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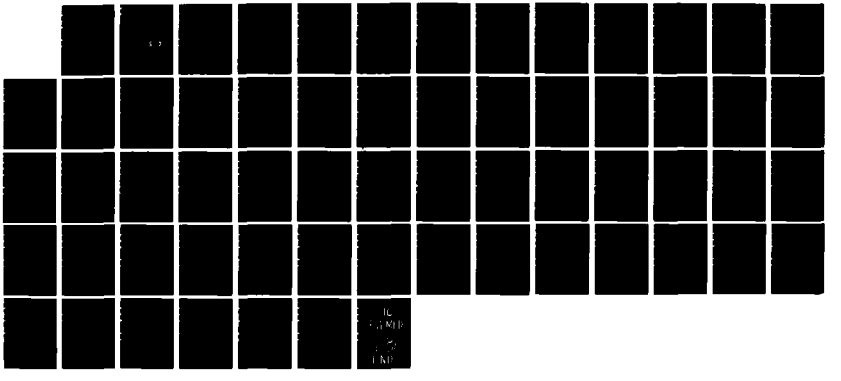

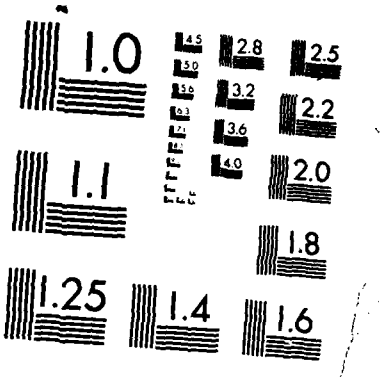

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INCREASING PRODUCTIVITY THROUGH SOCIAL STRUCTURE:

AN EXAMINATION OF SOCIAL LOAFING IN A COMPUTER-MEDIATED ENVIRONMENT

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Technical Report
February 15, 1985

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: TR-ONR-7	2. GOVT ACCESSION NO.: AD-A164 443
	3. RECIPIENT'S CATALOG NUMBER:
4. TITLE (and Subtitle): Increasing Productivity Through Social Structure: An Examination of Social Loafing in a Computer-Mediated Environment	5. TYPE OF REPORT & PERIOD COVERED: Final Technical Report
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): John Barefoot, Beverly Wiggins, James Harper, Bercedis Peterson	8. CONTRACT OR GRANT NUMBER(s): N00014-83-K-0279
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Institute for Research in Social Science, University of North Carolina, Manning Hall 026A, Chapel Hill, NC 27514	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 61153N 42, RR 042 0801, NR 170-954
11. CONTROLLING OFFICE NAME AND ADDRESS: Office of Naval Research, Organizational Effectiveness Group (Code 4420E), Arlington, VA 22217	12. REPORT DATE:
	13. NUMBER OF PAGES:
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The social loafing phenomenon has been demostrated in a variety of contexts and cultures, but most of the studies have involved tasks on physical effort. In this group of seven studies, we examined social loafing in cognitive tasks, and refined some of the questions on physical effort and social loafing. The specific questions we addressed were: Can social loafing be demonstrated in an electronically mediated group setting? Can social loafing be demonstrated for cognitive tasks as well as physical tasks? Does social loafing affect the quality as well as the quantity of work? How does social loafing impact on decision-making strategies

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S/N 0102-014-6601

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and how does it affect the quality of decisions? Does the magnitude of social loafing effect vary with the difficulty of the task? What is the effect of contingent monetary incentives on social loafing? Does the effect depnd on the perceived redundancy of effort in group settings? Does social loafing occur in standing groups as well as in ad hoc groups of anonymous individuals? Does the magnitude of the loafing effect vary with the size of the party affected by the output?

We demonstrated a social loafing effect in an electronically mediated group setting. Both cognitive and physical tasks showed a social loafing effect, although it was not present in all studies. When social loafing occurred on tasks concerned with the quality of work, it affected both the quality and quantity of work. Neither of the decision-making studies demonstrated a clear-cut social loafing effect. The magnitude of the social loafing effect did not vary with the difficulty of the task. Contingent monetary incentives did not have an effect on social loafing. We found that the social loafing effect did not depend on the perceived redundancy of effort. We discovered that the type of group can influence the social loafing effect. We could not determine whether the magnitude of social loafing varied with the size of the party affected by the output. We have indicated the answers to some of the questions, but most of them require further research to answer fully. Our research indicated intriguing possibilities for improving group productivity.

ABSTRACT

The social loafing phenomenon has been demonstrated in a variety of contexts and cultures, but most of the studies have involved tasks based on physical effort. In this group of seven studies, we examined social loafing in cognitive tasks, and refined some of the questions on physical effort and social loafing. The specific questions we addressed were: Can social loafing be demonstrated in an electronically mediated group setting? Can social loafing be demonstrated for cognitive tasks as well as physical tasks? Does social loafing affect the quality as well as the quantity of work? How does social loafing impact on decision-making strategies and how does it affect the quality of decisions? Does the magnitude of the social loafing effect vary with the difficulty of the task? What is the effect of contingent monetary incentives on social loafing? Does the effect depend on the perceived redundancy of effort in group settings? Does social loafing occur in standing groups as well as in ad hoc groups of anonymous individuals? Does the magnitude of the loafing effect vary with the size of the party affected by the output?

We demonstrated a social loafing effect in an electronically mediated group setting. Both cognitive and physical tasks showed a social loafing effect, although it was not present in all studies. When social loafing occurred on tasks concerned with the quality of work, it affected both the quality and quantity of work. Neither of the decision-making studies demonstrated a clear-cut social loafing effect. The magnitude of the social loafing effect did not vary with the difficulty of the task. Contingent monetary incentives did not have an effect on social loafing. We found that the social loafing effect did not depend on the perceived redundancy of effort. We discovered that the type of group can influence the social loafing effect. We could not determine whether the magnitude of social loafing varied with the size of the party affected by the output. We have indicated the answers to some of the questions, but most of them require further research to answer fully. Our research indicates intriguing possibilities for improving group productivity.

In the last few years, economists, politicians, journalists, and the general public have successively become aware of and concerned about declines in the rate of growth of the productivity of the American workforce. Many have pointed to insufficient productivity as a cause of increasing inflation, decreasing value of the dollar, and our declining world stature. Productivity problems are characteristic not only of industry and government, but, we suspect, even of the armed forces.

Many reasons undoubtedly contribute to lessened productivity gains. Some analysts focus on the behavior of our leadership, suggesting that we may not be plowing enough money into research and development or new and improved labor-saving devices. Other analysts focus on the behavior of workers themselves. One view would have it that large increases in the number of relatively inexperienced young people in the workforce have led to decreases in the average level of competence. More pessimistically, lowered productivity may simply reflect a reduction in effort by individuals.

The old saying, "many hands make light the work" represents one of the promises of social life-- that people can fulfill their individual goals more easily through collective action. We have found, however, that the saying holds true in a second, less hopeful way: it seems that when people work in groups, they work less hard than they ought to.

When people get together for some group aim, it is commonly believed, team spirit can spur individual effort and enhance the productivity of all. Some social-psychological theorists, along with those who advocate reorganizing assembly lines in favor of production by smaller groups, assume that the presence of other people encourages greater output by each one. This is not necessarily so. We have found that when the individual thinks his or her own contribution to the group cannot be measured, his or her output tends to slacken. This phenomenon we call "social loafing".

The initial evidence for social loafing goes back to 1927, when the German psychologist Walter Moede reported results of his student Ringelmann's test of workers' individual and group performance on a rope-pulling task. In this sort of trial, when there is no division of labor possible and group performance depends on the sum of individual efforts, we would expect three people pulling together to exert three times as much strain as one person, and eight to exert eight times as much. Ringelmann's results, however, were strikingly different. Asked to pull as hard as possible, individuals averaged a respectable 139 pounds of pressure, as measured by a strain gauge. But groups of three people exerted a force of 352 pounds, only two-and-a half times the average individual performance, and groups of eight pulled at 546 pounds, less than four times the solo rate. Thus, the collective group performance, while increasing somewhat with group size, was much less than the sum of the individual efforts.

Our own early work examined the extent and generalizability

of the group effect and its implications for a society based largely on principles of collective action. For some studies, we chose to measure cheering and clapping, two moderately tiring activities that people commonly perform together in social settings. Both, like rope pulling, depend on the simple sum of individual efforts, and can easily be measured.

In a prototypical experiment (Latané, Williams and Harkins, 1979), we studied eight groups of six male students. Each group was seated in a soundproof laboratory and told to clap or cheer as loudly as possible for five seconds when signaled. We tested each student alone and in groups of two, four, and six.

