ignore solution quality entirely, in that only unique, workable ideas were included in the dependent measure of idea quantity. Further, Diehl and Stroebe (1987), in a recent review of the brainstorming literature, provided strong evidence that quantity and quality of ideas generated in brainstorming are often highly correlated. Thus, quantity of unique, workable ideas appeared to be a sound first-cut measure.

Finally, the third experiment suggests further opportunities for the management of group problem solving. Managers might manipulate the evaluative tone within the group by injecting either a supportive or critical tone.

The research discussed above leads us to one simple conclusion; anonymity is a necessary part of a whole theory of GDSS. Unfortunately, we know little about the nature of anonymity. The model of Valacich and Jessup (1989) gives us hints about what creates anonymity. The Connolly, et al., (1989) model helps explain the balance of social forces operating on an individual in idea generation and evaluation, the forces that can either enhance or stifle an individual's idea generation. Empirical tests of the effects of GDSS anonymity suggest that anonymity enhances idea generation. Anonymous groups produce more comments and ideas than do identified groups. This evidence fits with the GDSS literature and our common sense. However, this research directly contradicts research in cognitive and social loafing which suggests that, given the right conditions, individuals working anonymously loaf. A theory of GDSS anonymity should help us explain this disparity. Why does anonymity operate differently in the two paradigms? When can we expect anonymity to have favorable effects on participants, and when will the effects of anonymity be unfavorable? Knowing this would strengthen the Valacich and Jessup theory. Perhaps the answer actually lies in the factors which create anonymity. Knowing this would strengthen the Connolly, et al., theory. We might be able to predict which way the balance of forces will swing, and explain the role of anonymity among the forces operating in idea generation. In the following section, a theory of the effects of anonymity on idea generation is presented. The theory explains why anonymity effects may sometimes be favorable or unfavorable. Two experiments testing this theory are presented.

3. TWO FURTHER EXPERIMENTS ON ANONYMITY

What is it that can turn anonymous group problem solving from its dark side - group members loaf and let others do the work, or, perhaps, engage in overly caustic interaction - into a productive problem solving session where key issues are dealt with openly and honestly and all members participate equally? One could induce sanctions on overly caustic remarks or reduced participation by offering local anonymity while later tracing group member comments to their original authors. Indeed, this is possible with a GDSS. But we would ultimately destroy anonymity for that group and abate any of the potential positive effects it may have on group process and outcome. It is proposed here that the answer lies not in the technology but in the nature of the work itself. The individual's interest in and commitment to the task will determine the outcomes achieved under anonymous interaction. Research on creativity supports this view that task commitment influences output. Creativity research suggests that people are most creative when they are intrinsically motivated; that is, people will be most creative when they feel motivated primarily by the interest, enjoyment, satisfaction, and challenge of the work itself - not by external pressures (Amabile, 1983; 1988; Hennessey & Amabile, 1988). Shalley (1989) proposed that thinking creatively requires a great deal of mental effort. In order to be creative, individuals thus have to be inherently interested in the task and motivated to find a solution (Steiner, 1965; Barron, 1965).

Though social psychological research on loafing and GDSS research share one important variable, anonymity, the two paradigms are different in their assumptions about task commitment and, consequently, their research approach. Loafing research attempts to identify and explain circumstances under which individuals will reduce their effort. The perspective is that individuals will, if given the chance, loaf. This perspective is fundamentally different than that in the GDSS literature, where individuals are assumed to anxiously await participation. Anonymity is thought to free them up to give their input. As such, the tasks used in these two paradigms are different. To simulate loafing, social psychological studies use tasks for which reduced effort is likely. To simulate executive problem solving, GDSS studies use tasks for which group member commitment is high. Effective loafing tasks should therefore be meaningless or aversive. On the other hand, effective GDSS tasks should be interesting and important to the subjects. This task contrast is reflected in loafing and GDSS experiments. Weldon, et al., (1989) had student subjects evaluate eighty part-time job descriptions, a repetitive, tedious task.

Here subjects tended to reduce their cognitive effort when anonymity allowed them to do so. Connolly, et al., (1989), in contrast, had student subjects generate and evaluate solutions to the campus parking problems at their University, a relevant, motivating task in which anonymity promoted idea generation and evaluation. Research from these two paradigms suggests, then, that for less interesting, less important tasks anonymity leads to reduced effort, while for more interesting, important tasks anonymity leads to increased effort. It is correct, logically, to say that the effects of anonymity on output are moderated by the individual's commitment to the task. However, we also say something about the individual's propensity to act, to utter an idea or opinion, and about the joint effects of anonymity and task on that individual's action. For individuals faced with a task that is neither interesting or important, the propensity to act is weak. They act only when forced to do so. Anonymity thus serves as a place to hide, masking the individual's effort, or, more appropriately, masking the lack of effort. With tasks that are interesting and important, the individual's propensity to act is strong. They are held back only by the fear of embarrassment or sanction for an ill-received remark. Anonymity is a shield enabling them to speak safely. Task thus helps us to explain the individual's motivation to act, and, more importantly, whether anonymity will conceal the reduced effort of a loafer or shield the guarded effort of an eager participant.

One alternative explanation of the difference between the Connolly and Weldon investigations is that Connolly's subjects had more task-related ability than did Weldon's subjects. It is possible that Connolly's subjects knew more about their task, generating solutions for the campus parking problem, than did Weldon's subjects evaluating college work study job descriptions. Weldon's anonymous subjects thus loafed because they had little knowledge of the task, while Connolly's subjects had more to say about the parking issue. Students may know more about the parking situation on their campus than they do about college work study jobs, but it is more plausible that their motivation to speak out on either issue is driven more strongly by their perceived importance of the problem rather than the amount of task-related knowledge they have.

The general question guiding this research is, "what are the effects of anonymity on idea generation and evaluation in automated group work?" Specifically, we must bridge the gap between loafing and GDSS research. To do this, we might design an experiment testing the joint effects of task commitment and anonymity on GDSS idea generation, but it is not clear how we would operationalize task commitment. Should we focus on commitment to the task, the group, or the rewards that effort may bring? Perhaps we should manipulate the fear of sanctions on reduced effort. A more reasonable first step is to replicate the Weldon et al., (1989) cognitive loafing study, but using the parking problem task from Connolly, et al., (1989) in place of the job evaluation task. It is hypothesized that with this more important and interesting task, subjects will increase, not reduce their effort under anonymity.

