The Effects of Publicly Displayed Individual Feedback on Social Loafing

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THE EFFECTS OF PUBLICLY DISPLAYED INDIVIDUAL FEEDBACK
ON SOCIAL LOAFING

by

Nelson R. Eikenhout

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THE EFFECTS OF PUBLICLY DISPLAYED INDIVIDUAL FEEDBACK ON SOCIAL LOAFING

Nelson R. Eikenhout, M.A.

Western Michigan University, 1996

The decrease in individual performance output that occurs when individuals perform a task in groups in which the output is pooled has been labelled social loafing. The purpose of this study was to determine what would happen to the quantity and quality of individual performance in groups when public, individual feedback was present and absent.

An ABCBC experimental design was used. Four subjects worked individually, together in a group without feedback, and in the group in the presence of feedback making widgets out of plastic pop beads. The number of widgets made and the number of widgets made correctly were recorded for each subject.

A small degree of social loafing was found for two subjects for the number of widgets correctly made and for one subject for the number of widgets made. When public, individual feedback was presented, both the quantity of widgets made and the quantity of widgets correctly made increased for all four subjects.
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INTRODUCTION

Background

For nearly 20 years social psychologists have been exploring a behavioral phenomenon called "social loafing." Of more than 60 studies published about social loafing none has been published in any of the behavioral journals. That social loafing has been completely ignored by behavioral psychologists is quite surprising for two reasons. First, given the emphasis that behavioral psychology places on environmental causes of behavior, a behavioral explanation of social loafing can provide us with a more complete understanding of how the environment can control behavior. It is surprising that behavior analysts haven't yet picked up on a large body of research that might aid in a better understanding of behavior. Second, and perhaps even more surprising is that organizational behavior management experts haven't looked at the social loafing phenomenon when it so obviously applies to work environments, most notably to team performance. Behavioral research on social loafing can provide an understanding of how to best arrange the work environment so that performance in groups with a pooled output (which is what teamwork, and many manual tasks such as sorting or group manufacturing of products involve) can be maximized.
Social loafing refers to the decrease in individual performance that occurs when individuals perform a task in groups in which the output is pooled. By pooled output we mean that the performance of all group members is added together to get a total group output. Therefore, since all group members contribute to a single group outcome, individual performance output is obscured. The first study demonstrating social loafing was conducted by Ringelman (1913, and summarized by Kravitz & Martin, 1986) and found that students pulled on a rope with less force when they worked together than would be predicted based on the sum of their individual outputs. This effect (later to be renamed "social loafing") was called the "Ringelman Effect." Over six decades separated the Ringelman study from the next study that demonstrated this phenomenon. Latane', Williams and Harkins (1979) found results similar to the Ringelman study, but with a different task. In the Latane' et al. (1979) study, individuals shouted louder when they were alone than when in a group. Latane' et al. labelled the phenomena of diminished productivity in groups with a pooled output "social loafing." This experiment led to numerous other studies that found social loafing occurred with a variety of tasks including pumping air (Kerr & Bruun, 1981), generating as many uses as possible for an object (Harkins & Petty, 1982), negotiating simple mazes (Jackson & Williams, 1985), and swimming (Miles & Greenberg, 1993; Williams, Nida, Baca, & Latane, 1989).
A number of theories have been proposed to explain the causes of social loafing. These include "motivation loss" (Latane' et al., 1979) which states that social forces arising from group interaction cause individuals to exert less effort than if they performed the task alone; "output equity" (Kerr, 1983) which asserts that social loafing occurs because individuals working in a group will adjust their level of output to the level they think others in the group are performing; "matching to standard" (Szymanski & Harkins, 1987) which states that social loafing occurs when standards of performance are absent (a better name to describe this theory might be "absence of standards"); and "absence of evaluation apprehension" (Jackson & Harkins, 1985). The absence of evaluation apprehension explanation for social loafing was explored in a study by Kerr and Bruun (1981) and was called the "hide in the crowd" explanation. This explanation stated that social loafing occurs when the performance task is simple, repetitive, and uninteresting (such as the widget constructing task employed in this study). Individuals performing such a task in groups become unmotivated because of the boring nature of the task and because the pooled output allows for individual performance to go unrecognized. These studies and others like them have almost exclusively come from social psychology journals and have attempted to explain social loafing by referring to various cognitive processes as the causes. The fact that almost all the research so far has attempted to use intervening variables to explain the causes of social loafing has not impaired exploration of ways in which social loafing can be reduced through environmental manipulation. For example,
Harkins and Jackson (1985) manipulated identifiability and the potential for evaluation of a brainstorming task and found that social loafing decreased most when subjects believed that their outputs could be identified and compared to the outputs of other subjects. This study and others such as Harkins (1985) and Szymanski and Harkins (1987) have suggested that performance feedback may be a simple, cost-effective intervention to use to reduce the negative effects on performance that results when individuals work together on a task where there is a common output.
REVIEW OF RELATED LITERATURE

Basically, social loafing research from the hide in the crowd explanation has demonstrated that social loafing occurs when individuals perform a task in groups with a pooled output in the absence of some type of performance identification or evaluation. There has been a wide variety of manipulations in this body of research based on this basic finding. These include variations in the type of performance identification/evaluation, the number of subjects in groups, and the type of task.

Type of Performance Identification/Evaluation

Early research based on the hide in the crowd explanation centered around the hypothesis that social loafing will occur in groups with a pooled output because individual output is not identified. Two studies examined identifiability of task performance. Williams, Harkins, and Latane (1981) measured how loud subjects shouted and Kerr and Bruun (1981) measured how much air subjects could pump into a rubber bulb in 30 seconds and found that social loafing decreased when individual performance was claimed by the experimenter to be identified.

Harkins and Jackson (1985) claimed that these studies really manipulated more than identifiability of task performance; they included the potential for
evaluation. This was because in both studies individuals worked together on the same task, and if each group member's performance could be identified by the experimenter, it could also be compared to the performance of others to make an evaluation of performance. Harkins and Jackson (1985) examined both identifiability and comparability by randomly assigning subjects to one of four conditions using a 2x2 factorial design. The task chosen was to generate as many uses as possible for an object. All subjects worked in groups with a pooled output, but subjects in two conditions were told individual output would be identified, and subjects in one condition were told that their outputs would be identified and that they were performing the same task as other group members. The results showed that social loafing effects were reduced only for subjects in the group where individual performance could be identified and compared to other subjects. This meant that individual performance evaluation was a necessary condition to reduce social loafing for this task. Harkins (1987) provided additional evidence that identifiability and potential for evaluation may be key factors in reducing social loafing effects. Harkins found that for a brainstorming task, if individual performance could be identified and evaluated, social loafing effects were reduced.