As might be expected, the more people clapping or cheering together, the more intense the noise and the more sound pressure produced. However, sound pressure did not grow in proportion to the number of people: the average sound pressure generated per person decreased with increasing group size. People averaged about 3.7 dynes/cm2 of sound pressure on their own, but only 2.6 in pairs, or 71 percent of the sum of their individual capacity. Four-person groups performed at 51 percent of capacity, and six-person groups at 40 percent--- the sound of 12 hands clapping is not even three times as intense as the sound of two.

Although the results of the study seemed to echo Ringelmann's and support the idea of social loafing, there was a possible alternative explanation. It may be that the group response suffered, not from a lack of individual effort, but as a result of group inefficiency or coordination loss: sound-pressure waves can interfere with one another, and cancel one another out; sound can be lost to measurement as voices are projected in different directions, or as they fall out of synchrony. A second experiment was designed to account for these possibilities; we arranged things so people could not hear one another shout. Students-- six groups of men-- were asked to wear headphones, and during each trial a constant 90-decibel recording of six people shouting was played over the headphones, ostensibly to reduce auditory feedback and to signal each trial. Thus, we could lead people to believe they were shouting in groups when they were actually shouting alone, thereby eliminating the problem of faulty coordination or sound cancellation.

Overall, participants shouted with considerably more intensity in the second experiment-- perhaps as a by-product of the headphones-- but the results were similar to those of our first experiment. Actual groups of two shouted at only 66 percent of capacity; groups of six at 36 percent. Our procedural changes, even though they prevented people from hearing and seeing one another, apparently did not eliminate the feeling they had of being in a group.

In the pseudogroups, when students believed one other person was yelling with them, they shouted 82 percent as intensely as when they believed they were shouting alone; and when they believed five others to be yelling, they shouted 74 percent as

intensely. By comparing the actual groups with the pseudogroups we can conclude that, for shouting, only half of the performance loss can be attributed to incoordination between participants; the rest must be due to social loafing.

These results have been replicated and extended in subsequent research in our laboratory and in others. They are reminiscent of Latanè and Darley's (1970) finding that the likelihood that a bystander will intervene in a situation in which someone requires assistance is substantially reduced by the addition of other bystanders who share in the responsibility for help.

Following up on these findings, were were interested in exploring a number of questions about social loafing, which range from basic and theoretical issues of psychological process to concerns about practical implications for society. The questions we addressed were:

1. Can social loafing be demonstrated in an electronically mediated group setting?

2. Can social loafing be demonstrated for cognitive tasks as well as physical tasks?

3. Does social loafing affect the quality as well as the quantity of work?

4. How does social loafing impact on decision-making strategies and how does it affect the quality of decisions?

5. Does the magnitude of the social loafing effect vary with the difficulty of the task?

6. What is the effect of contingent monetary incentives on social loafing?

7. Does the effect depend on the perceived redundancy of effort in group settings?

8. Does social loafing occur in standing groups as well as in <u>ad hoc</u> groups of anonymous individuals?

9. Does the magnitude of the loafing effect vary with the size of the party affected by the output?

We undertook the exploration of these questions in the context of an ONR funded program of research which utilized a data-collection facility called the Computer Administered Panel Study (CAPS), at the University of North Carolina at Chapel Hill. The Panel consists of 100 undergraduate students who are paid to attend weekly sessions at which they respond, via computer terminals, to computer administered questionnaires and experimental tasks. Using this resource allowed the collection of a large amount of data on each of the 100 respondents, thus facilitating

the examination of (1) within-subject variations in performance under various experimentally manipulated conditions and (2) the effects of background and personality factors on variations in performance.

This rep rt details the methodologies and findings of seven major experiments involving social loafing. The following table summarizes which questions are addressed by each experiment.

Table 1 Relationship Between Social Loafing Questions and CAPS Studies

Question	Sound Production	Counting	Restaurant Choice	Brainstorming	Brainstorm Judging	Anagrams	Paired Associates Learning
1. Electronic Mediation			X	X	X	X	X
2. Cognitive Task			X	X	X	X	X
3. Quality of Work		X	X	X	X	X	X
4. Decision-making			X		X		
5. Difficulty				X			X
6. Incentive						X	X
7. Redundancy						X	
8. Type of Group				X		X	X
9. Party Size			X				

Experiment 1: Sound Production

In this study, we attempted to replicate the social loafing effect demonstrated in several different settings by Latané, Harkins and Williams (1980). College students shouted and clapped individually and in groups to determine whether sound production was affected by group size. If a social loafing effect was present, respondents' individual sound production would be less than when they thought they were shouting or clapping with other people.

Method. Participants entered an isolated room in pairs and sat on opposite sides of a divider. The task monitor assigned them a color (red or green) for identification, and told them that the purpose of the study was to investigate the impact of reduction of auditory feedback on sound production. They were given earplugs, headphones, and blindfolds. Each noise maker was to clap or shout as loudly as possible when a taped cue was given. The tape asked one or both participants to clap or shout and delivered a masking noise of clapping and shouting. Instructions were manipulated so that only one person made noise during each trial, although sometimes participants thought that the other person was also clapping or shouting. There were 35 trials during the experiment in which one participant clapped or shouted.

Results. Shouters generated an average sound level of 8.6 dynes/cm2 and clappers produced an average level of 3.9 dynes/cm2. Individual shouters produced significantly more sound than group shouters but individual clappers did not make significantly more noise than group clappers (Table 2). Male clappers were significantly louder than female clappers but male shouters were not significantly noisier than female shouters. The sex by group size interaction was not significant for either task.

Discussion. Perhaps sex has a different effect on sound production by clapping than by shouting because physical strength has a greater effect on the amount of sound generated by clapping than by shouting. This study indicates that whether a task requires physical strength or simply physical effort may determine the degree of loafing which occurs.

Table 2
Mean Sound Production

(dynes/cm2)

	Individual	Group	F(1,83)
Shouting	9.30	7.89	7.58**
Clapping	3.94	3.92	0.01

	Male	Female	F(1,83)
Shouting	9.84	7.32	2.26
Clapping	4.76	3.08	7.58**

**$p<0.01$.

Experiment 2: Counting

In this task, we attempted to replicate a study by Gabrenya, Latané and Wang (1983) in which listeners counted a number of closely spaced tones heard in one ear or in both ears simultaneously. They counted the tones under three conditions -- alone, with a partner and then when we called "choice," in which they were to simultaneously count some tones alone and others with the other persons.

If the accuracy of individual counting in the conditions was greater than that in the group conditions, there would be evidence for a social loafing effect. When the participants could choose between allocating their efforts toward individual or toward group activities, greater accuracy in the individual activity would suggest one mechanism for social loafing, i.e., a tendency of individuals toward allocating their efforts to individual rather than group activities.

Method. Counters entered a room in pairs and were assigned a color for identification. The study monitor told them that the investigators were interested in performance on a difficult auditory task. The listeners counted tones which they heard in their left ear, right ear or both and indicated how many tones they had heard by holding up their fingers in a particular way. The counters were given a series of practice trials on tones which were slower than those used in the actual task. They heard the tones via stereo headphones in either the right or the left ear, or both ears (which caused the tone to seem to be in the middle of the auditory field). Each tone series included right, middle and left tones and ranged in total length from six to twelve tones. On each trial, listeners were instructed to count the middle tones and either the left or right tones. The tones were presented at a rate of two tones per second, with a 0.125 second inter-tone interval.

Counters indicated the number of tones by holding up fingers after each tone series. One hand was used for each type of tone and hands were held up relative to the face, in positions corresponding to the type of tones counted. For example, if the participant were asked to count middle and left tones and thought that two middle tones and three left tones had been presented, they would hold two fingers of the right hand up in front of the face and three fingers of the left hand up on the left side of the face.

A set of five tone series comprised a trial. Five trials made up a block. The stimulus set consisted of two blocks of equal overall difficulty which each contained trials of varying difficulty. After each trial, counters heard a low-pitched tone sound and after each block, they heard two low-pitched tones. Counters heard each tone series only once during the experiment.

Listeners received one of three types of instructions prior to each trial. On individual effort trials, one listener was

asked to count either left and middle or right and middle tones while the other participant removed his or her headphone. On group effort trials, both counters wore headphones and counted either left and middle or right and middle tones. On the "choice" trials, one participant was instructed to count left tones, the other to count right tones and both to count middle tones.

Results. We used the absolute difference between the listeners' count and the number of tones in the recording to assess their level of effort. The average absolute difference was 0.43 with a maximum average of 1.3 mistakes per tone series over the experiment. We determined that choice and its interaction with group size were significant (Table 3).

Listeners made more errors when working individually than they did when they worked with a partner under the no choice condition. The opposite was true under the choice condition. Overall, counters made more errors when they could choose how to allocate their efforts than when they worked only individually or only with a group. (Table 3).

Discussion. A mechanism for social loafing is indicated by these results, since the social loafing effect was present only when the listeners performed the individual and group tasks. Social loafing may operate under choice conditions because an individual tends to allocate his finite resources toward individual rather than group tasks.