The new studies use the same parking problem task as Connolly et al., (1989), but differ in technology and interaction. The technology used in the Connolly, et al, investigation was much more sophisticated and expensive, and may have induced an air of seriousness in the subjects beyond that of Weldon's subjects. Further, subjects interacted while Weldon's subjects worked alone. (They were instructed that their individual efforts would later be combined with those of other group members.) Peer pressure from direct interaction may have influenced participation patterns. These experiments, therefore, are a test of only one of three potentially important differences between these studies, the nature of the task performed.

Method

Weldon manipulated separately two components of anonymity, which she referred to as "identifiability" and "accountability", operationalized by whether or not the subject was asked to type in his or her name (identifiability) and telephone number (accountability). It was determined, and pilot testing confirmed, that the distinction was a strained one: What, for example, was the subject to make of a request for a phone number, but not for a name? We therefore collapsed these two components, asking "identified" subjects for both name and phone number, "anonymous" subjects for neither. We manipulated the second dimension, individual or shared responsibility for output, as did Weldon, by telling the subjects that their output either would or would not be pooled with that of several other subjects. Details of these manipulations are given below.

We conducted two studies. In Study 1, subjects were allowed to leave whenever they wished. In Study 2, they were required to work on the task for 30 minutes. The procedures were otherwise identical. Seventy-one subjects participated in Study 1, 80 in Study 2.

<u>Subjects</u>

Undergraduate business students participated in this experiment to fulfill a course requirement. They were randomly assigned to one of four conditions in a 2 (identifiability) x 2 (shared responsibility) design. In

Study 1, cell sizes of 17, 17, 18, and 19 were achieved. Cell sizes for Study 2 were 20 each.

Task and Equipment

Subjects were asked to generate as many good ideas as possible to solve the University's parking problem, and were given as much time as necessary to complete the task. Connolly, et al., (1989;p. 15) note that this issue generates "high involvement in student subjects, draws on their personal knowledge, and has been extensively explored by other researchers (see Gettys, Pliske, Manning, and Casey 1987)." As in Weldon's study, subjects in this experiment completed this task individually on microcomputers. Subjects in Weldon's experiment worked in groups of up to twenty in a single microcomputer laboratory. In this study, subjects worked in groups of up to eight in separate rooms, the maximum possible in the micro computer laboratory available for this experiment.

Manipulations

As in Weldon's experiment, instructions were given both verbally by the experimenter in a group briefing and as written instructions on each subject's computer screen. Subjects in the identified conditions heard and read the following instructions:

> "We are keeping the names of students who participate in this study and recording the ideas they generate. Please give us your full name so that we will know which responses are yours."

"We may want to contact you later to ask you to explain your ideas. We will want to know more information about the solutions you proposed. Please give us your phone number so we can call you sometime soon."

Subjects in the anonymous condition read the following instructions:

"It is our policy to keep all information anonymous. We cannot identify your responses or associate them with you in any way."

To manipulate responsibility, subjects were led to believe that they were either working alone to generate solutions to the campus parking problem or that they were one of sixteen subjects generating solutions. Students in the solo responsibility condition read the following instructions:

"Although many students will participate in this study, you alone are responsible for generating workable solutions to the campus parking problem. Try to do your best."

Subjects in the shared responsibility condition read the following instructions:

"You are one of 16 students working together to generate ideas to solve the campus parking problem. As soon as you are finished generating ideas, your output will be combined with that of the others to form a combined list of ideas. Thus, you and 15 other students share responsibility for the parking problem task. Try to do your best."

Data Collection and Analysis

Manipulation checks:

After completing the parking problem task, subjects responded to questions designed to gauge their understanding of the manipulations and determine the extent to which they thought the task was important and interesting. To check the identifiability manipulation, subjects were asked the following questions:

1. Were you asked to type in your name and phone number? (Y or N)

2. Will the experimenter be able to identify your comments apart from the comments of the other students? (Y or N)

3. Will the experimenter be able to contact you later to ask you about your ideas? (Y or N)

To check the responsibility manipulation, subjects were asked the following questions:

1. How many other students were assigned to work on the same problem that you worked on? (Please type in one number between 0 and 20) Note: We are not asking how many students came here today to participate in this study. Further, we are not asking how many worked with you in your room.)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20

2. Will your ideas be combined with other people's ideas or will your ideas be kept separate? (Please type in one of the following)

(C) Combined with others.
(S) Kept separate.

To test assumptions about the subject's interest in and perceived importance of the task, the following questions were asked:

1. How important is the problem you worked on

to life here at the University of Arizona?

1 2 3 4 5 6 7
not important at all — very important

2. How important did you feel it was for you to generate solutions to help solve this campus problem?

1 2 3 4 5 6 7
not at all important — very important

3. How useful were the ideas you generated to help solve this campus problem?

1 2 3 4 5 6 7
not useful at all — very useful

4. How much did you enjoy this task?

1 2 3 4 5 6 7
didn't enjoy it at all — enjoyed it very much

5. How hard did you work on this task?

1 2 3 4 5 6 7
not at all hard — very hard

Dependent Measures:

Several measures of each subject's output were used: the time spent performing the task; the byte size of the subject's text file of comments; the total number of comments generated; the total number of unique, workable ideas generated (i.e. total solutions minus redundancies and frivolous ideas); and the quality and rarity of the ideas generated.

The coding scheme used to evaluate solutions was identical to that used in the Connolly, et al., (1989) experiment. Raters classified subjects' comments into one of several comment categories (e.g., proposed solution, question about a solution, critical comment, critical argument, etc.). A description of comment categories is provided in the Appendix. Two raters made independent codings of each output file. Each rater first reviewed a paper transcript of the file, parsing it to indicate what he judged to be separate comments. The rater then assigned to each of these parsed units a code from the comment descriptions described in the Appendix. After completing these codings independently, the two raters met and discussed both parsings and codings to consensus.

Quality and rarity measures followed those used by Connolly, et al., (1989). Three senior employees from the campus Department of Parking and Transportation Services independently evaluated all items on the master list of alternatives, giving their judgments of the extent to which each was a workable and creative solution to the campus parking problem. Ratings were given on 7-point scales anchored at 1 (a very poor solution) and 7 (a very good solution). These ratings were averaged to form a simple scale of solution quality. Cronbach's alpha for this scale was 0.83. A measure of solution rarity was generated by counting the number of times each solution was proposed in the entire pool of responses, and computing the reciprocal of this count (cf. Diehl and Stroebe, 1987). A solution proposed only once thus had a rarity score of 1.0, with scores approaching zero for the commonest ideas.