In both Jackson and Harkins (1985) and Harkins (1987) the source of the performance evaluation was the experimenter. Szymanski and Harkins (1987) have identified two other potential sources of evaluation in group performance with a pooled output: evaluation by the co-participants and self-evaluation. Szymanski and Harkins (1987) argued that for an individual performer to be able to evaluate
his/her own performance, he/she must be able to measure his/her own output and have a standard to compare his/her performance to other group members.

Szymanski and Harkins (1987) asked subjects to generate as many uses as they could for a knife using a 2x2 factorial design that measured performance in four randomly assigned groups: experimenter evaluation versus no experimenter evaluation and self evaluation versus no self-evaluation. To allow for self-evaluation subjects in that condition were given average group performance data after each session. The results were that social loafing was reduced in conditions where the experimenter could evaluate performance and in conditions where the individual performer could self-evaluate. Social loafing was found only when neither form of evaluation was possible. This study was replicated two times by Harkins and Szymanski (1988, 1989) with a vigilance task and again they found that if subjects could compare their performance to others in the group the loafing effect was reduced. Szymanski and Harkins (1993) replicated their 1987 study and not only found similar performance results, but also that, when asked, subjects indicated a preference to perform in the condition where only self-evaluation of performance was possible (i.e., where only group performance data were presented).

Number of Subjects in Groups

The hide in the crowd theory asserts that social loafing occurs because performing in groups with a pooled output allows for individual performance to go
unrecognized, and that the larger the group the less likely individual performance can get recognized. Therefore, the theory predicts that as group size increases, the size of the social loafing effect should also increase. Most of the research involving the hide in the crowd theory, however, has not examined the effects of group size.

Kerr and Bruun (1981) directly manipulated group size and observed the resulting size of the social loafing effect. Kerr and Bruun placed subjects in either groups of two or four and found that individuals in the larger group pumped air into a rubber bulb with less force than subjects in the two person groups.

Since most of the research from the hide in the crowd explanation has analyzed performance data using a 2-factor ANOVA, group size has been held constant for the advantage of a more straightforward interpretation of main effects and the interaction between the two factors. Social loafing, however, has been demonstrated for groups of pairs (Harkins, 1986), groups of four (Harkins & Jackson, 1985), and for groups of up to 10 (Price, 1987). Other studies such as Szymanski and Harkins (1987) and Harkins and Szymanski (1988) fail to even describe the group size. Therefore, beyond the Kerr and Bruun (1981) study, very little is known about how the size of the social loafing effect might vary as a function of group size.

Type of Task

Research from the hide in the crowd theory has demonstrated social loafing
on a number of simple tasks. These include pumping air into a rubber bulb (Kerr & Bruun, 1981), shouting (Hoffman, 1993; Williams et al., 1981), generating uses for an object (Harkins & Jackson, 1985; Harkins, 1986; Szymanski & Harkins, 1987; Szymanski & Harkins, 1993), signal detection (Harkins & Szymanski, 1988; Harkins & Szymanski, 1989), decision making (Price, 1987), and a perceptual speed task (Matsui, 1987). These studies have demonstrated that social loafing can occur for a wide range of tasks.

Feedback Intervention Findings/Considerations

Social loafing research based on the "hide in the crowd" explanation has combined two important features: the presence of two or more individuals working on a task in which the output is pooled and whether or not individual outputs can be identified. According to the "hide in the crowd" explanation, social loafing occurs when working in a group with a pooled output (an antecedent condition) results in individual performance going unrecognized (a consequence of performing). Therefore, a logical intervention to reduce the social loafing performance decrements is to provide workers individual feedback about their performance.

Research from the "hide in the crowd explanation" has generally examined the effects of performance feedback on social loafing in various forms. For example, Harkins and Jackson (1985) manipulated identifiability and potential for evaluation of a brainstorming task and found that social loafing decreased most
when subjects believed that their outputs could be identified and compared to the outputs of other subjects. The effects of the feedback consequence on future performance were unfortunately not explored in this study since only single measures of individual performance were taken. However, these results still suggest that individual performance feedback for all group members best eliminates the social loafing performance decrements. This type of intervention involves changing the consequence for loafing from being able to "hide in the crowd" to recognition of individual performance.

Other studies, such as Matsui (1987) and Hoffman (1992), have also examined how performance feedback affects social loafing performance decrements. The results have shown generally positive effects of feedback on performance, although neither study showed entirely convincing evidence for the elimination of the loafing effect with feedback. The less than ideal effects of feedback found in both of these studies may, in part, be due to a couple of factors. First, neither study examined the effects of feedback alone and, therefore, the effects of feedback might have been confounded with the effects of the other independent variables (a non-specific goal for the Hoffman study and a team goal for the Matsui study). Also, for the Hoffman (1992) study, a shouting task was used and, therefore, individual performance could not be identified and measured when individuals shouted in groups. Therefore, only group performance feedback was provided which allows individual performance to remain unrecognized. The Matsui study, however, measured a perceptual speed task and did provide
individual feedback. However, in the Matsui study, measures of performance in the social loafing condition in the absence of the intervention were not taken. Comparisons could only be made between performance of individuals performing alone and the performance in pairs under a goal setting and feedback condition. Therefore, an assessment of how the feedback might have affected social loafing performance decrements was not determined. It was only shown that performance levels of individuals performing alone compared to individuals performing in groups with a pooled output and feedback were similar. Many other studies based on the "hide in the crowd" explanation have also employed feedback to try to reduce the social loafing effect. These include Brickner, Harkins, and Ostrom (1986), Harkins (1987), Jackson and Williams (1985), and Bartis, Szymanski, and Harkins (1986).

Interestingly, Harkins and Jackson (1985) and Matsui (1987), both found similar levels of performance in the un-pooled output condition versus the pooled output condition where individual performance could be recognized. A consequence for performing (recognition) is the same in both conditions. This observation may help to explain social loafing more clearly. It may be that social loafing is primarily a result of the lack of feedback for performance. Working in a group with a pooled output is only one possible condition where individual performance feedback may be lacking. It may be that, for example, we would find similar effects on behavior as found for social loafing if individuals work alone on a task without performance feedback. Two studies have looked at how individuals
working alone without feedback perform compared to performance in groups with a pooled output in the absence of feedback.