Table 3 Significant Effects for Analysis of Error Rate in Tone Counting Task

Effect	F	df
Choice Condition	31.27**	(1,88)
Group Size and Choice Condition	43.94**	(1,88)

**p<0.01.

Table 3.1 Mean Absolute Difference Between Tones Counted and Tones Heard for Significant Effects from Analysis of a Tone Counting Task (N=92)

		Group Size		
		Individual	Group	All Respondents
Choice Condition	No Choice	0.433	0.324	0.378
	Choice	0.421	0.532	0.476
All Respondents		0.427	0.428	

Experiment 3: Restaurant Choice

The restaurant choice task was designed to assess the effects of social loafing on decision-making strategy. A social loafing effect would lead decision-makers who share the responsibility of choosing a restaurant to use more effort-saving heuristics than those who choose individually, producing less complete information search, less time to reach a decision and a higher concentration of search time spent on certain attributes (more variance across attributes).

A second goal of the restaurant choice task was to assess the effect of affected group size on decision-making strategy. Social impact theory holds that the number of people involved in a situation (in this study, the size of a party planning to dine together at a restaurant) affects performance. We hypothesized that when more people were affected by the decision, information search would be more thorough.

Method. Respondents were asked to choose among five fictitious restaurants. They were presented with a five by five matrix with the columns consisting of the five restaurant names and the rows containing five attributes (average cost, type of food, service, atmosphere and taste). Service, atmosphere and taste were rated on a scale of one to ten, with ten being the highest score and one the lowest.

Tables 4 and 4.1 present the matrices of information used in the restaurant choice task. Each cell of the matrix contained a number; decision-makers could examine the information in any cell for five seconds by entering the cell number on the computer keyboard. They were allowed to search any cell in the matrix as often as they liked and could spend as much time as they wished to make their choice. When they felt that they had enough information to choose a restaurant, they typed in their selection on the computer. The row and column attributes were presented in different order for each decision-maker, but the restaurant profiles contained in the tables were the same for all respondents.

CAPS participants chose a restaurant in each of two sessions spaced one week apart. In one session, participants chose alone; in the other they believed that two other people shared the responsibility with them and that their choices would be aggregated. Respondents were assigned in equal numbers to each of the two orders of individual and group choice.

Respondents chose a restaurant for a party of either three or six people. Party size was held constant for each respondent across sessions, which created a between-subject variable.

The tendency to use heuristics was measured with four dependent variables which indicated how extensively a decision-maker searched the available information. The number of different cells searched, the number of cells searched more than

once and the amount of time spent searching were indicators of the volume of the information search. The variance of the search across attributes was also measured since heuristics such as elimination by attributes would lead the respondent to concentrate the search on fewer attributes, thereby producing high variability across attributes in the number of cells searched.

Results. Overall, participants spent an average of five minutes on the task, looked at the information in two-thirds of the 25 cells and returned to one or two (mean=1.6) cells for a second look. Approximately half of the participants studied every cell in the matrix.

Party size (number affected by the decision) (Table 4.2), had a significant overall effect on the four indicator variables but the direction of the differences (Table 4.3) was not entirely consistent with social impact theory.

The sex of the decision-maker did not affect the extent of search, as expected. Deciding group size (a within subject factor), unexpectedly, was not significant (MANOVA F=0.03, p=0.999), which indicated that social loafing did not occur in this study.

The interaction between party size and sex was not significant over all four variables, but was significant for two variables separately. Both the unique number of cells searched and the time spent in search showed a significant interaction of sex and party size (Table 4.2). However, the multivariate analysis indicated that the univariate interactions may have been spurious.

Despite the mixed results of the analysis of variance, we examined the effect of party size within sex. We observed the pattern predicted by social impact theory for females (the four variables indicated an increased extent of search when the party size increased (Table 4.3)). For males, all dependent variables but number of cells searched repeatedly showed exactly the opposite pattern.

Discussion. The results of this study may have been influenced by the small search matrix size. With only twenty-five cells to search, approximately half of the potential "diners" searched all cells. The task may have been too easy to motivate the use of heuristics in decision-making.

The decision-makers in this study were not social loafers, but the social impact of their choice may have influenced their decision-making process. Number of people affected had an effect on extent of search, but its effect on the four dependent variables was not consistent. Males and females showed a consistent difference in the effect of party size on extent of their search but the difference, although intriguing, was not significant when all the variables which measured extent of

search were examined simultaneously.

Table 4 Matrix for First Restaurant Task

	Restaurant				
Attribute	L	R	D	P	G
Average Cost	$4.50	$5.00	$10.00	$8.00	$6.50
Type of food	Chinese	Greek/ American	American	Mexican	Italian
Service (1-10)	3	8	6	7	8
Atmosphere (1-10)	7	6	5	8	4
Taste (1-10)	8	5	9	4	6

Table 4.1 Matrix for Second Restaurant Task

	Restaurant				
Attribute	E	R	N	O	G
Average cost	$7.00	$5.50	$10.50	$8.00	$4.50
Type of food	Seafood	American	American	Japanese	Italian
Service (1-10)	6	8	5	7	9
Atmosphere (1-10)	3	9	8	7	6
Taste (1-10)	8	4	10	7	6

Table 4.2 Univariate and Multivariate Analysis of Variance for Party Size and Party Size by Sex Interaction

Source	Dependent Variable	F	df
Party Size	MANOVA	2.90*	(4,89)
	Unique cells searched	1.05	(1,92)
	Cells searched repeatedly	6.61**	(1,92)
	Time spent searching	0.01	(1,92)
	Variance of search	0.75	(1,92)
Party Size by Sex	MANOVA	1.78	(4,89)
	Unique cells searched	5.86*	(1,92)
	Cells searched repeatedly	2.57	(1,92)
	Time spent searching	5.60*	(1,92)
	Variance of search	2.86	(1,92)

*$p<0.05$.
**$p<0.01$.

Table 4.3 Means of Four Dependent Variables for Party Size and Party Size by Sex Interactions

	Sex					
	Male		Female		All Respondents	
Party Size	Three (N=23)	Six (N=25)	Three (N=24)	Six (N=24)	Three (N=47)	Six (N=49)
Unique cells searched	18.04	14.66	16.36	17.73	17.18	16.16
Cells searched repeatedly	1.40	1.87	0.53	2.54	0.96	2.20
Time spent searching (secs.)	320.72	276.63	278.90	326.05	299.37	300.83
Variance of search	2.27	3.15	2.30	2.01	2.28	2.59

Experiment 4: Brainstorming

The CAPS participants worked on two versions of a brainstorming task. In our first version, we attempted to replicate and extend the study by Harkins and Petty (1982) in the CAPS setting. The second version of the brainstorm task emphasized the creativity of the uses generated for each object.

In the first version, we varied the task difficulty and group size for each participant to study the effect of difficulty on social loafing. We placed the brainstormers in anonymous or identified groups to investigate whether group type influenced social loafing. Computerized instructions told the thinkers that the number of uses generated, not the quality or creativity of those uses would be the criterion for individual or group scores.

As in the earlier version, the second version included individual and group conditions and identified and anonymous groups, but all stimulus objects were chosen to be of approximately the same difficulty. The object sets were always presented in the same order, so their effect on performance could not be differentiated from that of session number. In this task, we wanted to investigate individual and group performance when the goal was creativity and relate it to the performance when the goal was quantity. Relevant questions were: Does social loafing occur in both or only one setting? Does the type of group (identified or anonymous) affect the social loafing effect? And, does an interaction complicate the above effects?

Method. In the first brainstorming task, a computer program asked the brainstormers to generate uses for a set of two objects. Another set was presented in a second session three weeks later. One set of objects, a small kitchen knife and a shoebox, was easy to generate uses for while the other, a detached doorknob and a burned-out lightbulb, contained objects more difficult to generate uses for. Equal numbers of brainstormers worked on the easy and difficult object sets in the first session and each thinker received an opposite assignment in the second session.

Brainstormers worked on one object in a set individually and on the other object in a group. The order of group and individual conditions was balanced with respect to participants and sessions. Instructions for the individual condition stated that the thinker was working alone and that the record of performance would be individualized. Group instructions informed one set of brainstormers that they were working with their regular standing group and the rest of them that they were working with a collection of anonymous individuals. Group members were told that their performance results would be entered as a group.

Instructions told the thinkers that the quantity of their ideas, not their quality or creativity, would be judged, and that producing as many ideas as possible was the goal of the task. We

used the number of ideas produced and the time spent generating uses as the criteria of performance for the brainstormers.

We made two changes in the brainstorming task for the second version. We selected objects of approximately equal task difficulty. Instructions indicated that the quality of ideas, not quantity, was important.