Analysis:

In cases where outcome measures are related a Manova is often advocated as the starting point for data analysis. The overall multivariate effects can then be decomposed to focus on specific relationships. Here we have little a priori evidence that our dependent variables are related to each other. Indeed, there are no published studies in the GDSS literature that use a research design, methods, variables, or level of analysis such as those used in this investigation. Surveying a broad sampling of psychological investigations, Huberty and Morris (1989) showed that an approach using a series of multiple univariate tests is most appropriate for exploratory investigations of this type. Anova was therefore used to test the hypotheses.

4. RESULTS

Study 1

Means, standard deviations, and intercorrelations for all dependent variables are provided in Tables 1 and 2.

Content Coding: The content coding process resulted in a mean of 8.3 coded units per individual. The reliability of this process was assessed by recording the number of times the raters changed either parsings or codings in reaching their consensus. The parsing phase was successful; one rater changed an average of 0.3 parsings per file, the other 0.2, in arriving at agreement. There was thus initial agreement on over 95% [(8.3 - 0.3 - 0.2) / (8.3)] of the parsings of the files. The coding of these units is more difficult to assess. A change of parsing (changing the point at which one comment is thought to end and the next is thought to begin) generated at least one, and more often two, changes of codings, as when a single remark is cut to produce two new units. In total, the first coder recorded a mean of 0.8 coding changes per file in reaching consensus, the second 0.4 per file. To obtain a true measure of interater reliability for coding one must consider coding agreement while controlling for those coding changes caused by a change in parsing. Assuming only one coding change per parsing change yields an estimate of over 90% initial coding agreement {[8.3 - [(0.8 - 0.3) + (0.4 - 0.2)]] / (8.3)}, while two coding changes per parsing change indicates over 95% coding agreement {[8.3 - [[0.8 - 2(0.3)] + [0.4 - 2(0.2)]]] / (8.3)}. Both parsing and coding thus appear to have achieved adequate interater reliabilities.

Manipulation checks: Responses to the postexperimental questionnaire showed that the manipulations were understood by the subjects. All subjects in the Shared Responsibility condition reported that other subjects would be assigned to work on the same problem. 19 subjects in the Shared Responsibility condition (52.8%) reported that 15 others would work on the same problem, and 17 subjects (47.2%) reported that 16 others would work on the same problem. Apparently all believed that they shared responsibility for the problem they worked on, but were confused as to whether the question about responsibility included themselves ("how many work on this problem?") or not ("how many others work on this problem?"). A similar pattern was observed for subjects in the Solo Responsibility condition. 24 subjects (68.6%) reported that no other students worked on the problem, while 11 subjects (31.4%) selected 1 as their response. Apparently all subjects in this condition believed that they carried the burden of responsibility for the task they worked on, but were confused as to whether the question asked "how many were assigned to this task?"

or "how many others were assigned to this task?". Weldon found a similar pattern in her manipulation check data. On the second manipulation check for responsibility, all subjects in the Solo Responsibility condition thought that their ideas would be kept separate from other people's ideas, and all subjects in the Shared Responsibility condition thought that their ideas would be combined with the ideas of others.

All subjects in the Identified condition correctly reported that they were asked to input their name and phone number, and all in the Anonymous condition correctly reported that they had not been asked. Over 97% of the subjects in the Identified condition believed that the experimenter could identify their comments apart from the comments of other subjects, and that the experimenter could contact them later to ask them about their ideas. 92% of the subjects in the Anonymous condition believed that the experimenter could not identify their comments and 94.6% believed that the experimenter would not be able to contact them later.

Means, standard deviations, and intercorrelations for "Importance" measures are provided in Tables 3 and 4. Means for each of the five questionnaire items tapping task importance are above the mid-point on the seven-point scale used. There were no significant differences between experimental conditions on these items. It thus appears that the problem was at least moderately important and interesting to all subjects.

Means and standard deviations for all dependent variables (by groups) are provided in Tables 5 and 6. In the first experiment, when subjects could leave at their discretion, subjects in the identified condition spent nearly 50% more time working on the task than did subjects in the anonymous condition ($F = 14.190$, $P < 0.00$). Identified subjects also typed more, as indicated by the byte size of their files, than did the anonymous subjects ($F = 2.879$, $P = 0.094$), though this is only marginally significant. There were no significant main effects for the responsibility manipulation on time spent or file byte size.

It thus appears that subjects in the identified condition stayed longer and typed more than did subjects in the anonymous condition. The extent of the identified subjects' increased effort stops there, however. There were no significant differences between experimental conditions on the other measures of output: total number of comments; number of unique, workable ideas; idea quality or idea rarity. We must reject the hypothesis that subjects working anonymously will produce more output than will subjects who are identified.

Study 2

Means, standard deviations, and intercorrelations for all dependent variables are provided in Tables 7 and 8.

Content Coding: The content coding process resulted in a mean of 9.7 coded units per group. There was thus initial agreement on over 98% of the parsings of the files. Assuming only one coding change per parsing change yields an estimate of over 94% initial coding agreement, while two coding changes per parsing change indicates over 96% coding agreement. Both parsing and coding thus appear to have achieved adequate interater reliabilities.

Manipulation checks: Responses to the postexperimental questionnaire were identical to those in Study 1 and showed that the manipulations were understood by the subjects.

Means, standard deviations, and intercorrelations for "Importance" measures are provided in Tables 9 and 10. Means for each of the five questionnaire items tapping task importance are above the mid-point on the seven-point scale used. It thus appears that the problem was important and interesting to subjects.

Means and standard deviations for dependent variables (by groups) are provided in Tables 11 and 12. In the second experiment, with time controlled and all subjects spending 30 minutes working on the task, the pattern of behavior changes dramatically from that of the first experiment. Subjects in the solo responsibility condition expend more effort, whether measured by file byte size ($F = 11.085$, $P = 0.001$), total number of comments ($F = 17.016$, $P = 0.000$), or number of ideas ($F = 17.016$, $P = 0.000$), than do subjects who share responsibility for the task. There are no main effects for identifiability on these three output measures. Summed idea quality and rarity follow this same pattern ($F = 8.527$, $P = 0.005$; $F = 7.942$, $P = 0.006$, respectively), with subjects in the solo responsibility condition outscoring subjects who share responsibility. (Note, however, that scores for summed idea quality and rarity are driven by number of ideas, and are thus, likely to mirror the pattern for this variable.)

The only deviation from this pattern is for measures of solution rarity. Identified subjects scored higher on summed idea rarity ($F = 4.167$, $P = 0.045$), and on average rarity of their ideas ($F = 6.476$, $P = 0.013$) than did anonymous subjects.

These data force us to reject the hypothesis that anonymous subjects produce more output than identified subjects.