Williams et al. (1981) found that the average individual performing alone in the absence of feedback performed at a similar level to the average performance in a group with a pooled output and no feedback. The results of this study suggest that feedback may be an important controlling variable to explain why individuals loaf.

Price (1987), however, examined the same relationship as Williams et al. (1981), but found different results. Price found that, in the absence of feedback, individuals who had sole responsibility over a decision making task recalled less detail about their decision than individuals who shared the decision making responsibility. A major problem with this study is that the measure of recall performance seems a poor measurement choice for the decision making task. A measure more relevant to the task might have been to obtain a measure of the quality of the decision made. All of these studies have intervened with individual performance feedback to try to reduce the social loafing effect. Several studies have also shown positive effects of group feedback on social loafing. Szymanski and Harkins (1987), Harkins and Szymanski (1988), and Harkins and Szymanski (1989), which have been already described, have shown that if individuals are provided with feedback about group performance (through a group standard or average), individual performance increases and the social loafing effect is nearly reduced. These studies have described the mechanism for the behavior change as
self-evaluation, but the interventions are no different than normal group feedback.

In general, research from the hide in the crowd theory has shown positive effects of feedback on eliminating at least some of the social loafing effect.
EXPERIMENTAL QUESTION AND RATIONALE

This study attempted to answer the following question: what would happen to the quantity and quality of individual task performance in groups with a pooled output in the presence and absence of individual feedback?

This study addresses several important factors so far unexplored in research on social loafing. First, no studies on social loafing have shown that individual performance decreases when an individual performs in a group with a pooled output. All prior research on social loafing have employed between-subjects designs and have instead compared performance of the control group (individuals performing alone on a task) to performance of at least one experimental group (individuals performing together on a pooled group task). By comparing the mean performance of the two groups, conclusions have been made about the behavior of individuals. This approach can't, however, tell us much about the behavior of specific individuals within a group. This issue is especially relevant when we apply the same approach to assessing the effectiveness of interventions such as feedback on reducing the performance decrements of individuals who loaf. Since between-subjects designs don't expose individual subjects to both the presence and absence of the intervention and also don't track individual performance, the particular individuals who benefit from the intervention cannot be identified. Second, very few studies of social loafing have taken multiple measures of individual
performance. Matsui (1987) is the exception and no performance measures were taken in a social loafing condition. Also, no studies have taken repeated measures of individual performance under a single experimental condition. Third, no studies have examined the effects of individual performance feedback on individual task performance in groups with a pooled output compared to performance of individuals in groups in the absence of the feedback. This could be due, in part, to the difficulty in identifying individual performance when outputs are pooled. This study was designed to correct for this oversight. Finally, previous studies of social loafing have focused on limited dimensions of work performance, i.e., intensity and rate. Such tasks as shouting, pulling ropes, generating ideas, and navigating a maze have ignored an organizationally relevant dimension of work performance: quality. Oftentimes in organizations, it is of more concern if quality of work suffers as a result of working in groups than if just quantity decreases. It may be that working in groups decreases quantity while having no detrimental effects on the overall quality of work. No prior research on social loafing has examined this relationship.
METHODS

Subjects

The subjects in the study were 4 undergraduate student volunteers enrolled in Psychology courses at Western Michigan University (W.M.U). Subjects each received $2.00 for each experimental session in which they participated and an additional $15.00 for completing the study and $10.00 for participating in an exit interview and debriefing session. Subjects were paid each Friday for attendance at the 15 weekly experimental sessions. Subjects read and signed a written statement of informed consent before any experimental sessions were begun.

Setting

The study was conducted in the Psychology 100 office, 301 Wood Hall at W.M.U. The setting is an experimental setting not designed to simulate an actual organizational setting, so that the controlling variables can be examined while minimizing the influence of potential extraneous factors. Subjects worked individually at separate office cubicles and in a four person group at a large rectangular table.

Materials

The work task consisted of constructing "widgets" from plastic pop beads. Pop
beads are small and spherical with a hole in one end and a nipple on the other which can be fit into the hole of another widget. Widgets were constructed by joining together 16 beads; 8 white, 4 blue, and 4 purple. Any variation on this configuration was considered an incorrectly made widget. Subjects each received 3 containers of pop beads when working individually and in groups. Individual performance in the pooled-group conditions was identified by a small dot of blue, black, green, or red permanent paint on the nipple of each purple bead. Each subject was allowed to choose which set of pop beads to use before each group session.

Data

There were two dependent measures in the study. A measure of the number of widgets correctly made by each subject in each 15 minute session provided a measure of the quantity based only on quality performance. The number of widgets made per 15 minute session was also recorded. This measure provided a measure of quantity independent of quality and was also used to help determine the percentage of widgets correctly made. The percentage of widgets correctly made by each subject in each session provided a measure of the quality of performance independent of rate. This measure was calculated by dividing the number of widgets correctly made by the total number of widgets made (correctly and incorrectly) per session and multiplying by 100. The measure of the percentage of widgets correctly made provided a measure of performance based solely on
accuracy. No study on social loafing thus far has examined whether social loafing affects the accuracy of performance.

Each session was monitored by the experimenter and another observer to ensure that no problems, such as cheating on the task, arose. After each session, both observers counted the number of widgets made correctly and incorrectly by each subject. Interobserver agreement was calculated for both dependent measures. For quantity of widgets correctly made, interobserver agreement was calculated by taking the ratio of widgets both observers have identified as correctly made and multiplying the ratio by 100. For the percentage of widgets correctly made, interobserver agreement was calculated by taking the ratio of the percentages each observer calculated independently and multiplying the ratio by 100.

Independent Variable

There were two levels of the independent variable: (1) four person groups in which the output of the widget making task is pooled; and (2) the presence of individual feedback, graphically and publicly displayed showing the number of widgets correctly made after each session.

The public nature of the feedback was chosen because it is the form of feedback that should maximize the potential for evaluation. In Harkins and Jackson (1985), it was found that social loafing reduced most in groups when there was some measure of output taken (identifiability) and when there was some standard against which the output could be compared. The public method of providing
feedback covers both, and also allows performance evaluation by the subject, co-
participants, and the experimenter.

Experimental Design

The design employed is an A-B-C-B-C design consisting of a baseline
phase and four experimental phases. Subjects were first read instructions on how to
perform the widget making task and were allowed a 15-minute preliminary session
in which to practice the task.