The first pair of objects was a brick and an empty beer can and the second was an out-of-date telephone directory and a toothpick. In session one, all participants evaluated the beer can and brick and in session two, they all generated uses for the toothpick and telephone directory. The order of condition assignment and individual object presentation was balanced within each session and with respect to thinkers. Brainstormers were told that the quality and creativity of their ideas was the task objective and that creativity would be the only factor judged. In fact, in addition to 1) the average judged quality of the uses in a set and 2) the judged quality of the entire set of uses for an object, 3) the time spent generating uses and 4) the number of ideas generated were analyzed. The first two dependent variables measured the stated objective of quality while the other two reflected the quantity of effort expended.

Results. We will present the results of each version of the brainstorming task separately and then give the results of a joint analysis of variables common to both tasks.

In version one, on the average, CAPS participants spent 5.3 minutes brainstorming and thought of 8.5 uses while in version two, they generated 6.7 uses in 3.9 minutes. The average rating for the objects in version two was 5.9 and the mean set rating was 6.0.

Object difficulty, which was confounded with session number was the only significant simple effect (Table 5). Brainstormers generated significantly more uses for easy than difficult objects (Table 5.1) and, interestingly, spent significantly more time on the task with easy than difficult objects.

We found an interaction between group size and the two other variables, session and group type (Table 5). The thinkers took more time in a group than as individuals when they worked with an identified group and took less time in a group than individually when the group was anonymous (Table 5.1). Brainstormers generated more uses individually than in a group in session one, but more uses in a group than individually in session two (Table 5.1).

In the second brainstorming task, we found significant main effects of sex and session and a significant interaction between group size and object type (Table 5.2). We discovered two three-way interactions involving group size and object type with session or sex (Table 5.2).

We saw an interesting trend in the univariate analysis of the two measures of quality. Whenever one of the effects was significant for average quality of uses, it was not significant for overall set quality and vice versa.

Average judged quality of uses had a simpler relationship with the independent variables (Table 5.2). Females produced ideas of higher average judged quality than males and the ideas produced in the first session were of higher average judged quality than those produced in the second session (Table 5.4).

The overall set quality analysis yielded two second order interactions which were more complex but were composed of the same variables found to be significant for average judged quality. For object set one, brainstormers working under the group condition thought of more creative uses, on the average, than did those working alone. The reverse was true for object set two. Such an interaction was not expected, since the objects were chosen to be of equal difficulty.

The group size effect on set quality for males and object set one was opposite to the same effect for males and object type two (Table 5.4). The same was true for females, but all effects were in the opposite direction to those of males. A similar opposing effect was seen when session number was analyzed in place of sex (Table 5.4). The group size effect in session three was in a different direction for object set one than for object set two.

We also examined two variables measuring the quantity of effort expended, even though quality was the stated objective of the task. We found one significant and one nearly significant interaction in this analysis (Table 5.5).

More uses were given for object set one by brainstormers in anonymous groups than those in identified groups. Thinkers in identified groups gave more uses for object set two than ones in anonymous groups.

Anonymous group brainstormers spent more time on object set one than identified ones but identified group members spent more time than anonymous ones on object set two (Table 5.6).

Female anonymous thinkers spent more time at the task than identified ones of the same sex, while males showed an opposite pattern.

We performed a joint analysis of the two tasks, since they were similar, had been done by the same group of CAPS participants and had two performance criteria in common. We created a third criterion, rate of use creation, which was the ratio of the first two variables.

The main effects of group size and session and the interaction of group size and session were significant for number of uses generated (Table 5.7). Group size and session were

significant main effects for time spent generating uses, but their interaction was not significant (Table 5.7). For rate of idea creation, session was the only significant effect (Table 5.7).

We questioned whether two of the dependent variables, number of uses and rate of idea creation were normally distributed. A log transformation improved their distributional characteristics, but had no effect on the significance results for number of uses. For rate of idea creation, the single significant effect, session, became non-significant ($F(3,261) = 2.58$, $p = 0.054$). Since univariate repeated measures analysis assumes normality of the dependent variable, this non-significant result may indicate that there was no significant effect of session on the rate of idea creation.

We demonstrated an overall social loafing effect and found a reverse social loafing effect on number of uses in session one, a social loafing effect in session two and a modest social loafing effect in sessions three and four (Table 5.9). Brainstormers generated about the same number of ideas in sessions one and two but generated more in sessions three and four (Table 5.9).

We revealed a social loafing effect for time spent generating uses (Table 5.8). Thinkers in sessions one and two took more time than they did in sessions three and four (Table 5.8). Brainstormers thought of ideas faster in sessions three and four than in sessions one and two.

Discussion. As might be expected, in the first version of the brainstorming task, the CAPS participants found more uses for an object which was considered to be easier to find uses for. However, they spent more time finding the easy uses than the hard ones, presumably because the easy task was more pleasurable.

We revealed two interactions involving a group size effect. The effect of group size on time spent for an anonymous group was as predicted by social loafing theory, while the effect for an identified group was weaker but in the opposite direction. Social loafing occurred in the predicted pattern in session two but had a weaker, opposite pattern in session one.

Quantity of effort expended was measured by the same dependent variables in version two as in version one, but the effects seen were different. Males seemed more reluctant to spend time working on the task in anonymous groups, while females spent more time on the task when they were working in an anonymous group. This interaction may have been spurious, since a multivariate test of the effect was not significant. Although the two object sets seemed to be of equal difficulty, effort expended (both number of uses generated and time spent on the task) in identified versus anonymous groups showed opposing patterns within each object type. Perhaps a factor other than difficulty that distinguished the two objects within the sets was motivating the respondents.

The same set of variables affected the average judged quality and the idea set quality, but the relationships among them were different. We saw a social loafing effect for average quality within object set two (empty beer can or toothpick) but an opposite effect within object set one (brick or telephone directory). Overall, females produced ideas of higher average judged quality than males and the ideas from the first session were of higher average judged quality than from the second session.

Social loafing effects for judged quality of idea sets were seen for males with object set one, females with object type two, in session one with object set two and in session two with both object types. An opposite effect was seen for the other categories within those interactions.

Our combined analysis indicated an overall social loafing effect on the time spent working on the task. The time spent declined each session, with a precipitous fall when quality was the object of the task (sessions three and four). The rate of idea creation was higher in sessions three and four, primarily due to decreased time spent, since the number of ideas generated was not significantly different for any session.

Social loafing clearly occurred on this cognitive task. However, analyses of smaller segments of the study indicate that social loafing often operates only under certain conditions. Variables such as the type of group (identified or anonymous) and previous experience (session number) may modify the social loafing effect, especially when the quantity of ideas is important.

If the quality of ideas is important, social loafing may be affected by the object of the task (object set) and sex or previous experience (session number). However, when quality is the goal, quantity of ideas and time spent do not seem to show any social loafing effect.

In summary, social loafing operated over two different cognitive tasks. Its effect was clear only over both tasks and only for the time spent working on the task. A task involving quantity production of ideas showed a less complicated social loafing effect than a task which sought quality ideas.

Table 5 Multivariate and Univariate Repeated Measures Tests for the Effect of Significant Variables on Number of Uses Generated and Time Spent in a Brainstorming Task

	MANOVA	Univariate Repeated Measures	
Variable	F(2,89)	Uses F(1,90)	Time F(1,97)
Object Difficulty	92.10**	155.98**	16.67**
Group Type by Group Size	4.61*	0.72	8.05**
Session by Group size	4.54*	9.00**	1.84

*$p<0.05$
**$p<0.01$

Table 5.1 Means Corresponding to Significant Effects in Table 5

Difficulty Main Effect

Variable	Difficulty	
	Easy	Difficult
Number of uses	10.7	6.3
Amount of time (secs.)	341.2	291.2

Group Size by Group Type Effect

Time (secs.)