Discussion

In Study 1, subjects understood the manipulations, but thought the task was of only moderate importance. Identified subjects were compelled to stay longer and, possibly, type more than did subjects who were anonymous.

Identified subjects inputted their name and phone number and were directly accountable for their work, and thus expended at least a passable level of effort. Anonymous subjects, with fewer social controls to constrain them, expended much less effort, leaving earlier and typing less than did identified subjects. Ultimately, there were no differences between the experimental conditions for the number of unique, workable ideas produced. The average number of ideas generated was between 8 and 9 for all cells. Apparently, the motivation for identified subjects to stay longer had no effect on the number, quality, or rarity of ideas they generated.

These data suggest loafing, though not pure social loafing, as one would expect to see main effects for the responsibility manipulation. It is likely that in this simple setting, where subjects can leave at their discretion, issues of responsibility never surface. Subjects want to leave as soon as they can, and do so unless constrained by identification. Identified subjects at least stay longer, and may type more, but their subsequent output is no better than that of their hurried anonymous counterparts.

As did subjects in the first experiment, subjects in Study 2 understood the manipulations, but thought the task to be of only moderate importance. These subjects, forced to work for 30 minutes, produced more bytes, comments, and ideas on average than did subjects in the first experiment, and, as a result, scored higher on each of the five post-experimental questionnaire items measuring task importance. (See Table 3 and 9. Two of the five task importance measures were statistically significant: Item 2, "Input Necessary", F = 3.004, P = 0.085; Item 4, "Enjoy Task", F = 11.513, P = 0.001) This was not enough motivation, however, to overcome the temptation to loaf. Apparently, these subjects, resigned to work on the problem for 30 minutes, were somewhat more committed to the task than were subjects in the first experiment. They knew that they had to stay and work, and so didn't need to be pressured into staying to work by being identified. However, since they were committed to be there and work, issues of responsibility increased in importance. The data support this speculation that in Study 2 identifiability lost importance while responsibility rose in importance when subjects were forced to work for a specified time; while all subjects understood the manipulations, there was little or no effect for identification yet substantial and significant effects for responsibility on effort measures. One measure of task importance, "How hard did you work on this task?", provided further evidence that responsibility rose in importance in Study 2. Subjects in Study 2 who had sole responsibility reported that they worked harder (mean

= 5.5) than did all other subjects in Study 1 and 2 (subjects with sole responsibility in Study 1, mean = 4.771, subjects with shared responsibility in Study 1, mean = 4.806, subjects with shared responsibility in Study 2, mean = 4.475, F for the interaction = 5.846, P = 0.017). This pattern suggests pure social loafing.

Taken together, these results clearly do not parallel either the Connolly et al., (1989) investigation of anonymity with a GDSS, or the Weldon et al., (1989) cognitive loafing investigation. Results of Study 1, the closest replication of Weldon's experiment, are quite different from her results; Study 1 shows strong main effects for identifiability. Results of Study 2, where time spent on the task is controlled, more closely approximates Weldon's findings. Across nearly all of the output measures in Study 2, the cell means mirror those in the Weldon study, with the exception of subjects who are identified and share responsibility for the task. In the Weldon investigation, subjects in this condition worked hard, scoring as high on effort measures as subjects who were identified and had sole responsibility for the task. In contrast, subjects in the identified, shared responsibility cell in Study 2 loafed, scoring roughly the same as subjects in the anonymous, shared responsibility cell.

Both this and the Weldon investigation suggest that cognitive loafing can be a real threat in group work, though the two studies point to different preconditions. A possible explanation is that subjects in the identified, shared responsibility condition in Weldon's study felt a fear of social comparison against an objective standard. The task, rating a typical set of job descriptions, each embodying a standard set of five job attributes, and using a quantified job rating scale, lends itself to direct objective comparisons of subject output. Working in close proximity to the other subjects and the experimenter could heighten this apprehension. Subjects who were identified and worked with 15 others in the same room thus tried harder because they feared the comparison and were accountable. In the present Study 2, subjects in the identified, shared responsibility cell were likely to correctly judge that there was no objective standard for comparing their work with others. They performed a creativity task (idea generation) which lacks an objective standard for what is good and what is bad. Further, subjects in this experiment worked on terminals in separate rooms and the distance from other subjects and the experimenter may have helped to reduce any fear of comparison. Thus identified subjects sharing responsibility in Study 2 felt little apprehension about being compared negatively with others and reduced their effort accordingly.

Reconciling this experiment with the Connolly et al, GDSS study is a bit easier. The parking problem task is interesting, but is not enough, alone, to overcome the temptation to loaf. Further, the positive effects of anonymity on idea generation (its role in fostering creativity enhancing factors and curbing creativity stifling factors) do not operate as strongly for subjects who work alone as they do for subjects who work directly with other individuals. When subjects work in interacting groups creativity stifling factors operate more strongly (e.g., evaluation apprehension). Anonymity should be helpful in those circumstances, as the data showed. When the subject works alone, creativity stifling factors are virtually nonexistent (e.g., little or no direct evaluation apprehension). Anonymity is not as helpful under those circumstances. In fact, it may hurt. In Study 1, where subjects were free to quit and leave at their discretion, anonymous subjects abused the privilege.

Three differences between the Connolly and Weldon investigations were noted earlier: the task, interpersonal interaction, and technology. Were propositions about task as an important variable fundamentally wrong? Possibly. It is more likely, however, that the parking problem task was not sufficiently important and interesting to students for it to overcome the ill-effects of working with a comparatively low-technology laboratory and working alone. The now "lukewarm" parking problem task is enough to get people motivated in the high-technology lab when working directly with a group of idea generators (or at least it is not quite so dull that it drowns the positive effects of the technology and the interaction), but it is not strong enough to stand on its own and keep people working diligently with a low-tech lab and no direct interaction.

In this chapter, results from two experiments on computer supported idea generation were presented. Subjects in both experiments appeared to loaf, though the pattern of loafing changed when time constraints were added. The hypothesis that anonymous subjects would produce more than would identified subjects was rejected. These results are summarized in the following chapter.