Baseline

During baseline each subject made widgets individually in a room with no
one present except the experimenter. Before each session, the experimenter
instructed each subject that he/she had 15 minutes in which to make as many
widgets as possible. Subjects were told to do their best. Two subjects performed
the task at the same time in separate cubicles which prevented subjects from seeing
each other's work. Three sessions were conducted daily during baseline. Baseline
measurement was taken for six sessions for all four subjects.

Pooled Group Output Condition

In this phase subjects performed the same widget making task in 15-minute
sessions in a single four person group. Before each session, the experimenter
instructed the group that they had 15 minutes in which to construct as many
widgets as possible. The group was told to do their best. Data were collected on individual task performance measures as during baseline. The method for identifying individual task performance during this phase was as follows: Each subject in the group was given purple pop beads in which the nipple of each bead had been painted a color that identified which subject constructed a widget. Subjects were allowed to choose which set of beads to use before each session. The placement of the containers of purple pop beads at the four work areas on the large table was also alternated randomly before each day's sessions. After each session, the experimenter and research assistant collected the total number of widgets made by the group and then dismissed the subjects. In private the number of widgets made by each subject was recorded by taking apart each widget to see the color. Data were collected for six sessions during this phase.

**Pooled Group Output With Individual Feedback**

The final phase of the study consisted of providing graphic, public portrayals of individual performance after each session. Subjects were instructed to keep their pile of widgets separate from other subjects so that their individual output could be identified. This change from the pooled group output condition (in which all the widgets made by group members were placed in one pile) was necessary to control for potential carryover effects when reversing back to the pooled group output condition. It was hoped that subjects would believe that their individual outputs could only be identified when they placed their widgets in
separate piles. Before each session in this phase the experimenter instructed the group that they had 15 minutes to make as many widgets as possible. They were told to do their best. They were also told that their individual performance would be identified, and that after each session a graph would be displayed showing the number of widgets correctly made by each group member. Subjects were allowed five minutes before the beginning of the next session in which to examine their's and other subjects' performance. The graph was portrayed on a bulletin board directly in front of the main work table in which subjects were seated. The number of widgets correctly made in each session was displayed numerically next to each subject's name and graphically on a single line graph. Each subject was assigned a color which was used to identify him/herself on the graph. Data were collected for six sessions also during this phase.

**Pooled Group Output Condition**

This phase was conducted exactly as the first pooled group output phase. Data were collected for six sessions during this phase.

**Pooled Group Output With Individual Feedback**

This phase was conducted exactly as the first pooled group with individual feedback phase. Data were collected for six sessions during this phase.
RESULTS

In general terms, the intent of this study was to examine the effects of individual, publicly displayed feedback on social loafing. This section is divided into two main parts. First the results concerning the occurrence of social loafing are presented. The effects of feedback on task performance will then be described in the context of the social loafing results.

Did Social Loafing Occur?

Number of Widgets Made

Group Level Analysis

If we look at just the quantity of widgets made we see little indication of a decrease in performance when subjects performed in groups with a pooled output. In fact what was found was generally a slight increase in the quantity of widgets made. As is depicted in Table 1, the mean number of widgets made by all four subjects together without feedback was 126.5 and 126 in phases 2 and 4, respectively, compared to 122.5 when working individually in phase 1.

Table 5 in Appendix A shows the mean scores for the individual, group pooled (phases 2 and 4 combined), and group pooled individual feedback (phases 3 and 5 combined) conditions and the associated statistical analyses for the number
of widgets made. Analyses were computed to determine whether the differences between the group means for each experimental condition were significant. The t-value ($t = -0.87$) for the difference between the individual group mean and the pooled output group mean was not statistically significant.

Table 1

Totals for the Number of Widgets Made per Phase

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>143</td>
<td>136</td>
<td>152</td>
<td>135</td>
<td>152</td>
</tr>
<tr>
<td>Subject 2</td>
<td>117</td>
<td>121</td>
<td>156</td>
<td>116</td>
<td>160</td>
</tr>
<tr>
<td>Subject 3</td>
<td>87</td>
<td>100</td>
<td>122</td>
<td>96</td>
<td>134</td>
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<tr>
<td>Subject 4</td>
<td>143</td>
<td>149</td>
<td>167</td>
<td>157</td>
<td>175</td>
</tr>
<tr>
<td>Mean</td>
<td>122.5</td>
<td>126.5</td>
<td>149.25</td>
<td>126</td>
<td>155.25</td>
</tr>
</tbody>
</table>

A 3X4 (conditions by subjects) repeated measurement analysis of variance was performed to determine if there were significant differences among the means of the three experimental conditions. The F obtained (14.97) was statistically significant at $a=0.01$. Protected LSD tests were performed to determine where significant differences lie between conditions. The t-value comparing the means for individual versus pooled output performance was -0.63 and was not statistically significant.
Individual Level Analysis

Although the comparisons of the mean performance under the three conditions provide a useful summary of the overall outcome, a more sophisticated analysis focusing on the individual behavior change within and between phases was carried out. Regression slopes were used to model the behavior within each phase for each subject. Figures 1 and 2 depict slopes for all four subjects' performance on single graphs for purposes of easy comparison. Figure 1 shows the graph of the slopes per phase for the number of widgets made and Figure 2 shows the same graph for the number of widgets correctly made. The steepest slopes overall are in phase 2. Their magnitude may have been due to social comparison or to a learning curve that could have been simply a function of subjects being able to observe each others' widget making techniques. We can see in both Figure 1 and 2 that although there was considerable variability in the data from phase to phase for each subject, the individual differences that existed were mostly consistent across the phases. Subject 4 consistently made more widgets than the other subjects. Subject 1 made the next most widgets except during the feedback phases, and Subject 3 consistently produced the fewest widgets across each phase.

Individual totals are mostly consistent with group totals. However, Subject 1 produced seven and eight widgets fewer in phases 2 and 4 than the 143 widgets she made in phase 1, and subject 2 made 116 widgets in phase 4 compared to 117 in phase 1. Subjects 3 and 4 totals ranged from increases of 6 to 14 more widgets
Figure 1. Graph of Slopes per Phase for the Number of Widgets Made.
Figure 2. Graph of Slopes per Phase for the Number of Widgets Correctly Made.
made in the pooled output/no feedback setting compared to the individual setting.

Figures 3-7 show the graphs for the number of widgets made for each subject and the whole group. The graph of Subject 3's performance in Figure 5 shows an interesting trend. The number of widgets made in the first two sessions of phase 2 is three fewer compared to the last data point in phase 1. This is followed by a steady increase in performance through session 11 which account for the overall increase in performance for phase 2 by Subject 3.

