

## Mechanism of Feedback Affecting Task Performance

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Two experiments found that the beneficial effect of feedback on performance was a negative function of goal progress. In Study 1, 87 female college students were given the goal to solve 70 arithmetic problems on a trial lasting 10 min. After 5-min work on the trial, the subjects received feedback on the number attempted. To the extent that their goal progress was low, the subjects felt less satisfied with their previous progress, had a low expectancy of reaching the goal, became more involved in the task, and worked faster than they had previously. In addition, it was suggested that the goal and feedback induced a larger amount of effort from the subjects who were low in progress than from the subjects who were high in progress. Study 2, using 103 male undergraduates as subjects, replicated the previous findings, and also found that feedback improved performance only through its influence on the subjects' intention to work faster. Implications for previous goal/feedback related findings are discussed.

In the last decade, many studies (Becker, 1978; Cummings, Schwab, & Rosen, 1971; Dossett, Latham, & Mitchell, 1979; Erez, 1977; Ilgen, Fisher, & Taylor, 1979; Kim & Hamner, 1976; Latham & Yukl, 1975; Locke, 1967, 1968; Locke & Bryan, 1968, 1969; Locke, Cartledge, & Koeppel, 1968; Shaw, Locke, Bobko, & Beitzell, Note 1; Strang, Lawrence, & Fowler, 1978; Steers & Porter, 1974) were concerned with the effect of feedback on performance. Erez (1977), Becker (1978), Strang *et al.* (1978), and Shaw *et al.* (Note 1) found that specific, hard goals led to improved performance only if subjects received feedback on their performance. In their review article, Locke, Shaw, Saari, and Latham (1981) summarized the results of 10 goal/feedback-related studies and concluded that both goals and feedback are necessary to improve performance. Thus, it is widely confirmed that specific goals lead to improved task

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performance if feedback is provided. Nevertheless, the mechanism by which feedback affects the task performance has not been fully explained.

The present study tested the hypothesis that the effect of feedback on performance is a negative function of the subjects' previous goal progress. Locke, Cartledge, and Knerr (1970) argued that satisfaction with one's past performance generates the desire to maintain one's previous level of performance, whereas dissatisfaction with one's past performance produces the desire to change one's performance. This argument suggests that feedback would increase the task performance only for subjects who believe they are not progressing satisfactorily toward their goal. If subjects feel that they are close to the goal (i.e., high progress), then they would come to have a high expectancy of reaching the goal. These subjects might set a goal simply to maintain their previous rate of progress. In contrast, if subjects feel that they are far from the goal (i.e., low progress), then they would come to have a low expectancy of reaching the goal given their past rate of progress. Thus, these subjects then would set, in effect, a harder goal. Matsui, Okada, and Mizuguchi (1981) found that when subjects were each given an easier and a harder goal, they (subjects) exerted a larger amount of effort to attain the harder goal than to attain the easier goal. This agrees with the findings of Locke *et al.* (1981). It is therefore logical to predict that feedback would increase the task performance to the extent that the subjects' goal progress is low.

## STUDY 1

### *Method*

*Subjects and procedure.* Eighty-seven female students enrolled in business courses at a women's college volunteered to participate in the experiment.

The task was to solve arithmetic problems consisting of adding a chain of 7 single-digit numbers from 2 to 9 (e.g.,  $3 + 8 + 6 + 2 + 7 + 8 + 5$ ).

There was one practice trial and one experimental trial. The practice trial was conducted to obtain an ability measure and lasted 5 min. The experimenter told the subjects to work at "what you would consider to be normal pace for an 8-hr workday assuming no time limits." After the trial the subjects were allowed to count the number attempted so that they could rationally judge their chance of reaching the assigned goal for the experimental trial. The mean number attempted and the number correct were 30.8 ( $SD = 11.71$ ) and 27.7 ( $SD = 10.91$ ), respectively.

The experimental trial was partitioned into a first and second part, each lasting 5 min. However, the subjects were told that there would be one trial lasting 10 min. The problems presented in the experimental trial were arranged irregularly so that the subjects could not know the exact number of problems they attempted during the task.

Before the experimental trial, the experimenter told the subjects that they were to solve 70 problems or more in the 10 min and that this goal was considered to be reasonable for college students on the basis of the experimenter's previous experience. The number of the subjects who actually attained the goal was 34 (39.1%). Thus, the goal was of moderate difficulty. After the assignment of the goal, the subjects were asked to indicate their expectancy of reaching goal, using a 7-point scale.

After 5 min of work on the experimental trial, the subjects were asked to discontinue their work. The experimenter then told them that half of the total time had elapsed and allowed them to count the number of problems they had attempted to determine how close they were to the goal. After counting the number attempted, the subjects were asked to indicate how satisfied they felt with the number attempted and to indicate their expectancy of reaching the goal, each on a 7-point scale.

After the conclusion of the experimental trial, the subjects were asked to indicate which of the two parts they were more involved in. The response alternatives were "I was involved in the first part to a higher degree," "I was involved in the second part to a higher degree," and "I was involved in the two parts to an equal degree." The response alternatives were scored 1, 3, and 2, respectively.