5. CONCLUSIONS

The research reported here is intended to improve our understanding of the role of anonymity on idea generation in computer-supported groups. The central findings are summarized here. Study 1 showed main effects for identifiability; identified subjects worked longer and produced more output than did anonymous subjects. Beyond these raw output measures, there were no substantive differences between the work of identified and anonymous subjects. There were no significant effects for responsibility. In contrast, Study 2 showed main effects for responsibility; subjects with sole responsibility produced more output, whether measured by bytes, comments, ideas, summed quality, or summed rarity, than did subjects who shared responsibility. There were no significant effects for identifiability. These results tracked neither Connolly nor Weldon cleanly. Subjects loafed in the experiments presented here, but the pattern of their loafing is different across the two experiments. In Study 1, where subjects could leave at their discretion, identification kept them longer and caused them to type more, though there were no differences in the quantity or quality of the ideas across experimental conditions. In Study 2, where subjects were forced to stay, identifiability lost importance. Responsibility, however, rose in importance. Subjects with sole responsibility for their task produced more output than did subjects who shared responsibility. Taken together, these results forced us to reject the hypothesis that anonymous subjects would produce more output than would identified subjects.

These results show that we cannot speak simply of the effects of anonymity on idea generation in computer-supported groups. With a straightforward interpretation of previous experiments on GDSS anonymity, it was hypothesized that anonymous subjects would produce more than identified subjects. They did not. In Study 1, identified subjects produced more output than did anonymous subjects. In Study 2, there were no significant identifiability effects. It is clear that anonymity will lead to deindividuation, enabling participants to engage in uninhibited behavior. However, whether their behavior is productive or unproductive is determined, at least in part, by task, interaction, and technology.

Though the results contradict the hypothesis, they help to integrate anonymity research in loafing and GDSS. The question was raised as to why anonymity operates differently in these two paradigms. Three culprits were identified. One (task) was tested. Even with what was thought to be a motivating task, subjects loafed when working anonymously on personal computers. These data suggest that given the right conditions, in this case a task of only moderate importance, no direct interaction, and simple technology, individuals working on personal computers may abuse anonymity. Though these data represent ad hoc, synthetic groups, they support the Connolly et al., "Balance of Forces Model," which suggests that a myriad of forces operate on idea generating groups and anonymity's influence is therefore multifaceted. These studies show that with the same task subjects in two different settings behave differently. Here, with no interaction and simple technology, anonymous subjects performing the parking problem task are among the most unproductive. In Connolly's experiment, with interacting groups and sophisticated technology, anonymous subjects are among the most productive. A better understanding of task, interaction, and technology may help us to better predict anonymity effects within the balance of forces model.

Implications

That anonymity is an integral part of a complete theory of automated group idea generation highlights Huber's warning (1988) that subtle system differences may be profoundly important. The message, one that is relevant to a variety of audiences, is that the influence of anonymity is different for different systems, tasks, and groups. A better understanding of anonymity is important to system users, system developers, and empirical researchers throughout organizational behavior, management information systems, social psychology and other relevant disciplines. Each audience will be addressed below.

For system developers and users, improved understanding of the technology will enable more effective and efficient design, construction, and use. Structural contingency theory suggests that the fit between technology, task, and user is crucial (Drazin and Van de Ven, 1985). A system could, for example, be configured using a contingency model to best fit a group's needs and wants, or for different times during the group's development (cf. Gersick, 1988). The present studies suggest that anonymity should not be used for aversive or boring tasks. Further research would help to determine other situations where anonymity should or should not be used. Perhaps anonymity could be increased for mixed-status groups, or groups dealing with delicate or personally threatening issues. For other groups, lower levels of anonymity may be more appropriate; a team of experts, whose knowledge lies in disparate areas, meets to solve important national policy problems; a group of office employees works together to perform a traditionally aversive task where loafing is likely; fast-track executives, commonly rewarded for good ideas and timely comments during meetings, convene to solve important strategic problems. Further study would help us develop contingencies that would serve GDSS use in these and other situations.

These studies provide a further warning that in specific situations users may abuse anonymity. For tasks and software where the efforts of dispersed individuals are pooled, for example a Nominal Group Technique involving dispersed executives, participants may loaf. Further, identification would not be an effective deterrent, as it may serve only to prompt passable effort and not good ideas. It may be best to avoid such quick solutions, or to avoid these situations altogether.

For the researcher, these experiments suggest that we have only just begun to understand anonymity in automated work. The model of Valacich and Jessup (1989; see Figure 1) outlines antecedents to anonymity, and the model of Connolly, et al., (1989; see Figure 2) describes the consequent forces acting upon an individual offering ideas to the group, but neither model helps us to predict whether anonymity's influence will be positive or negative. The experiments discussed above suggest that task, interaction, and technology, moderate the effects of anonymity on behavior. It is clear that more research is needed.

These studies point to task as an important variable in loafing research. The results show that loafing is likely even with idea generation tasks of moderate importance to the subjects, however, the results are different than those found in cognitive loafing studies. Further, the results show that the pattern of loafing changes dramatically with the addition of time constraints. This underlines the importance of task in a theory of loafing. Studies of cognitive loafing are focused on external mechanisms to control loafing: identifiability, accountability, responsibility. The experiments presented here highlight the controls on behavior that come from within the individual; an inherent interest in the task. It may be fruitful to study forces that "push" and "pull" effort.

These studies provide support for newly devised measures of cognitive effort (Weldon et al., 1988, 1989). While Weldon uses complex measures to tap dimensions of cognitive effort - mathematical models which measure consistency of attention and concentration in multiple judgments - the measures used in these experiments are simple approximations of cognitive effort in common work processes - quantity, quality, and rarity of ideas generated. The two measures of cognitive effort seem to generally run parallel and, in that respect, support each other.

Finally, these results contradict those of Diehl and Stroebe (1987), which suggest that free riding is not a major cause of productivity loss in brainstorming groups.

They posited that unlike the physical tasks used in social loafing research, brainstorming does not require a great deal of effort. With an economic interpretation, they reasoned that the temptation to free ride should vary as a function of the cost of contributing. They argued that individuals generating ideas thus have little temptation to free ride since the task is practically effortless and involves no time costs (subjects in their experiment had to stay for a given period of time no matter what they did). Subjects in the brainstorming experiments presented here, loafed with and without time constraints. An economic interpretation of these results suggests that brainstorming involves effort and subjects do indeed loaf. Further, the reduction in time costs associated with a mandatory time constraint were not strong enough here to overcome the subject's temptation to free ride on the efforts of others. These results suggest that we should either modify or abandon a purely economic model of automated brainstorming.

Computer supported group work may fundamentally change organizational work processes. The research discussed above suggests that these computer systems influence the process and outcomes of group work. The use of the computer in group work causes us to reinterpret old theories of group functioning and to develop new, more adequate theories. Further, the need for research in this area grows as the use of the technology is becoming more pervasive. The studies presented in this dissertation are but a preliminary step in a stream of research necessary to enable a more educated understanding of a seemingly powerful technology.