		Group Type	
		Identified (N=47)	Anonymous (N=47)
Group Size	Individual	316.3	330.1
	Group	322.4	296.1

Group Size by Session Effect

Number of Uses

	Session Number	
	One	Two
Individual	8.2	9.3
Group	8.5	8.0

Table 5.2 Significant Effects Indicated by Multivariate and Univariate Repeated Measures Analysis of Variance on Variables Measuring Quality of Ideas Generated During a Brainstorming Task

Effect	Test	Dependent Variable	F	df
Sex	MANOVA	Both	3.54*	(2,85)
	Univariate Repeated Measures	Average Quality	6.91*	(1,86)
		Set Quality	0.85	(1,86)
Session	MANOVA	Both	4.40*	(2,85)
	Univariate Repeated Measures	Average Quality	7.18**	(1,86)
		Set Quality	<0.01	(1,86)
Group Size and Object	MANOVA	Both	11.01**	(2,85)
	Univariate Repeated Measures	Average Quality	21.40**	(1,86)
		Set Quality	1.27	(1,86)
Group Size, Object and Sex	MANOVA	Both	5.94**	(2,85)
	Univariate Repeated Measures	Average Quality	1.01	(1,86)
		Set Quality	11.76**	(1,86)
Group Size and Object and Session	MANOVA	Both	5.58**	(2,85)
	Univariate Repeated Measures	Average Quality	1.48	(1,86)
		Set Quality	9.08**	(1,87)

*p<0.05
**p<0.01

Table 5.3 Means Corresponding to Significant Effects for Average Judged Quality of Uses

	Sex			
	Male	N	Female	N
Average quality	5.70	46	6.02	48

	Session			
	One	N	Two	N
Average quality	5.97	94	5.75	94

		Group Size and Individual Object Type			
		Group Size			
		Individual	N	Group	N
Object Set	One	5.89	92	6.16	92
	Two	5.89	96	5.52	96

Table 5.4 Means for Judged Quality of a Set of Uses According to Group Size, Object Set, Sex and Session

		Sex			
		Male		Female	
	Object Set	One (N=44)	Two (N=48)	One (N=48)	Two (N=50)
Group Size	Individual	6.04	5.84	6.12	6.10
	Group	5.67	5.92	6.46	5.52

		Session			
		Three		Four	
	Object Set	One (N=46)	Two (N=49)	One (N=46)	Two (N=49)
Group Size	Individual	5.81	6.22	6.35	5.73
	Group	6.16	5.71	6.01	5.72

Table 5.5 Multivariate and Univariate Repeated Measures Analysis of Number of Uses Generated and Time Spent on a Brainstorming Task

Effect	Test	Dependent Variable	F	df
Group Type and Object Set	MANOVA	Both	3.10*	(2,88)
	Univariate Repeated Measures	Number of Uses	4.35*	(1,89)
		Time Spent	4.98*	(1,89)
Group Type and Sex	MANOVA	Both	2.53	(2,88)
	Univariate Repeated Measures	Number of Uses	2.32	(1,89)
		Time Spent	4.86*	(1,89)

*$p<0.05$

Table 5.6 Mean of Number of Uses Generated and Time Spent for the Effects in Table 5.6

Number of Uses

		Group Type: Identified	N	Anonymous	N
Object Set	One	5.92	25	7.00	21
	Two	7.49	27	6.16	24

Time Spent

		Group Type: Identified	N	Anonymous	N
Object Set	One	220.2	25	264.1	21
	Two	246.5	27	219.2	24

Time Spent

		Group Type: Identified	N	Anonymous	N
Sex	Male	265.2	26	234.0	21
	Female	202.5	26	245.6	24

Table 5.7 Significant Effects in All Sessions of the Brainstorming Tasks for the Dependent Variables Number of Uses, Time Spent Generating Uses and Rate of Idea Creation

Effect	Dependent Variable	F	df
Group Size	Number of Uses	5.03*	(1,87)
	Time Spent	4.57*	(1,87)
	Rate of Idea Creation	0.45	(1,87)
Session	Number of Uses	8.89**	(1,87)
	Time Spent	21.77**	(3,261)
	Rate of Idea Creation	3.47*	(3,261)
Group Size and Session	Number of Uses	6.38**	(3,261)
	Time Spent	1.90	(3,261)
	Rate of Idea Creation	1.94	(3,261)

*$p<0.05$
**$p<0.01$

Table 5.8 Means Corresponding to the Significant Effects in Table 5.8

Time Spent Generating Uses

Group Size	Individual	Group
Time (secs.)	280.1	269.3

Session	One	Two	Three	Four
Time (secs.)	320.9	304.1	239.6	234.3

Rate of Idea Generation

Session	One	Two	Three	Four
Rate (Idea/min.)	1.65	1.78	1.91	1.80

Number of Uses

		Session				
		One	Two	Three	Four	All
Group Size	Individual	7.96	9.34	6.99	6.67	7.74
	Group	8.40	7.93	6.80	6.34	7.37
All Respondents		8.18	8.63	6.89	6.51	

Experiment 5: Brainstorm Judging

We designed the brainstorm judging task as a study of the impact of social loafing on a judgement task which would also provide objective measures of the creativity of the uses generated by participants in the second brainstorming task. For half the uses that they were judging, the raters were told that they were judging them individually and for the other half, they were told that they were judging them along with five other judges.

With the above design, we could assess the effects of perceived shared responsibility on judgement of creativity. We were interested in two comparisons. We compared the individual and group mean levels of creativity ratings assigned by the judges. We assessed the difference in the variance of the creativity ratings between individual and group raters to indicate whether there was a difference in the degree to which raters discriminated among the items that they were judging.

Method. Judges were shown the brainstorming task ideas of other CAPS participants. They were asked to judge the creativity of the ideas, first as individual ideas and then as sets of ideas for an object generated by a brainstormer. Each judge rated the ideas of six "randomly selected" participants on a one to ten creativity scale, where one was unimaginative and ten was very creative.

In actuality, four of the idea sets were from their regular and anonymous group members and the other two were standard sets of ideas which were rated by all judges. Judges had no way of learning the identity of the people whose ideas they were judging nor who was rating their ideas. The two standard sets of uses were presented to the judges in a specified order relative to the individual or group condition. Half of the raters judged the first control set (and two brainstormers' sets) in the individual condition (control condition one) and the other half judged it in the group condition (control condition two).

The brainstorming ideas were rated under either an individual judge or a multiple judge condition. For half of the ideas they rated, judges were told that they alone were judging the creativity of the uses generated for an object. For the other half of the ideas, they were told that they shared the responsibility for judging the creativity of the ideas with five other judges and that the creativity score would be the average of the ratings from all six judges. Actually, two judges rated each idea and each set, one in the individual judge condition and one in the multiple judge condition.

Results. Our analysis indicated several significant main effects and interactions (Table 6). In many cases, the effects involved only

one of the dependent variables.

Object set had a significant effect on both average and set ratings, although its strongest relationship was with the overall rating of a set of uses. We will not discuss the significant interaction between object set and session, since there are other interactions of greater interest.

The remaining interactions consistently included group size and control condition as variables. Their interaction was significant for the average rating of uses, as was a three way interaction including them and sex. We were also interested in the interaction involving group size, control condition and session, which was significant for the ratings of a sets of uses.

We were less interested in the last two interactions in Table 6.1 because both were difficult to interpret. The interaction of group size, control condition and object set included two variables which were related to the characteristics of objects. Since it is hard to define which characteristic might be operating, their interaction is even more difficult to describe. The final interaction added a variable to the interaction just discussed and made it more complicated.

The judges' mean average ratings were less than their mean set ratings (Table 6.2). The set ratings in session one were higher than in session two. Object set one (brick or phone directory) received higher average ratings than object set two (beer can or toothpick) while its idea set ratings had the opposite trend.

We found a social loafing effect in control condition one but an opposite effect in control condition two. When sex was included in the interaction, males and females showed a similar pattern to the overall group although the males displayed a weaker social loafing effect and almost no reverse effect.

Judging session however, had a very different effect on the interaction. Session one contained a social loafing effect in both control conditions, while session two had a reverse effect under both control conditions.

When we analyzed the variance of the judges' ratings (Table 6.3), we discovered that the variances were not normally distributed. A log transformation improved their distribution, and we used the log of the variances in our analysis. The analysis indicated two significant effects by MANOVA (Table 6.4). We included control condition (MANOVA $p<0.10$), group size (MANOVA $p<0.10$) and the interaction of group size, session and control condition (MANOVA $p<0.10$) as possible effects, because one of their univariate repeated measures statistics was significant and because they are similar to the effects seen in the analysis of the ratings.

Judges varied more in their set ratings than their average

ratings and the geometric mean variance of the set ratings for session one (1.92) was greater than that of session two (1.44). We will not discuss the interaction of group size, object type and control condition for the same reasons as were given when it was significant for the average and set ratings.

Discussion. The large number of significant effects in this analysis makes it difficult to reach overall conclusions. The judges' ratings and their variance were influenced by judging, object set, order of control ideas presentation (control condition) and group size. This indicates that social loafing occurred only under complicated conditions relating to the type of uses judged and the order in which they were judged.

The effect of session and control condition on the ratings is reasonable, since the creativity of the first uses judged may affect the ratings of subsequent uses. If one of the ideas judged in the first session were very creative, then a respondent might assign lower values for less creative ideas in the second session than he would have if he had judged the same ideas before seeing the creative one. Similarly, the order of presentation of the control sets could affect the internal rating scale of the respondent. If the rating scale changed, then the variance of the ratings would also be expected to change.

The type of object might influence the creativity of the uses given for it, so ratings and their variance would also be expected to differ for the two object sets. However, the trend for average ratings was opposite to the trend for the set ratings.