### Results

Relevant means and standard deviations for high- and low-progress groups are presented in Table 1. Both groups were formed based on the median of the number attempted on the first part (i.e., goal progress). There are three main findings.

TABLE 1  
EXPECTANCY, SATISFACTION, INVOLVEMENT, NUMBER ATTEMPTED MEANS AND  
STANDARD DEVIATIONS FOR HIGH- AND LOW-PROGRESS GROUPS

	High progress ( $N = 40$ )		Low progress ( $N = 47$ )	
	First part	Second part	First part	Second part
Expectancy				
<i>M</i>	4.6	5.3	4.0	2.4
<i>SD</i>	1.22	1.46	1.34	1.30
Satisfaction				
<i>M</i>	4.3		2.7	
<i>SD</i>	1.31		1.14	
Involvement				
<i>M</i>		2.0		2.5
<i>SD</i>		.74		.58
Number attempted				
<i>M</i>	40.5	41.4	26.8	29.1
<i>SD</i>	9.35	8.73	4.05	4.46

First, mean expectancy increases from the first to the second part for the high-progress group, whereas it decreases for the low-progress group. Analysis of variance with repeated measures yielded significant interaction ( $F(1, 87) = 51.64, p < .01$ ) between the goal progress and the part. The high-progress subjects came to have a high expectancy of reaching the goal, whereas the low-progress subjects came to have a low expectancy. Thus, the feedback had the expected differing impact on the high- and low-progress subjects, supporting the manipulation.

Second, mean satisfaction is higher ( $t(85) = 5.93, p < .01$ ) and involvement lower ( $t(85) = 3.49, p < .01$ ) for the high-progress group than for the low-progress group. The low-progress subjects were less satisfied with their past progress and more involved in the second part than were the high-progress subjects, supporting the previous argument of Locke *et al.* (1970).

Third, mean number attempted increases from the first to the second part only for the low-progress group. Analysis of variance with repeated measures yielded significant interaction ( $F(1, 87) = 4.05, p < .05$ ) between the goal progress and the part. The high-progress subjects maintained their previous rate of progress, whereas the low-progress subjects improved their rate of progress. This is supportive of the hypothesis.

The extent to which the number attempted reflected the subjects' ability and effort was determined for the high- and low-progress group. Every subject was given the same goals, which suggests that the goals were harder for the low-ability subjects than for the high-ability subjects. The number attempted on the practice trial (i.e., ability:  $M = 38.6, SD = 11.95$ ) of the high-progress group was significantly higher ( $t = 7.14, p < .01$ ) than that ( $M = 24.2, SD = 6.13$ ) of the low-progress group, suggesting that the low-progress subjects were in effect those of low ability. Thus, the low-progress subjects might have exerted a larger amount of effort to reach the goal than did the high-progress subjects. Effort was operationalized as the residual gain in the number attempted from the practice score. The correlations between the number attempted and the practice score and between the number attempted and the residual gain score were .91 ( $p < .01$ ) and .42 ( $p < .01$ ) for the first part and .87 ( $p < .01$ ) and .51 ( $p < .01$ ) for the second part for the high-progress group, and .67 ( $p < .01$ ) and .74 ( $p < .01$ ) for the first part and .78 ( $p < .01$ ) and .62 ( $p < .01$ ) for the second part for the low-progress group. In other words, for the high-progress group, the variance in the number attempted accounted for by ability and effort was 82.2 versus 17.8% for the first part, and 75.7 versus 25.3% for the second part, whereas for the low-progress group, the variance was 44.9 versus 55.1% for the first part, and 60.8 versus 39.2% for the second part. These findings suggest that the goal and feedback

tended to induce a larger amount of effort from the low-progress subjects than from the high-progress subjects.

### *Discussion*

This study found that feedback improved the task performance only for subjects who were "behind" schedule in their goal progress. To the extent that their goal progress was low, the subjects came to have a low expectancy of reaching the goal, were less satisfied with their rate of progress, became more involved in the task, and worked faster than they had previously. In addition, it was found that the goal and feedback tended to induce a larger amount of effort from the low-progress (ability) subjects than from the high-progress (ability) subjects.

Although the results are supportive of the hypothesis, there are some shortcomings inherent in the present data set.

First, the experimental subjects consisted of females alone. This raises a question by asking whether the findings can be replicated by male samples. Deci, Cascio, and Krusell (1973) found that positive verbal feedback worked differently for males and females.

Second, Study 1 did not use any control group. This precludes the possibility that the feedback effect observed reflected a regression toward the mean effect.

Finally, Study 1 did not involve any personal goal measure, which prevents full understanding of the feedback-performance change process.

To solve the shortcomings listed, Study 2 was conducted.

## STUDY 2

### *Method*

*Subjects.* The subjects were 103 male undergraduates enrolled in two classes of management sciences. One class ( $N = 58$ ) was designated as an experimental group and the remaining class ( $N = 45$ ) as a control group.