Limitations

The goal of these studies was to develop and test a theory of automated group idea generation. As such, the methods used were empirical, and the objective was to conduct a systematic, controlled investigation. Thus, precision was achieved to the detriment of realism. Though efforts were made to simulate the "real" world, the subjects were indeed students, working in contrived groups to perform an impromptu task in a laboratory environment. It may be that in this simple environment it is appropriate to think of task as the major precursor to motivation and behavior. However, in on-going groups, status and politics operate more strongly, and members are likely to have differing personal knowledge bases. In this setting, task is but one of several variables influencing motivation and behavior. Laboratory experimentation of this sort never provides the definitive answer. Replication in the field, or with executives in the laboratory, though lacking in control, would provide the realism necessary to substantiate findings within these studies.

Exacerbating the laboratory vs. field tradeoff is the fact that this investigation was quite focused. Only one piece of the puzzle was examined. Analytical myopia is necessary in investigations of this type, but, indeed, there is much more of the puzzle to be studied. The focus here was on task as the link between current GDSS and loafing research. Two other possible links, interaction and technology, and a host of other important and manipulable variables remain. Further investigations will help to give us a more complete picture of automated group idea generation.

Future Research

In addition to pure laboratory replications of these experiments, replications with executives in the laboratory and in the field would add a sense of realism to the research and offer needed triangulation.

Beyond these simple methodological extensions one has a wealth of opportunity. The two experiments presented here addressed only one (task) of the three proposed differences between GDSS and loafing research. It is possible that the parking problem task was not sufficiently important and interesting for students to overcome the ill-effects of working with a low-technology laboratory and working alone. It may be that more suitable tasks exist to overcome an individual's temptation to loaf. It seems likely that anonymity would be most useful when the task is highly interesting and important (as was the parking problem), yet the individual feels threatened when participating. This is something that may have been lacking in the two experiments presented here. Anonymity may thus best serve tasks for which there is both high commitment and high threat; that is, anonymity is most likely to be helpful with a task for which the group members feel they have something very important to say, but do not feel safe voicing their ideas and opinions.

A pilot study is underway to investigate one such task, actual student evaluations of an on-going course and its instructor. As do students performing the parking problem task, students will assuredly have something to say about their course. However, the course evaluation task adds high threat. The potential danger in offering an idea is that the instructor may see student comments before the final grades are submitted. The parking problem was moderately threatening in that someone (e.g., the experimenter, or a Parking and Transportation expert) might later see the students' comments. It is thus likely that the subjects felt some evaluation apprehension (cf., Cottrell, Wack, Sekerak, and Rittle, 1968; Seta, 1982; Worringham and Messick, 1983). The course evaluation task is likely to promote this basic evaluation apprehension as well as the threat of direct sanctions from the course instructor, a situation very much like a mixed-status organizational meeting.

Another obvious avenue for further investigation is to unravel task commitment. The interpretations of task commitment used here were simple. An individual's propensity to act is clearly influenced by more than the interest and importance of the work. Time constraints, for example, had marked effects on behavior. Further, individuals in on-going work groups are likely to have motivation beyond that provided by task. For example, commitment to the group and organization, or monetary rewards for productive effort, will undoubtedly influence behavior. Further research is necessary.

Perhaps our efforts would be better spent investigating the other two key variables, interaction and technology. First, it may be that the social controls inherent in working directly with others are strong enough to overcome the temptation to loaf. Even when working with others on a computer system one can gauge the participation of others by what is visible on the screen. Group members may also be able to see and hear whether or not others are typing. Interaction issues thus warrant further investigation. Second, the technology can help to overcome the temptation to loaf. The perceived sophistication of the system, the "seriousness" of the decision room, or the structuring forced by the process may negate loafing tendencies. Further research of such technology effects are necessary.

In addition to these three variables - task, interaction, technology - a myriad of potentially important variables operate within a GDSS environment. For example, aspects of the software, the composition of the group, or time constraints, an important factor in these studies, may influence system use. This investigation is a glimpse at only one GDSS contingency.

Huber's (1988) warning that subtle system differences count, and Gutek's (1989) suggestion that we move past simple, first generation research strategies, are especially true for anonymity research. Thoughtful investigations of anonymity will help to build a theory of automated group idea generation, and, ultimately, a grand theory of automated group work that will enable an effective and efficient use of the technology.

Figure 1. A Model of Anonymity in Automated Group Work
(Valacich and Jessup, 1989)

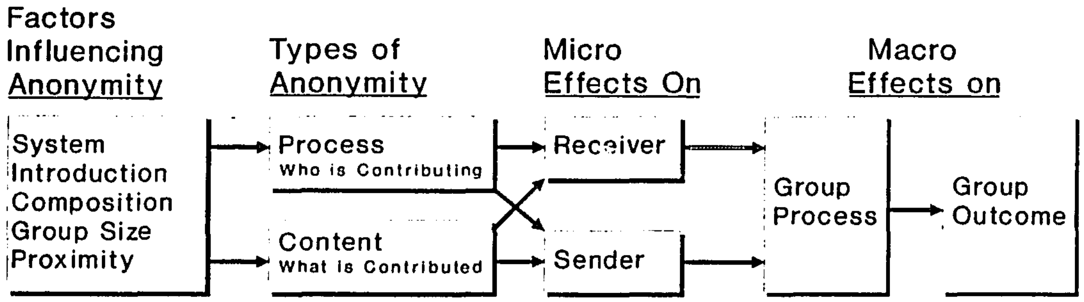
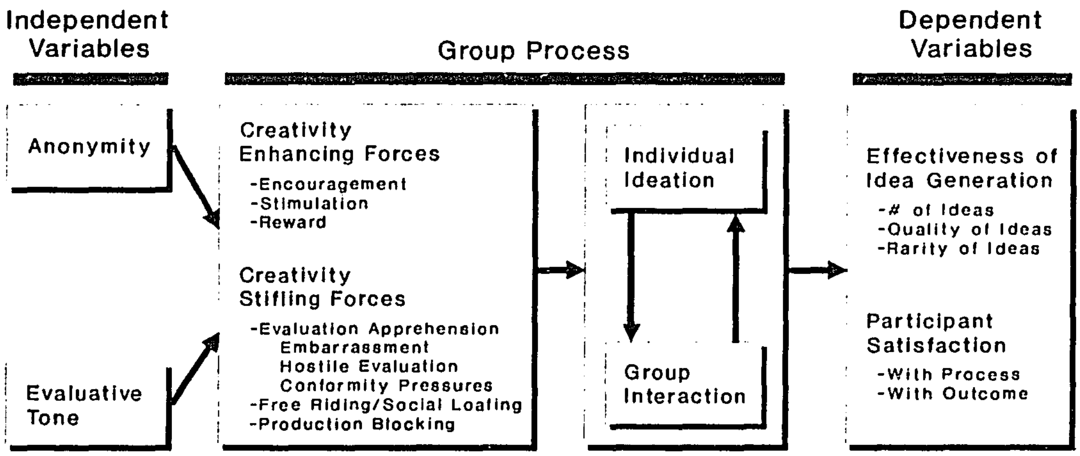


Figure 2. A Balance of Forces Model
(Connolly, Jessup, and Valacich, 1989)



APPENDIX A
PARKING PROBLEM CODING SCHEME

Parsing rules:

1. Text continuing or developing a single idea should be coded as one unit. For example, a proposal and supporting details or developments should be coded as one proposal.