One can understand how the above three variables might affect the ratings and their variance but their effect on the difference between ratings (and their variances) done individually and ratings (and their variances) done with a group is not clear. Rating different sets of uses may be different tasks (boring or interesting) and may have different social loafing effects. The time sequence of rating tasks may also influence social loafing.

We found a social loafing effect in this study, under limited conditions. The type of uses judged and their order of presentation influenced the expression of the loafing effect, making it difficult to reach any conclusion. Further studies which control the object types and their order of presentation need to be done.

Table 6 Significant Main Effects and Two-Way Interactions From Multivariate and Univariate Analyses of Judges Ratings (Average Ratings and Set Ratings) of Use from Brainstorming Task

Effect	Test	Dependent Variable	F	df
Session	MANOVA	Both	11.87**	(2,80)
	Univariate Repeated Measures	Average Rating	3.15	(1,81)
		Set Rating	21.47**	(1,81)
Object Set	MANOVA	Both	44.78**	(2,80)
	Univariate Repeated Measures	Average Rating	4.32*	(1,81)
		Set Rating	56.70**	(1,81)
Session and Object Set	MANOVA	Both	30.55**	(2,80)
	Univariate Repeated Measures	Average Rating	9.42**	(1,81)
		Set Rating	61.48**	(1,81)

*$p<0.05$
**$p<0.01$

Table 6.1 Significant Three-Variable and Higher Interactions From Multivariate and Univariate Analyses of a Brainstorm Judging Task

Effect	Test	Dependent Variable	F	df
Group Size, Sex and Control Condition	MANOVA	Both	4.89**	(2,80)
	Univariate Repeated Measures	Average Rating	9.47**	(1,81)
		Set Rating	0.06	(1,81)
Group Size, Session and Control Condition	MANOVA	Both	18.54**	(2,80)
	Univariate Repeated Measures	Average Rating	1.85	(1,81)
		Set Rating	0.06	(1,81)
Group Size, Object Type and Control Condition	MANOVA	Both	50.30**	(2,80)
	Univariate Repeated Measures	Average Rating	6.03*	(1,81)
		Set Rating	69.23**	(1,81)
Group Size, Session, Object Type and Control Condition	MANOVA	Both	38.09**	(2,80)
	Univariate Repeated Measures	Average Rating	76.35**	(1,81)
		Set Rating	18.45**	(1,81)

Table 6.2 Means Corresponding to the Significant Main Effects and Relevant Interactions For Judges' Ratings (Average and Set Ratings) of Uses From a Brainstorming Task

Session

	One	Two
Set Rating	6.85	6.26

Object Type

	One	Two
Average Rating	5.91	5.76
Set Rating	6.27	6.83

Average Rating

Control Condition

	One				Two			
Group Size	Individual	N	Group	N	Individual	N	Group	N
All Respondents	5.87	39	5.57	39	5.80	46	6.07	46
Male	5.67	17	5.52	17	5.60	23	5.66	23
Female	6.03	22	5.60	22	6.00	23	6.47	23

Set Rating

Control Condition

		One (N=39)		Two (N=46)	
	Group Size	Individual	Group	Individual	Group
Session	One	6.76	6.62	6.59	6.01
	Two	5.85	6.31	5.60	7.32

Table 6.3 Significant Effects From Multivariate and Univariate Analyses of the Variance of the Judge's Ratings (average ratings and set ratings) of Uses From a Brainstorming Task (logs have been taken to normalize the distribution of values).

Effect	Test	Dependent Variable	F	df	p
Session	MANOVA	Both	3.50*	(2,83)	0.03
	Univariate	Average	0.28	(1,84)	0.60
	Repeated Measures	Set	7.06**	(1,84)	0.01
Group Size, Object Set and Control Condition	MANOVA	Both	13.037**	(2,83)	<0.001
	Univariate Repeated Measures	Average	13.45**	(1,84)	<0.001
		Set	21.62	(1,84)	<0.001

*p< 0.05
**p< 0.01

Experiment 6: Anagrams

We administered two versions of an anagrams task to a group of college students to see if a cognitive task elicited a social loafing effect. In the first version, we presented four words to the participants and asked them to form as many four or more letter words from them as possible. During each of two sessions, a word-maker worked on one word individually and on another word along with the rest of his or her group. The instuctions indicated that a participant was in either an anonymous or an identified group so that we could study whether the type of group had any effect on social loafing.

We made two changes between the first and second versions of the anagrams task: 1) group members were told that they were working on different words for a combined score 2) an incentive manipulation was added. We changed the stimulus words because, in the group condition, a respondent might have felt that his or her efforts were redundant to those of the other group members and might not have worked as hard on the task. To eliminate this possible effect, which cannot be differentiated from a true social loafing effect, four sets of stimulus words were constructed. Each set consisted of three words with the same letters in different orders. Each member of a group was assigned to a different word in the set but was working with the same group of letters as the other members of the group. A perceived redundancy was no longer likely and any effect of the group condition would be due to social loafing.

We included an incentive manipulation to examine whether the social loafing effect was enhanced or diminished by the presence of contingent monetary rewards. The reward in the individual condition was based on individual scores while, in the group condition, it was based on the average score of the group.

High scores on the dependent measures (number of correct responses) could reflect two different creative strategies. Word-makers might concentrate and use their time more efficiently or simply spend more time working on the task. We employed another measure to differentiate these two processes. We determined the time spent on each stimulus word to measure persistence at the task, or quantity of performance. We analyzed the ratio of the above two measures, number of correct responses per unit time, as an index of efficiency of performance.

Method. In the first version of the anagrams task, computerized instructions asked the scramblers to form at least four-letter words from the word MASTER, VIRGINAL, ANGELIC and ROTATES. They could not use proper names and plurals of three-letter words. After each response, the computer informed the respondent whether the word was correct, incorrect or a duplicate of a previous response. It continuously displayed the correct responses that had already been produced.

The computer program presented two stimulus words in each

session, one in the individual and one in the group condition. The order of the group or individual condition and of word presentation was balanced across subjects. Instructions for the individual condition stated the respondent was working alone and that his or her record of performance would be entered as an individual score. Group instructions informed half the participants that they were working with an identified group and the other half that they were working with an anonymous group and that the results would be entered as an average group score. Each scrambler worked with only one type of group for both sessions of the first version of the task.

The four sets of words for the second version of the anagrams task were: 1) MARBLE, RAMBLE, AMBLER; 2) MARINE, AIRMEN, REMAIN; 3) NECTAR, TRANCE, CANTER; AND 4) DETAIL, TAILED, DILATE. Rules for proper responses and entry of correct answers into the computer were the same as in the first version.

Word-makers were assigned to the individual and group conditions as before. The individual and group instructions were the same. However, half the scramblers worked under an incentive condition. Under individual instructions, these word-makers were told that the nine individuals with the highest scores would receive a three dollar bonus. Incentive respondents working in the group condition were told that three dollar bonuses would be given to the members of the three highest scoring groups (also nine respondents).

In anonymous and identified group situations, participants were told that they were the only member of their group who was working on a particular word. In the group condition, each member was given a different word from each anagram set to eliminate the possibility that scramblers would feel that their individual efforts were redundant.

Results. The average word-maker took 10 minutes to create 14.8 allowed words in the first version of the task. In the second version, an average scrambler created 12.9 words in 7.75 minutes.

Significant multivariate effects for the first anagrams task are given in Table 7. We were not interested in the session and wordset interaction and found the relationships within the session, group size and wordset interaction too complicated to interpret, so neither will be discussed further.

On the first version of the task, word-makers produced more words in the second session than the first and there was an overall social loafing effect on both the number correct and the time spent working on the task (Table 7.1). All the categories of sex and group type showed a consistent loafing effect for both dependent variables.

Initial analysis of the second anagrams task, with three between-subject variables, had one cell in the design with only two subjects. Since sex was involved only in the highest order interaction, and since that interaction was marginally significant, we conducted the analysis without sex. This design had a minimum cell size of eleven.

We showed a significant session effect on the number of correct words (Table 7.2). Group size and the interaction of group size, wordset and incentive were significant effects for the time spent working on the task.

Respondents were able to produce more words in the second session than the first. (Table 7.3) Time spent showed an overall social loafing effect which we demonstrated in all categories of the wordset and incentive interaction with group size.

We present the significant effects from an overall analysis of the two tasks in Table 7.4. Scramblers produced more words in sessions one and two than in sessions three and four (Table 7.5). Word-makers generated more words individually than in a group. We found a social loafing effect for time spent in all four sessions of the anagrams task.

Since both the quantity of words generated and the time spent working on the task showed a social loafing effect, we did an analysis of the ratio of the two, the rate of word production, to investigate its relationship with group size, session and sex. A univariate repeated measures analysis of the relationship between the three variables and the log of the rate (the log transformation made the distribution more normal) showed a significant ($F(3,255)=27.37$, $p<0.01$) effect of session, but no effect of group size.