Number of Widgets Correctly Made

Group Level Analysis

The number of widgets correctly made provides some evidence for the existence of social loafing, if only in some subjects. The group means show a slight decrease in the mean number of widgets correctly made from 122.25 widgets in phase 1 to 121 in phase 2 (see Table 2). The individual performance data are more interesting, however. Changing from working alone to working in a small group with a pooled output affected subjects' performance in different ways.

Table 6 in Appendix A shows the mean scores for the individual, pooled group (phases 2 and 4 combined), and pooled group individual feedback (phases 3 and 5 combined) conditions and the associated statistical analyses for the number of widgets correctly made. The t-value for the difference between group means for individual performance versus pooled output performance is -0.10 and is not
Figure 3. Graph of Number of Widgets Made per Session for Subject 1.
Figure 4. Graph of Number of Widgets Made per Session for Subject 2.
Figure 5. Graph of Number of Widgets Made per Session for Subject 3.
Figure 6. Graph of Number of Widgets Made per Session for Subject 4.
Figure 7. Graph of Number of Widgets Made per Session for Group Total.
significant. The protected LSD test t-value for the same comparison is -0.63 and also is not significant. There is thus no statistical support for the occurrence of social loafing for the group as a whole for either widgets made or widgets correctly made.

Table 2
Totals for the Number of Widgets Made Correctly per Phase

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>143</td>
<td>136</td>
<td>152</td>
<td>135</td>
<td>151</td>
</tr>
<tr>
<td>Subject 2</td>
<td>117</td>
<td>106</td>
<td>136</td>
<td>112</td>
<td>137</td>
</tr>
<tr>
<td>Subject 3</td>
<td>86</td>
<td>97</td>
<td>122</td>
<td>96</td>
<td>133</td>
</tr>
<tr>
<td>Subject 4</td>
<td>143</td>
<td>145</td>
<td>167</td>
<td>155</td>
<td>175</td>
</tr>
<tr>
<td>Mean</td>
<td>122.25</td>
<td>121</td>
<td>144.25</td>
<td>124.5</td>
<td>149</td>
</tr>
</tbody>
</table>

Individual Level Analysis

Figures 8-12 show the graphs for the number of widgets correctly made for each of the four subjects and the whole group. Some evidence for social loafing was found for two of the four subjects. Subject 1's totals decreased from 143 to 136 from phase 1 to phase 2. Her phase 4 total of 135 widgets correctly made is consistent with the decrease observed in phase 2. Inspection of her performance by session in Figure 8 shows a slight decrease in widgets correctly made during the first four sessions of phase 2 followed by a slight increase in the last two sessions.
Figure 8. Graph of Number of Widgets Correctly Made per Session for Subject 1.
Figure 9. Graph of Number of Widgets Correctly Made per Session for Subject 2.
Figure 10. Graph of Number of Widgets Correctly Made per Session for Subject 3.
Subject 4

Figure 11. Graph of Number of Widgets Correctly Made per Session for Subject 4.
Figure 12. Graph of Number of Widgets Correctly Made per Session for Group Total.
of the phase.

The data for Subject 2 also show a small decrease in the number of widgets correctly made in phase 2 compared to phase 1. Subject 2 made 106 correct widgets in phase 2 compared to 117 in phase 1. The 112 widgets correctly made in phase 4 is also a slight decrease in production compared to her work alone on the task. It is interesting that the decrease in performance found in phase 2 for Subject 2 was due to a substantial increase in the number of errors made when she worked in the group with a pooled output. Table 3 shows that Subject 2 made 15 errors in phase 2 and 4 in phase 4 compared to none in phase 1. In fact there is a substantial increase in the number of errors this subject made in all the group phases and especially when feedback was implemented. It appears that some aspect or aspects of the group environment and/or feedback is contributing to an increase in errors made.

Subject 3 produced 11 more widgets in phase 2 than in phase 1, but the session graph of his performance in Figure 10 shows that the increased production in phase 2 is from increasing numbers of widgets made near the end of the phase. The first few sessions of phase 2 show a small decrease in performance compared to phase 1. The total for phase 4 are consistent with phase 2 (97 compared to 96), but a linear increasing trend in the graph of the data is not present. It is possible that this subject found an improved widget making technique or just became increasingly more proficient at making widgets beginning in the middle of phase 2.

Subject 4 made approximately the same number of correct widgets in phase
2 (145) compared to phase 1 (143). The phase 4 total of 155 was somewhat higher. The graph of his session performance in Figure 11 shows that widget production is mostly consistent across the session in phases 1, 2, and 4 except for the second and third sessions of phase 4.

Overall, the results about the occurrence of social loafing on a simple manufacturing task are inconclusive. Performance decreased or increased slightly depending on the subject. The largest decreases in widget production occurred for the number of correctly produced widgets.

The Effects of Individual, Public Feedback

Number of Widgets Made

Group Level Analysis

Feedback produced an immediate and strong positive effect on the total number of widgets produced in both phases 3 and 5 as can be seen in Figure 7. As summarized in Table 1, the mean number of widgets made increased from 126.5 in phase 2 when there was no feedback to 149.25 in phase 3 when feedback was first implemented. In phase 3 when feedback was withdrawn, the mean number of widgets produced dropped to 126, but increased to 155.25 in phase 5 when feedback was reintroduced. The average number of widgets made per session increased from 21.08 in phase 2 to 24.88 in phase 3 and from 21.0 in phase 4 to 25.9 in phase 5.
The t-value comparing the group means for individual performance versus pooled output with feedback is 3.93 and is statistically significant. The t-value comparing the group means for pooled output performance versus pooled output with feedback performance was also statistically significant (t=-4.80). The Protected LSD tests comparing the group means of the individual condition with the feedback condition and comparing the group means of the pooled output condition with the feedback condition also show statistically significant t-values (t=-5.025, and t=-4.39).

**Individual Level Analysis**

All four subjects produced more widgets when feedback was present than when producing in the group without feedback and when working alone without feedback. Subject 1 made 16 more widgets in phase 3 than in phase 2 (from 136 to 152) and 17 more widgets in phase 5 than in phase 4 (from 135 to 152). The effects of the feedback are delayed, however, if we look at the graph of session performance in Figure 3. An increase in performance is evident beginning with the third session of phase 3 and beginning with the second session of phase 5.