2. Assign text into first category which shows a good fit (i.e., try first to assign it as a PS; if this fails, try as an SC; etc.).

Categories:

PS n.n Proposes Solution # n.n from modified Gettys scheme. Proposed solutions not on the scheme are coded as PS X.

SC Supportive Comment. e.g., "Good idea"; "I like that proposal". Expresses support for a proposal without adding evidence or argument.

SA Supportive Argument. e.g., "I like that because it will eliminate the crowding".

SCL Solution Clarification. e.g., "We could make the remote parking in a shopping center". Adds detail or new features favoring a proposed solution.

PCL Problem Clarification. e.g., "The real problem is time, as well as money"; "Another thing we need to worry about is congestion on the local streets". Adds detail or new features to problem statement.

CC Critical Comment. e.g., "I don't like that"; "That's a terrible idea". Expresses opposition to a proposal without adding evidence or argument.

CA Critical Argument. e.g., "A drawback to that scheme is .....". Opposes a proposal and gives evidence or argument.

QS Query Solution. e.g., "How would the shuttle deal with handicapped riders?" Requests clarification of a proposed solution. Responses will be coded as one of the other categories.

QP Query Problem. e.g., "Are we trying to deal with student parking or just faculty/staff?". Requests clarification of problem specification or solution criteria. Responses will be coded as one of the other categories.

COMP,+/- Positive, negative, or neutral comment about the computer network or its operation. e.g., "This system is too slow".

GRP,+/- Positive, negative, or neutral comment about the interpersonal processes of the group. e.g., "Let's try to agree on something, anyway".

OTT Comments that are "off the topic" and do not fit into the existing categories.

UC Uncodable text.

APPENDIX B
MODIFIED GETTYS SOLUTION CODING

I. **Use available parking space more efficiently**

a. _____ Reline existing parking lots (e.g. "small car" spaces, diagonal spaces, tighter packing)

II. **Increase on-campus parking space**

a. _____ Convert more university land into parking

b. _____ Buy or use adjacent land for parking

c. _____ Build multi-level parking structures (above or below ground)

d. _____ Build campus buildings high-rise, closer together, or in some other fashion designed to free parking spaces around them

e. _____ Expand campus in direction of open space

f. _____ Stop constructing buildings on campus altogether

g. _____ Build satellite campus

III. **Reduced demand for on-campus parking**

a. _____ Restrict number of cars allowed to park on campus

b. _____ Outlaw cars on campus entirely

c. _____ Provide off-campus remote parking with shuttle, tram, etc

d. _____ Provide or improve existing alternative forms of transportation (rideshare, carpool, buses, bike paths/lots/racks, etc)

e. _____ Raises, incentives, propaganda, etc., promoting use of alternative forms of transportation

f. _____ Educate people about commuting alternatives

g. _____ Encourage students not to bring cars from their home town to the university

h. _____ Build moving sidewalks

i. _____ Reduce peak demand for parking

j. _____ Raise permit fees

k. _____ Build more on-campus, or near-campus, student and/or faculty housing

l. _____ Offer correspondence or off-campus courses

m. _____ Impound cars of parking violators

n. _____ Reduce the number of students allowed to attend the University

IV. **Change parking priorities and/or policies**

a. _____ Do away with parking restrictions altogether

b. _____ Reduce the parking fees

c. _____ Allot a specific space to each student

d. _____ Reduce service vehicle parking

e. _____ Reduce faculty parking

f. _____ Do not allow Graduate Assistants to park in faculty parking

g. _____ Allow more open parking time in Faculty/Staff lots

h. _____ Change the current distribution of colored permits (e.g., more "Red" lots)

i. _____ Change the current distribution system for permits (e.g., distribute based on student grade level, use a bidding or lottery system)

j. _____ Better use of parking meters

k. _____ Improvements to existing parking lot security and enforcement

l. _____ Better planning and forecasting of parking needs and solutions

m. _____ Improvements to existing parking lot shuttle service

V. **Other**

a. _____ Construct a tunnel under Speedway Blvd. to reroute automobile and pedestrian traffic.

VI. **Frivolous Responses**

VII. **Combinations of two or more options**

Table 1. Means and Standard Deviations for Dependent Variables in Study 1 (N = 71).

	Measures	means	s.d.
1)	Time Spent	22.822	10.303
2)	File Byte Size	1002.366	585.165
3)	Total Comments	8.268	4.623
4)	Total Ideas	7.197	4.073
5)	Total Quality	30.725	17.993
6)	Average Quality	4.262	1.305
7)	Highest Quality	6.366	1.287
8)	Total Rarity	.892	.923
9)	Average Rarity	.123	.119
10)	Highest Rarity	.442	.400

Since subjects in the anonymous condition were truly anonymous the mean for time spent on the task represents the average for subjects in that condition and is not linked to specific individuals within that condition.

Table 2. Intercorrelations for Dependent Variables in Study 1 (N = 71).

	1	2	3	4	5	6	7	8	9	10
1)	-									
2)	-	-								
3)	-	754	-							
4)	-	729	933	-						
5)	-	611	804	882	-					
6)	-	-032	-081	-006	373	-				
7)	-	241	285	405	534	653	-			
8)	-	478	562	594	339	-292	002	-		
9)	-	011	021	019	-147	-323	-302	681	-	
10)	-	149	238	296	151	-207	-094	763	814	-

Variables names are given in the preceding table. Correlations for time spent on the task were not calculable since anonymous subjects were truly anonymous and their output was not linked directly with their finish times.

Table 3. Means and Standard Deviations for "Importance" Measures in Study 1 (N = 71).