Comparing geometric means, scramblers produced more words in session two than in session one and the word-makers in session four produced more than in session three. Participants generated more words in the last two sessions than in the first two.

Discussion. The relationships of the experimental factors were more complicated in the first anagrams task than the second. We found a significant social loafing effect in both tasks, and within two of the three significant interactions, all categories showed a social loafing effect.

The difference in the instructions between the first and second version of the anagrams task narrowed the gap between individual and group for both dependent variables. Our concern that participants felt that their efforts were redundant when working in a group during the first version may have been correct.

The joint analysis indicated a clear social loafing effect that prevailed in all four sessions of the task. We discovered a consistent social loafing effect in the separate analyses which

persisted within most of the significant interactions. The type of cognitive task represented by anagrams showed a social loafing effect which appeared even within categories of variables, such as the wordset, type of group, session and incertive, which also affected the quantity of output expended.

We were interested that there was no social loafing effect on the rate of word production. Word-makers produced less output under the group condition, but they also spent less time working on the task, so their rate of output for the task was not significantly different. Apparently, social loafing affected the amount of time the participants were willing to spend on the task but did not affect their rate of word production.

Table 7 Significant Multivariate Effects From the First Version of an Anagrams Task

Effect	Test	Dependent Variable	F	df
Session	MANOVA	Both	18.22**	(2,77)
	Univariate Repeated Measures	Number Correct	7.35**	(1,78)
		Time	1.76	(1.78)
Group Size	MANOVA	Both	10.50**	(2,77)
	Univariate Repeated Measures	Number Correct	12.86**	(1,78)
		Time	20.95**	(1,78)
Session and Wordset	MANOVA	Both	3.35**	(6,154)
	Univariate Repeated Measures	Number Correct	4.00**	(3,78)
		Time	5.89**	(3,78)
Session, Group and Workset	MANOVA	Both	25.61**	(6,154)
	Univariate Repeated Measures	Number Correct	63.20**	(3,78)
		Time	0.76	(3,78)
Group Size, Sex and Group Type	MANOVA	Both	3.72*	(2,77)
	Univariate Repeated Measures	Number Correct	7.48**	(1,78)
		Time	4.26*	(1,78)

*$p<0.05$
**$p<0.01$

Table 7.1 Means Corresponding to the Main Effects and the Group Size, Sex and Group Type Interactions in Table 7.1

	Session	
	One	Two
Number Correct	14.09	15.52

	Group Size	
	Individual	Group
Number Correct	15.60	14.01
Time (secs.)	650.6	550.2

Number Correct

		Sex			
		Male (N=23)		Female (N=24)	
Group Size		Individual	Group	Individual	Group
Group Type	Anonymous	18.11	14.39	14.17	13.75
	Identified	15.74	15.35	14.48	12.63

Time (secs.)

		Sex			
		Male (N=23)		Female (N=24)	
Group Size		Individual	Group	Individual	Group
Group Type	Anonymous	765.2	558.3	540.5	492.1
	Identified	713.0	646.7	591.2	507.9

Table 7.2 Significant Multivariate Effects from an Analysis of The Number of Correct Words Produced and the Time Spent Working on the Second Version of an Anagrams Task

Effect	Test	Dependent Variable	F	df
Session	MANOVA	Both	48.35**	(2,86)
	Univariate Repeated Measures	Number Correct	60.80**	(1,87)
		Time	0.01	(1,87)
Group Size	MANOVA	Both	7.02**	(2,86)
	Univariate Repeated Measures	Number Correct	2.60	(1,87)
		Time	14.20**	(1,87)
Group Size, Wordset and Incentive	MANOVA	Both	3.85*	(2,86)
	Univariate Repeated Measures	Number Correct	3.63	(1,87)
		Time	6.95**	(1,87)

*$p<0.05$
**$p<0.01$

Table 7.3 Means for the Significant Effects in Table 7.3

Number of Correct Words Produced

Session

One	Two
11.85	13.98

Time Spent Working on the Task

Group Size

Individual	Group
480.1	450.9

Wordset

		One (N=23)		Two (N=24)	
Group Size		Individual	Group	Individual	Group
Incentive	None	483.4	435.2	419.3	415.4
	Incentive	481.5	467.7	536.6	484.9

Table 7.4 Significant Multivariate Effects From an Analysis of Sex, Session and Group Size on Number of Correct Answers and Time Spent Working on Both Versions of an Anagrams Task

Effect	Test	Dependent Variable	F	df
Session	MANOVA	Both	26.78**	(6,80)
	Univariate	Number Correct	26.04**	(3,83)
	Repeated Measures	Time	7.86**	(3,83)
Group Size	MANOVA	Both	14.12**	(2,84)
	Univariate	Number Correct	12.39**	(1,85)
	Repeated Measures	Time	28.19**	(1,85)
Group Size and Session	MANOVA	Both	2.37*	(6,80)
	Univariate	Number Correct	1.24	(3,83)
	Repeated Measures	Time	4.13**	(3,83)

*$p<0.05$
**$p<0.01$

Table 7.5 Means Corresponding to Significant Effects in Table 7.5

Session

	One	Two	Three	Four
Number Correct	14.25	15.67	11.84	13.99
Time (secs.)	623.5	574.3	459.8	459.3

Group Size

	Individual	Group
Number Correct	14.49	13.38
Time (secs.)	561.1	497.4

Time (secs.)

Group Size

		Individual	Group
Session	One	679.4	567.5
	Two	618.1	530.4
	Three	477.2	442.3
	Four	469.5	449.1

Experiment 7: Paired Associates Learning

In this study, we examined the possibility of a social loafing effect on a learning task. The difficulty of the learning task was varied and an incentive was included to determine the influence of each on the social loafing effect.

Method. The learning material consisted of four lists, two of which were easy and two which were difficult. We followed the principles for list construction of Spence, Farber and McFann (1956). Easy lists contained words with high prior association between stimulus and response (e.g., belief-faith) and with low prior association across pairs. Difficult lists consisted of words with low intra-pair association and high inter-pair association. Computerized instructions told the learners that the task objective was to remember the second of the two words from the pair when the stimulus (first word) was presented. They were given eight seconds to enter the correct response.

Table 8 presents the four word lists. Students began with a practice list of five easy pairs of words administered to insure that they understood the instructions.

Learners worked on one easy and one difficult list in each of two sessions. In one session, students learned the lists in the individual condition (they were told that their score would be entered individually) and in the other session, they worked on both lists in the group condition (they were told that their group score would be entered). Therefore, condition was confounded with session, in the within subjects design.

The computer program presented the word pairs one at a time for eight seconds each to allow the learners to memorize the lists. The students tried each word list five times. Word pairs were presented in random order for each trial.

Half of the learners worked with an incentive. They were told that the nine individuals or the individuals in the three groups (if they were working with a group) with the highest scores would receive a three dollar bonus.

We measured the students' effort by the total number of errors in the five trials and the total time spent on the task.

Results. An average participant spent almost 27 seconds trying a word list and made 1.6 mistakes. For the first two trials, the average learner spent 30 seconds per trial and made 2.6 mistakes, but he or she improved on the last three trials to an average of 25 seconds and less than one error.

We discovered that sex and list difficulty had significant effects on both dependent variables and that their interaction was significant for time spent on the task (Table 8.1). Group size and sex showed a significant effect on the number of incorrect answers and the interaction of group size, list

difficulty and sex was significant for the total response time. Their nonsignificant multivariate statistics indicate that the univariate result may have been due to chance.

Women made fewer errors than men and also took less time to respond to the stimulus words (Table 8.2). All learners made fewer errors and took less time to respond on easy lists.

The mean number of errors and mean time spent within the sex and difficulty interaction were as expected from the direction of the main effects.

Males exhibited a social loafing effect for the number incorrect (an increase indicates social loafing), but females showed a weak effect in the opposite direction. Females spent slightly less time on difficult lists in the group condition while males loafed on easy lists. The opposite was true for females working on easy matches and males working on hard matches.

We subdivided the above analyses into the first two trials and the last two trials of a list to separate the initial learning period from the later period when, presumably, most of the learning had occurred. We found the same effects as in Table 8.1 and discovered some effects of trial number (Table 8.3).

Students made considerably more mistakes on the first two trials than the last three while their response time decreased significantly but not as drastically (Table 8.4). The means within the trial number and list difficulty interaction were as expected from the direction of the main effects.

Discussion. We discovered two interesting effects associated with the sex of the respondents. Women performed much better than the men both in mean number of incorrect answers and in mean response time. Surprisingly, men took less time to respond on difficult lists than easy ones. Perhaps they were frustrated and entered any response when presented with a stimulus word.

We saw little evidence of social loafing in this experiment. Monetary incentive had no effect. However, we found two expected results: list difficulty and trial number were highly significant effects for both dependent variables.