Feedback had the largest effect on the number of widgets produced for Subject 2. Her total widget production increased from 121 in phase 2 to 156 in phase 3 and from 116 in phase 4 to 160 in phase 5. The graph of her by session production of widgets in Figure 4 shows that the number produced increased noticeably and immediately in both phases 3 and 5.
Subjects 3 and 4 also produced more widgets in the presence of feedback than in its absence. The number of widgets produced by Subject 3 increased from 100 in phase 2 to 122 in phase 3 and from 96 in phase 4 to 134 in phase 5. Subject 4 produced 149 widgets in phase 2 without feedback, 167 with feedback in phase 3, 157 in phase 4, and 175 in phase 5. The graph of by session production of widgets for Subject 3, shown on Figure 5, and the corresponding graph for Subject 4 on Figure 6 show a fairly consistent increase in the number of widgets made across the sessions in the feedback phases.

The positive effects of feedback are smaller for subjects 1 and 4, but these two subjects made consistently more widgets during the three non-feedback phases than the other two. Given that there are obviously physical limitations to the number of widgets that can be made in a 15 minute session, it is not surprising that the effects of feedback should be strongest for subjects who have more room for improvement. What is noteworthy is that individual, publicly displayed feedback had prominent positive effects for Subject 4 who made about as many widgets in the absence of feedback as other subjects did in the presence of feedback.

Number of Widgets Correctly Made

Group Level Analysis

Feedback also produced a substantial increase in the total number of
widgets correctly made in both phase 3 and phase 5. The graph on Figure 12 shows an immediate increase in the number of widgets produced in both phases in which feedback was implemented. As is summarized in Table 2, the mean number of correctly produced widgets increased from 121 in phase 2 to 144.25 in phase 3 and from 124.5 in phase 4 to 149 in phase 5. The effects of feedback overall are not quite as great as for total widgets made and this is due, in part, to the 17 more errors that were made in the feedback phases compared to the group phases without feedback.

The t-value comparing the group means for individual performance versus pooled output with feedback performance (t=-3.5) is statistically significant at \(a=0.05\). The t-value comparing the group means for pooled output versus pooled output with feedback performance is -7.14 and is also statistically significant. The Protected LSD tests comparing marginal means also result in statistically significant t-values for all comparisons involving feedback. The t-value for the comparison of the individual versus feedback condition marginal means is -4.64 and the comparison of the pooled output versus feedback condition marginal means is -4.54. There is thus strong statistical support for the positive effect of feedback on both the number of widgets made and the number of widgets correctly made for the group of subjects.

**Individual Level Analysis**

Feedback also increased the number of correctly made widgets for all four
subjects. Subject 1 made 136 correct widgets in phase 2, 152 in phase 3, 135 in phase 4, and 151 in phase 5. The graph of session performance for this subject (shown in Figure 8) is almost the same as for the number of widgets made since she only made a single widget incorrectly. As with Figure 3, the increase in performance is evident beginning with the third session of phase 3 and the second session of phase 5.

The graph on Figure 9 for Subject 2 shows a significant increase in the number of widgets correctly made in the first session in both feedback phases and higher levels of performance throughout the remaining feedback sessions. The positive effects of the performance feedback are, however, not as large as for the number of widgets made. This is due to the 24 more errors Subject 2 made while performing in the two feedback phases. Despite the increase in errors, Subject 2 produced her highest totals in sessions where feedback was present (136 in phase 3 and 137 in phase 5) compared to the group sessions without feedback (106 in phase 2 and 112 in phase 4).

Subjects 3 and 4, who were the lowest and highest producers of widgets throughout the experiment, both made more correct widgets in the presence of feedback than in its absence. Widget production for Subject 3 increased from 97 in phase 2 to 122 in phase 3 and from 96 in phase 4 to 133 in phase 5. For Subject 4 the number of widgets correctly produced increased from 145 in phase 2 to 167 in phase 3 and from 155 in phase 4 to 175 in phase 5. The graph of by session performance for Subject 3 is shown in Figure 10 and in Figure 11 for subject 4.
An increase in the number of widgets correctly made is evident beginning with the first session in both feedback phases for both subjects. The increase in performance is more pronounced in phase 5 for Subject 3, especially considering the increasing trend in performance during phase 2.

Errors and Percentage of Widgets Made Correctly

The majority of errors made in widget making during the experiment were from Subject 2. She made 62 of the 74 total incorrectly made widgets. Table 3 summarizes the number of errors made by phase. Subject 1 made only 1 error during the experiment, Subject 3 made five errors, and Subject 4 made six errors. Overall errors were higher when subjects worked in the group with the pooled output. Only one error was made by subjects in phase 1 while working individually compared to 22 errors in phase 2, 20 in phase 3, 6 in phase 4, and 25 in phase 5. It is interesting that Subject 2 made no errors in phase 1 even though she had little experience making widgets, but made 15 errors in phase 2, 20 errors in phase 3, 4 errors in phase 4, and 23 errors in phase 5. It appears that the group environment may have contributed to the higher number of errors made by this subject in phases 2 thru 5.

Table 4 shows that the percentage of widgets made correctly was high for all five phases of the experiment. A substantial loss of quality in widget production was only found for one subject in the experiment. Only Subject 2 produced less than 97% correct widgets during any one phase. The percentage of widgets made
Table 3  
Total Number of Incorrectly Made Widgets  
(Errors) by Phase

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Subject 2</td>
<td>0</td>
<td>15</td>
<td>20</td>
<td>4</td>
<td>23</td>
</tr>
<tr>
<td>Subject 3</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Subject 4</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>22</td>
<td>20</td>
<td>6</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 4  
Percentage of Widgets Made Correctly by Phase

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>99.34</td>
</tr>
<tr>
<td>Subject 2</td>
<td>100</td>
<td>87.60</td>
<td>87.18</td>
<td>96.55</td>
<td>85.63</td>
</tr>
<tr>
<td>Subject 3</td>
<td>98.85</td>
<td>97</td>
<td>100</td>
<td>100</td>
<td>99.25</td>
</tr>
<tr>
<td>Subject 4</td>
<td>100</td>
<td>97.32</td>
<td>100</td>
<td>98.73</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>99.80</td>
<td>95.65</td>
<td>96.65</td>
<td>98.81</td>
<td>95.97</td>
</tr>
</tbody>
</table>

correctly by Subject 2 dropped from 100% in phase 1 to 87.6% in phase 2, 87.18% in phase 3, increased to 96.55% in phase 4 when feedback was removed, and fell
to 85.63% in phase 5 when feedback was reintroduced. Quality was lowest during the feedback phases for this subject, but widget production was also highest for her in the presence of feedback.