Measures	means	s.d.
1) Problem Important	5.479	1.511
2) Input Necessary	4.592	1.661
3) Input Useful	4.761	1.399
4) Enjoy Task	4.394	1.270
5) Effort Level	4.789	1.330

Each item was measured on a seven-point scale (see methods section for a description of each item).

Table 4. Intercorrelations for "Importance" Measures in Study 1 (N = 71).

	1	2	3	4	5
1)	-				
2)	421	-			
3)	319	418	-		
4)	317	375	432	-	
5)	250	368	333	312	-

Variables names are given in the preceding table. Each item was measured on a seven-point scale (see methods section for a description of each item).

Table 5. Means and Standard Deviations for Dependent Variables in Study 1 (by groups, N = 71).

	#1		#2		#3		#4	
	means	s.d.	means	s.d.	means	s.d.	means	s.d.
1)	27.22	10.20	27.24	10.53	18.78	10.51	18.75	6.94
2)	1099.3	706.9	1152.0	608.8	896.0	476.9	882.5	539.5
3)	7.77	4.24	9.18	4.08	7.94	3.64	8.21	6.22
4)	5.8[illegible]	4.36	8.35	3.74	7.28	2.76	7.26	5.01
5)	24.59	16.83	33.40	15.04	32.57	15.69	32.08	22.93
6)	4.08	1.52	4.11	1.23	4.29	1.29	4.53	1.24
7)	6.14	1.77	6.41	1.22	6.57	1.17	6.33	0.98
8)	1.021	1.249	0.984	0.731	0.545	0.459	1.023	1.042
9)	0.153	0.154	0.116	0.081	0.089	0.117	0.133	0.116
10)	0.509	0.442	0.499	0.406	0.273	0.303	0.491	0.423

Condition #1 = Identified, Solo Responsibility
Condition #2 = Identified, Shared Responsibility
Condition #3 = Anonymous, Solo Responsibility
Condition #4 = Anonymous, Shared Responsibility

Table 6. F Statistics for Dependent Variables in Study 1 (by groups, N = 71).

	F Value		
	Identifiability	Responsibility	Interaction
1)	14.190***	-	-
2)	2.879*	-	-
3)	-	-	-
4)	-	-	-
5)	-	-	-
6)	-	-	-
7)	-	-	-
8)	-	-	-
9)	-	-	-
10)	-	-	-

Main and interaction effects are listed under the appropriate column headings. [* = $p < 0.10$, ** = $p < 0.05$, *** = $p < 0.01$]. N = 71, df = 1 for anon, 1 for resp, 1 for interaction, 67 for error.

Table 7. Means and Standard Deviations for Dependent Variables in Study 2 (N = 80).

	Measures	means	s.d.
1)	Time Spent	30.000	-
2)	File Byte Size	1228.800	637.760
3)	Total Comments	9.675	4.904
4)	Total Ideas	8.075	4.446
5)	Total Quality	36.316	20.197
6)	Average Quality	4.543	1.093
7)	Highest Quality	6.549	1.024
8)	Total Rarity	.785	.988
9)	Average Rarity	.090	.088
10)	Highest Rarity	.385	.396

Time spent on the task was controlled at 30 minutes for all subjects.

Table 8. Intercorrelations for Dependent Variables in Study 2 (N = 80).

	1	2	3	4	5	6	7	8	9	10
1)	-									
2)	-	-								
3)	-	754	-							
4)	-	729	933	-						
5)	-	611	804	882	-					
6)	-	-032	-081	-006	373	-				
7)	-	241	285	405	534	653	-			
8)	-	478	562	594	339	-292	002	-		
9)	-	011	021	019	-147	-323	-302	681	-	
10)	-	149	238	296	151	-207	-094	763	814	-

Variables names are given in the preceding table.
Correlations for time spent on the task are not given since all subjects worked for 30 minutes.

Table 9. Means and Standard Deviations for "Importance" Measures in Study 2 (N = 80).

Measures	means	s.d.
1) Problem Important	5.737	1.329
2) Input Necessary	5.050	1.574
3) Input Useful	5.113	1.414
4) Enjoy Task	5.087	1.193
5) Effort Level	4.987	1.401

Each item was measured on a seven-point scale (see methods section for a description of each item).

Table 10. Intercorrelations for "Importance" Measures in Study 2 (N = 80).

	1	2	3	4	5
1)	-				
2)	442	-			
3)	-031	356	-		
4)	390	470	204	-	
5)	093	-028	-089	-075	-

Variables names are given in the preceding table. Each item was measured on a seven-point scale (see methods section for a description of each item).

Table 11. Means and Standard Deviations for Dependent Variables in Study 2 (by groups, N = 80).

	#1 means	#1 s.d.	#2 means	#2 s.d.	#3 means	#3 s.d.	#4 means	#4 s.d.
1)	30.00	-	30.00	-	30.00	-	30.00	-
2)	1536.0	679.0	915.2	449.7	1369.6	731.3	1094.4	499.1
3)	12.00	4.46	7.10	3.24	11.35	6.19	8.25	3.67
4)	10.15	4.45	5.45	2.70	9.75	5.37	6.95	3.19
5)	43.83	19.90	25.06	16.14	41.35	22.23	35.03	18.02
6)	4.33	0.83	4.49	1.46	4.38	0.82	4.97	1.09
7)	6.58	0.86	6.09	1.52	6.80	0.41	6.72	0.92
8)	1.371	1.544	0.624	0.721	0.786	0.632	0.359	0.414
9)	0.116	0.095	0.114	0.121	0.079	0.060	0.053	0.044
10)	0.542	0.439	0.369	0.399	0.388	0.392	0.239	0.311

Condition #1 = Identified, Solo Responsibility
Condition #2 = Identified, Shared Responsibility
Condition #3 = Anonymous, Solo Responsibility
Condition #4 = Anonymous, Shared Responsibility

Time spent on the task was controlled for all subjects at 30 minutes.

Table 12. F Statistics for Dependent Variables in Study 2 (by groups, N = 80).

	F Value		
	Identifiability	Responsibility	Interaction
1)	-	-	-
2)	-	11.085***	-
3)	-	15.569***	-
4)	-	17.016***	-
5)	-	8.527***	-
6)	-	-	-
7)	3.450*	-	-
8)	4.167**	7.942***	-
9)	6.476**	-	-
10)	-	3.451*	-

Main and interaction effects are listed under the appropriate column headings. [* = $p < 0.10$, ** = $p < 0.05$, *** = $p < 0.01$]. N = 71, df = 1 for anon, 1 for resp, 1 for interaction, 67 for error. Time spent on the task was controlled at 30 minutes for all subjects.

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