Table 8 Word Lists Presented

Session 1

Easy

Stimulus	Response
Insane	Crazy
Stanza	Verse
Adept	Skillful
Wisdom	Truth
Frigid	Arctic
Complete	Thorough
Distant	Remote
Empty	Vacant

Difficult

Stimulus	Response
Quiet	Double
Serene	Headstrong
Migrant	Agile
Gypsy	Opaque
Roving	Nomad
Tranquil	Placid

Session 2

Easy

Stimulus	Response
Device	Gadget
Belief	Faith
Urgent	Pressing
Pious	Devout
Hermit	Alone
Mammoth	Oversize
Stubborn	Headstrong
Wicked	Evil

Difficult

Stimulus	Response
Barren	Fruitless
Little	Minute
Petite	Yonder
Desert	Leading
Arid	Grouchy
Undersized	Wholesome

Table 8.1 Significant Effects From a Multivariate and Univariate Analysis of the Number of Incorrect Answers and the Total Response Time of a Paired Associates Learning Task

Effect	Test	Dependent Variable	F	df	p
Sex	MANOVA	Both	14.02**	(2,87)	<0.01
	Univariate Repeated Measures	Number Incorrect	12.17**	(1,88)	<0.01
		Time	28.35**	(1,88)	<0.01
List Difficulty	MANOVA	Both	78.93**	(2,87)	<0.01
	Univariate Repeated Measures	Number Incorrect	118.71**	(1,88)	<0.01
		Time	4.26*	(1,88)	0.04
Sex and List Difficulty	MANOVA	Both	14.63**	(2,87)	<0.01
	Univariate Repeated Measures	Number Incorrect	0.24	(1,88)	0.63
		Time	19.99**	(1,88)	<0.01
Group Size and Sex	MANOVA	Both	2.55	(2,87)	0.08
	Univariate Repeated Measures	Number Incorrect	4.50*	(1,88)	0.04
		Time	0.07	(1,88)	0.79
Group Size, List Difficulty and Sex	MANOVA	Both	2.31	(2,87)	0.11
	Univariate Repeated Measures	Number Incorrect	1.89	(1,88)	0.17
		Time	4.67*	(1,88)	0.03

Table 8.2 Means Corresponding to the Significant Univariate Effects in Table 8.2 for Mean Number of Incorrect Responses and Mean Response Time Per List

Sex

Incorrect	Male	Female
Mean Number Incorrect	.88	1.31
Mean Time	29.87	24.02

List Difficulty

	Easy	Difficult
Mean Number Incorrect	1.05	2.13
Mean Time (secs.)	26.40	27.36

Number Incorrect

Sex

		Male	Female
List Difficulty	Easy	1.36	0.75
	Difficult	2.39	1.88

Group Size

		Individual	Group
Sex	Male	1.74	2.02
	Female	1.34	1.29

Mean Response Time (secs.)

Sex

		Male	Female
List Difficulty	Easy	30.42	22.55
	Difficult	29.33	25.49

Table 8.2 (cont.)

		Sex			
		Male		Female	
		Individual	Group	Individual	Group
List Difficulty	Easy	30.92	29.92	22.27	22.83
	Difficult	28.59	30.06	25.72	25.25

Table 8.3 Significant Results From Univariate and Multivariate Analyses of Trial Number and the Variables in Table 8.1

Effect	Test	Dependent Variable	F	df	p
Trial Number	MANOVA	Both	397.7**	(2,87)	<0.01
	Univariate Repeated Measures	Number Incorrect	635.6**	(1,88)	<0.01
		Time	274.3**	(1,88)	<0.01
Trial Number and List Difficulty	MANOVA	Both	21.81**	(2,87)	<0.01
	Univariate Repeated Measures	Number Incorrect	24.56**	(1,88)	0.01
		Time	2.41	(1,88)	0.12
Trial Number Group Size and Sex	MANOVA	Both	2.50	(2,87)	0.09
	Univariate Repeated Measures	Number Incorrect	4.01*	(1,88)	0.05
		Time	2.13	(1,88)	0.15

* $p<0.05$
** $p<0.01$

Table 8.4 Mean Number of Incorrect Answers and Mean Response Time by Trial Number and by Trial Number and List Difficulty

	Trial Number	
	1-2	3-5
Number Incorrect	2.62	0.90
Time	30.43	24.64

Number of Incorrect Answers

		Trial Number	
		1-2	3-5
List Difficulty	Easy	1.88	0.50
	Difficult	3.36	1.31

Summary

We summarize the results of the seven CAPS studies in Table 9. In the analyses reports there, a main effect is evidence for social loafing and consistent interactions strengthen our conviction that social loafing occurred. Inconclusive interactions are suggestive, but further study is necessary to determine if social loafing occurs under the relevant conditions.

We demonstrated a social loafing effect in an electronically mediated group setting. The brainstorming and anagrams studies showed an overall social loafing effect for a total of four dependent variables. However, the restaurant, brainstorm judging and paired-associates learning tasks did *not* have a social loafing effect. The social loafing effect occurs with computerized group tasks, but it may occur only with certain types of tasks.

Both cognitive and physical tasks showed a social loafing effect, although it was not present in all studies. One of the two physical tasks (shouting but not clapping) demonstrated social loafing effects while two (brainstorming and anagrams) of the six cognitive tasks were distinguished by a social loafing effect. From these results, we conclude that physical tasks are very likely to show a social loafing effect while electronically mediated cognitive tasks demonstrate one less frequently. The inconclusive interactions involving social loafing found in the brainstorming, brainstorm judging and paired-associates learning tasks indicate that further research needs to be done to pinpoint the conditions under which social loafing occurs in a electronically mediated cognitive tasks.

When social loafing occurred on tasks concerned with the quality of work, it affected both the quality and quantity of work. In the anagrams task, the number of correct words produced, a measure of quality, and time spent, a measure of quantity, showed a social loafing effect and consistent interactions. Inconclusive interactions in the brainstorming, brainstorm judging and paired-associates learning tasks require further study to determine the conditions under which social loafing affects the quality of output.

Neither of the decision-making studies (restaurant and brainstorm judging) demonstrated a clear-cut social loafing effect, but the variance of the judges' ratings (an indicator of the quality of their discrimination) showed social loafing under certain limited conditions. The restaurant choice task indicated no effect of social loafing on decision-making strategies or decision quality. These mixed results point to a need for more research.

The magnitude of the social loafing effect did not vary with the difficulty of the brainstorming task, even though both group size and difficulty had a significant effect on the quantity of

ideas and the time spent at the task. In the paired-associates learning task, there was a significant difficulty effect, but no social loafing effect and no interaction between them. Although this suggests no relationship, further research needs to be done.

According to the results of the anagrams and paired-associates learning tasks, contingent monetary incentives do not have an effect on social loafing. Incentive had a significant relationship with the social loafing effect present in the anagrams task but its relationship to social loafing depended on the wordset presented. The social loafing effect was present within all levels of wordset and incentive. In the paired-associates task, there was no significant social loafing effect for the incentive to modify. Different types of incentives in different tasks need to be studied.

We found that perceived redundancy of effort in group settings (anagrams task) increased the difference between a participant's individual and group efforts, but when we removed the redundancy, a social loafing effect was still present. The effect of redundancy of effort mimicked a social loafing effect but the social loafing effect did not depend on the perceived redundancy of effort.

We found that the type of group can influence the social loafing effect. In the first brainstorming task, anonymous group members displayed a social loafing effect while standing group members showed a reverse effect. In the anagrams task, both anonymous and standing group members demonstrated a social loafing effect while, in the paired associates task, we found no significant relationship between the social loafing effect and group type. Further research is needed to clarify this issue.

Since there was not a significant social loafing effect in the restaurant choice task, we cannot determine whether the magnitude of the social loafing effect varies with the size of the party affected by the output. Party size affected the decision-making process and determined how long the process took, but it was not associated with group size in our study.

We have indicated the answers to some of the questions posed earlier, but most of them require further research to answer fully. Our research indicates intriguing possibilities for improving output of several people by having them work individually and, if they must work in groups, by avoiding anonymous types of groups. Other means of improving output, such as individual versus group work on quality and quantity tasks, difficult and easy tasks and on decision-making tasks need to be investigated further.

Table 9 Significant Effects and Interactions Found Relating to Social Loafing

Study	Dependent Variable	Social Loafing Effect Found: Main Effect	Consistent Interactions	Inconclusive Interactions
Sound Production	Shouting	X		
	Clapping			
Counting	Errors	X	X	
Restaurant	Unique Cells			
	Repeat Cells			
	Time			
	Variance			
Brainstorming	Quantity	X		X
	Quality			X
	Time	X		X
Brainstorm Judging	Ratings			X
	Variance			X
Anagrams	Correct Words	X	X	
	Time	X	X	
Paired-Associates Learning	Errors			X
	Time			X

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