There is evidence that social loafing in terms of quality (independent of quantity) occurred only for Subject 2. Feedback had no effect in increasing the level of quality for this subject and may have actually contributed to its decrease. The data regarding the percentage of widgets made are inconclusive since no consistent patterns were found for all subjects.
DISCUSSION

This study provided little evidence of social loafing, but clearly demonstrated that individuals working on a simple, repetitive manufacturing task in a small group in which their outputs were pooled produced more when public, individual feedback was presented. Unconvincing evidence for social loafing was found for two of the four subjects. These two subjects accounted for the very slight decrease in the overall quantity of correct widgets made from when subjects worked individually in phase 1 relative to when subjects worked in a four person group with a pooled output in phase 2. There was a mild decrease in the number of correct widgets made for subjects 1 and 2 from phase 1 to phase 2.

This study also looked at whether social loafing performance decrements would be found for accuracy measured as the percentage of widgets made correctly. By far the largest decreases in the percentage of widgets made correctly was found for Subject 2. Much smaller decreases were found for subjects 3 and 4. Unfortunately, despite these results, this study did not find convincing evidence to support the existence of social loafing for a simple manufacturing task. There are at least several possible reasons why convincing evidence to support prior research on social loafing was not found in this study.

First of all, the experimental methodology used to study an individual behavioral phenomenon such as social loafing has been problematic. Previous
studies involving social loafing, which have been from exclusively non-behavioral journals, have studied the behavior of groups and have inappropriately generalized the results to the behavior of individuals. These studies have measured the behavior of at least two separate groups each working on the same task: (1) a group of subjects working individually, and (2) another group working together on the task. Comparing the mean outputs of the two groups tells us very little about whether individuals loaf or not and nothing at all about which individuals show performance output decrements. Also, prior studies on social loafing used different individuals in each group and didn't take multiple measures of individual performance. Therefore, the differing experimental procedures between this experiment and previous studies involving social loafing may have contributed to the somewhat different results found.

In addition to problems with the experimental methods used to study social loafing in earlier studies, the experimental setting may have resulted in less of a decrease in individual output than might have been observed if the same task had been performed in a real work setting. All possible measures were taken to make the experimental setting as much like an actual work setting as possible by allowing subjects to engage in off-task behaviors such as talking, and listening to the radio, and by having drinks and snacks available. Despite these attempts to make the experimental setting the best simulation environment possible, the setting was clearly one in which behavior was being measured and studied. In fact three out of the four subjects in the study answered in the post experimental
questionnaire that they believed that their individual outputs were being measured during the pooled output with no feedback phases even though this setting was one in which individual outputs became obscured by being thrown into a common group pile. In real work settings whether work behavior is being constantly or carefully measured or is even important is not always as obvious as during an experiment. Since the two types of setting are clearly different, it is not surprising that different measures of performance on the same task by the same subjects might be obtained.

Also, it may be that if social loafing is a pattern of behavior that readily exists in work environments it would be more noticeable as workers perform a new pooled output task over a longer period than was observed in this study. A worker performing a task for the first time may expect some feedback when she initially starts a new job and this may function to support the individual's level of performance for some time in the absence of feedback. We see such increases in performance in the first session in the feedback phases (before feedback is actually delivered) for both the number of widgets made and the number of widgets correctly made for subjects 2, 3, and 4. As a worker continues to perform the pooled task without feedback, we may see performance levels decrease with time. The possibility that individual performance in a group with a pooled output will decrease as individuals perform the task longer in the absence of feedback (or performance based incentives) is worthy of further investigation. Unfortunately, time and monetary constraints for this study limited a proper analysis of the long-
term effects of group pooled output performance in the absence of feedback.

The observation that some decreases in performance were found for two of the four subjects while the other two showed small increases in performance in phase 2 is not necessarily against expectations. That social loafing exists in some work settings seems intuitive when we think of common experiences in school in which students are assigned a group assignment. Most often one or a couple of the students in the group contribute a disproportionate amount of work to the group final project while others do less than their equal share. Here the final output is the same as if the instructor had assigned equal parts of the project individually to students. The group as a whole isn't loafing, but some individuals in the group are producing less than if they had worked alone. This scenario is somewhat similar to what was found in this experiment. If we look at the data for the number of widgets correctly made in table 2, we see that subject 1 and subject 2 made 7 and 11 fewer correct widgets than their outputs from phase 1 while subject 3 and subject 4 made 11 and 2 more widgets. The data from this study support the notion that social loafing performance decrements may be found for only certain individuals within a group and that other individuals performing within the group may perform at similar or even greater levels than when working individually on the task.

Certainly the phenomenon of social loafing should be an interesting topic for future behavioral research. The full range of environmental factors that may cause some individuals to produce less when performing a task in a group with a
pooled output is a question that has yet to be answered.

This study has shown that individual performance based feedback that is publicly displayed will substantially improve both the quantity of widgets made as well as the quantity of widgets correctly made by individual subjects in such a pooled group output working environment. Since the percentage of widgets made correctly was 97% or above for three of the four subjects, the feedback was unlikely to have much effect on accuracy. For Subject 2 whose accuracy in making widgets might have been affected, the lowest percentage of widgets made correctly was actually during the two feedback phases. The effect might have been different for this subject if the feedback had been based only on the accuracy of widget making, and not on quantity.

The effects of performance feedback on quantity, however, were prominent even for Subject 1 and Subject 4 who made widgets at a high rate during the non-feedback phases. To illustrate this, subject 4 made 25.8 correct widgets per session on the average during phase 4. This translates to 1.72 widgets made per minute or 25.8 pop beads being placed together per minute on the average during this phase. During phase 5 when feedback was reintroduced, Subject 4 increased his widget production to an average of 29.2 per session. Clearly, within the pooled output work setting individual, publicly displayed feedback noticeably improved widget production for all four subjects. Individual, public feedback is, however, but one potential method to help improve individual output in a pooled output setting.

Further research examining performance within a group pooled output
environment could look at other methods of providing feedback to see if another may be more optimal or practical than the method of feedback employed in this study. For example, individual versus group and/or public versus private properties of feedback could be examined separately and in combination to see which maximizes performance in the group pooled output setting.

Monetary incentives may also improve individual performance in a social loafing setting. The effects of a variety of monetary incentive systems on widget making in a social loafing setting are currently being explored in an ongoing study by Smoot (1996). It should be of further interest to examine the effects of combining performance based monetary incentives and feedback to see if individual performance is improved more than either one by itself. Whether feedback or monetary incentives are more effective in improving individual performance within a group pooled output setting should also be an interesting topic for future research.