*Task and procedure.* The task was the same as that used in Study 1. There were one practice trial and one experimental trial. The practice trial lasted 5 min for the experimental group and 2 min for the control group. The subjects were told to work at what they considered to be normal pace for an 8-hr workday assuming no time limits. After the practice trial the subjects were allowed to count the number attempted. The mean number attempted was 30.7 ( $SD = 8.20$ ) for the experimental group and 29.9 ( $SD = 9.09$ ) for the control group when the number attempted for the control group was adjusted to the 5-min trial.

The experimental trial lasted 10 min for both groups. Before the trial, the subjects were told that they were to solve 70 problems or more in the

10 min and that this goal was considered to be reasonable for college students on the basis of the experimenter's previous experience. After the assignment of the goal, only the experimental subjects were asked to indicate how fast they would work (to be referred to as "intention") as compared with their pace in the practice trial. A 7-point scale (1 for the same pace as the practice pace, 2 for a little faster than the practice pace, and so forth, up to 7 for an extremely fast pace) was used for the subjects' responses. The number of subjects who actually attained the goal in each group was 30 (51.7%) and 15 (31.9%), respectively.

After 5 min of work on the experimental trial, the subjects were asked to discontinue their work. The experimental subjects were told that half of the total time had elapsed and allowed to count the number attempted. After counting the number attempted, they were asked to indicate how fast they would work. The control subjects, on the other hand, were neither told the time elapsed nor allowed to count the number attempted. They were asked only to indicate their expectancy of reaching the goal using a 7-point scale.

### Results

Relevant means and standard deviations for high- and low-progress groups for the experimental and control groups are presented in Table 2. Mean intention to work fast increased only for the low-progress group. Analysis of variance with repeated measures yielded significant interaction ( $F(1, 58) = 22.63, p < .01$ ) between the goal progress and the part.

TABLE 2  
INTENTION, NUMBER ATTEMPTED MEANS AND STANDARD DEVIATIONS FOR  
TWO PROGRESS GROUPS FOR TWO CONDITIONS

	High progress <sup>a</sup>		Low progress <sup>b</sup>	
	First part	Second part	First part	Second part
Intention				
<i>M</i>	2.9	2.8	3.3	4.7
<i>SD</i>	1.44	1.70	1.18	1.57
Number attempted				
Experimental				
<i>M</i>	38.4	39.5	27.0	30.2
<i>SD</i>	4.04	4.47	4.15	5.73
Control				
<i>M</i>	39.2	38.2	26.0	26.5
<i>SD</i>	6.74	7.32	3.84	4.43

<sup>a</sup>  $N = 29$  for the experimental group 20 for the control group.

<sup>b</sup>  $N = 29$  for the experimental group 25 for the control group.

Mean number attempted for the experimental group increased also only for the low-progress group. Analysis of variance with repeated measures yielded significant interaction ( $F(1, 58) = 4.26, p < .05$ ). Only the low progress subjects intended to work faster and actually did work faster than they had previously. This replicates the finding of Study 1.

Correlational analyses of the experimental data provided additional information. The number attempted on the first part (i.e., goal progress) correlated  $-.53$  ( $p < .01$ ) with the intention change and  $-.26$  ( $p < .05$ ) with the number attempted change. The intention and the number attempted changes correlated  $.39$  ( $p < .01$ ) with one another. The partial correlation between the goal progress and the number attempted change was nonsignificant ( $r = .07, t(84) = .64$ ) when the intention change was held constant. This suggests that feedback affected the task performance only through its influence on the intention to work fast.

Mean number attempted for the control group changes across the two parts neither for the high- nor for the low-progress group. This indicates that the feedback effect for the experimental group could not be attributed to regression toward the mean effect.

### Discussion

Study 2 replicated the finding of Study 1, suggesting that the beneficial effect of feedback on task performance was essentially the same for the male and female samples. In addition, it suggested that feedback improved the task performance only through its influence on the intention to work fast.

The present results suggest that subjects' knowledge of their goal progress is essential for goals to affect task performance. If subjects do not receive feedback, they cannot evaluate their goal progress even if they have goals, resulting in no performance increase. Shaw *et al.* (Note 1) take a position that is similar to the suggestion when they state that

When subjects are given specific, hard goals but no means to keep track of their progress in relation to them, the goals become virtually meaningless. It's like telling an individual: "Do 50 pushups, but I will prevent you from keeping track of how many you have done and I will not tell you when you reach 50." (p. 21)

The present results may help to explain previous goal/feedback-related findings. Becker (1978), Shaw *et al.* (Note 1), and Strang *et al.* (1978) found that among combinations of easier/harder goals and feedback/no feedback conditions, only the harder goal/feedback condition improved performance. The no feedback condition might not give subjects exact knowledge of their progress. The easier goal/feedback condition may have resulted in a few subjects who were low in progress because the goal was easy. Only the harder goal/feedback condition might

yield a sufficient number of subjects who were low in their goal progress and who tried to improve performance.

While the present trial lasted only 10 min, this does not seem to have hurt the findings. Locke (in press) found that even 1-min trials confirmed most of the basic phenomena of goal setting.

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