As mentioned earlier, errors in widget making were higher during the group pooled output phases than when subjects worked individually. However, Subject 2 made the large majority of the total errors. It appears that decreased accuracy on a simple manufacturing task such as widget making may be a concern for some individuals when working in a group pooled setting. Identifying the environmental factors that cause some individuals to manufacture products less accurately within a group pooled output setting might help suggest better ways to improve manufacturing accuracy.
It might also be interesting to explore performance in a group pooled output setting for more complex manufacturing tasks or for non-manufacturing tasks such as those performed in quality teams in organizations. The extent that social loafing may be found for more complex tasks is not known. Even if social loafing is not found to be a major problem for team productivity within organizations, exploring better ways to improve performance within the team setting should still be a very worthy experimental pursuit.
Appendix A

Tables of Statistical Data
### Table 5
Summary Statistics for Number of Widgets Made

#### Slope per Phase

<table>
<thead>
<tr>
<th>Subject</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.041</td>
<td>0.6059</td>
<td>0.1512</td>
<td>-0.7064</td>
<td>1.4</td>
</tr>
<tr>
<td>2</td>
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<td>3</td>
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<tr>
<td>4</td>
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<td>0.2628</td>
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</tr>
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<td>-0.057375</td>
<td>0.314325</td>
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</tbody>
</table>

#### Average Widgets Made by Experimental Condition

<table>
<thead>
<tr>
<th>Subject</th>
<th>Individual</th>
<th>Pooled Output</th>
<th>Pooled w/ Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>143</td>
<td>135.5</td>
<td>152</td>
</tr>
<tr>
<td>2</td>
<td>117</td>
<td>118.5</td>
<td>158</td>
</tr>
<tr>
<td>3</td>
<td>87</td>
<td>98</td>
<td>128</td>
</tr>
<tr>
<td>4</td>
<td>143</td>
<td>153</td>
<td>171</td>
</tr>
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</table>

#### t-Values for Differences in Group Means

<table>
<thead>
<tr>
<th></th>
<th>Individual vs. Pooled Output</th>
<th>Indiv. vs. Pooled w/ Feedback</th>
<th>Pooled vs. Pooled w/ Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>-0.87</td>
<td>-3.93</td>
<td>-4.80</td>
</tr>
<tr>
<td>p</td>
<td>0.45</td>
<td>0.029</td>
<td>0.017</td>
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</table>

#### Change in Slope Between Phases

<table>
<thead>
<tr>
<th>Subject</th>
<th>Phase 1 to 2</th>
<th>Phase 2 to 3</th>
<th>Phase 3 to 4</th>
<th>Phase 4 to 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.647</td>
<td>0.4547</td>
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</tr>
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<td>p</td>
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<td>0.001</td>
</tr>
<tr>
<td>2</td>
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<td>-0.1027</td>
</tr>
<tr>
<td>p</td>
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<td>Mean</td>
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<td>0.013</td>
<td>0.958</td>
<td>0.299</td>
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</table>

#### Level Change Between Phases

<table>
<thead>
<tr>
<th>Subject</th>
<th>Phase 1 to 2</th>
<th>Phase 2 to 3</th>
<th>Phase 3 to 4</th>
<th>Phase 4 to 5</th>
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<tbody>
<tr>
<td>1</td>
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<td>p</td>
<td>0.202</td>
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### Analysis of Variance Summary Table

<table>
<thead>
<tr>
<th>Source</th>
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<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
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<tbody>
<tr>
<td>Subject</td>
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<td>1447.4</td>
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<td>Condition</td>
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### Protected LSD Tests

<table>
<thead>
<tr>
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<th>t-Value Obtained</th>
<th>Critical Conventional</th>
<th>Critical Conservative</th>
<th>Bonferroni t</th>
</tr>
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<tbody>
<tr>
<td>Indiv. vs. Pooled</td>
<td>-0.63</td>
<td>2.447</td>
<td>3.18</td>
<td>3.29</td>
</tr>
<tr>
<td>Indiv. vs. Feedback</td>
<td>-5.025</td>
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<td>3.29</td>
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<td>2.447</td>
<td>3.18</td>
<td>3.29</td>
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Table 6
Summary Statistics for Number of Widgets Correctly Made

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<tr>
<th>Subject</th>
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<th>3</th>
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<td>0.62675</td>
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Average Widgets Made by Experimental Condition

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<thead>
<tr>
<th>Subject</th>
<th>Individual</th>
<th>Pooled Output</th>
<th>Pooled with Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>143</td>
<td>135.5</td>
<td>151.5</td>
</tr>
<tr>
<td>2</td>
<td>117</td>
<td>109</td>
<td>136.5</td>
</tr>
<tr>
<td>3</td>
<td>86</td>
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<td>127.5</td>
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<td>4</td>
<td>143</td>
<td>150</td>
<td>171</td>
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<table>
<thead>
<tr>
<th>t-Values for Differences in Group Means</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>t=0.10</td>
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<tr>
<td>p=0.92</td>
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Change in Slope Between Phases

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<th>Subject</th>
<th>Phase 1 to 2</th>
<th>Phase 2 to 3</th>
<th>Phase 3 to 4</th>
<th>Phase 4 to 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>-0.8576</td>
<td>1.9922</td>
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<tr>
<td></td>
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<tr>
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<tr>
<td></td>
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<td>p=0.940</td>
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<td>Group</td>
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<td>Mean</td>
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<td>p=0.217</td>
</tr>
</tbody>
</table>

Level Change Between Phases

<table>
<thead>
<tr>
<th>Subject</th>
<th>Phase 1 to 2</th>
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<tbody>
<tr>
<td>1</td>
<td>-2.43</td>
<td>0.06</td>
<td>-1.672</td>
<td>2.001</td>
</tr>
<tr>
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<td>p=0.065</td>
<td>p=0.054</td>
<td>p=0.007</td>
</tr>
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<th>p</th>
</tr>
</thead>
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Protected LSD Tests

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<thead>
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<th>Critical Conservative</th>
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<td>3.18</td>
<td>3.29</td>
</tr>
</tbody>
</table>
Appendix B

Approval Letter From the Human Subjects
Institutional Review Board
Date: March 22, 1995

To: Nelson R. Eikenhout

From: Richard Wright, Interim Chair

Re: HSIRB Project Number 95-03-04

This letter will serve as confirmation that your research project entitled "The effects of publicly displayed individual feedback on social loafing" has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you must seek specific approval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date. In addition if there are any unanticipated adverse or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: Mar. 22, 1995

xc: Heitema, PSY


