12-1986

The Effect of Feedback on Low-Goal Task Performance

Jeffrey David Klawsky
University of Nebraska at Omaha

The Effect of Feedback on Low-Goal Task Performance

A Thesis

Presented to the

Department of Psychology

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

University of Nebraska at Omaha

by

Jeffrey David Klawsky

December, 1986

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

THESIS ACCEPTANCE

Acceptance for the faculty of the Graduate College, University of Nebraska, in partial fulfillment of the requirements for the degree Master of Arts, University of Nebraska at Omaha.

Committee

Name	Department
[signature]	Psychology
[signature]	Psychology
[signature]	Bus Admin

[signature]
Chairman

12/18/86
Date

Acknowledgments

I would like to express gratitude to my advisor, Dr. Wayne Harrison. His critiques both improved the quality of this thesis and increased my knowledge of research and industrial/organizational psychology. I would also like to extend thanks to Dr. Douglas Cellar, Dr. Robert Ottemann, and Dr. James Thomas for their helpful comments and recommendations. Thanks are also extended to Kim Kohlhepp for his computer programming hints.

Finally, I would like to express appreciation to my parents for their continuous support and guidance. My accomplishments are a result of their endless love and devotion.

Table of Contents

List of Tables

List of Figures

Abstract

This experiment was conducted to study the effect of feedback on task performance under a low performance standard (goal). Fifty-two undergraduate students were presented with the task of mentally summing seven single-digit numbers to solve a problem. Subjects either received a high or low goal for the number of problems to solve in 15 minutes, and continuous feedback or no feedback about how many problems they had solved. It was predicted that feedback would result in higher performance for high goal subjects and lower performance for low goal subjects. A marginal main effect of goal difficulty ($p<.067$) in the predicted direction was obtained, but no goal difficulty-feedback interaction. Possible explanations for the observed results are discussed along with implications for future research.

Chapter I

Introduction

Overview

One of the most widely studied and well established theories in Industrial/Organizational Psychology is Locke's goal setting theory (See Locke, Saari, Shaw, & Latham, 1981, for a review). The basic principle of the theory is that as the level of a performance goal (quantitatively measured) increases, the corresponding level of performance will increase in a linear manner. Two conditions are considered necessary for this linear relationship to be observed (Locke et al., 1981). First, the goal must be accepted by the person who will perform the task. Second, feedback must be provided concerning task performance.

Will the same linear relationship be observed when no feedback is provided? It is proposed here that the relationship between goal difficulty and performance, without feedback, is also linear, but that the relationship is weaker (see Figure 1).

It has been repeatedly shown that a high goal with feedback results in greater performance than a high goal without feedback. However, as depicted in Figure 1, it is proposed that the opposite goal-performance relationship will be observed at the lower end of the "level of goal"

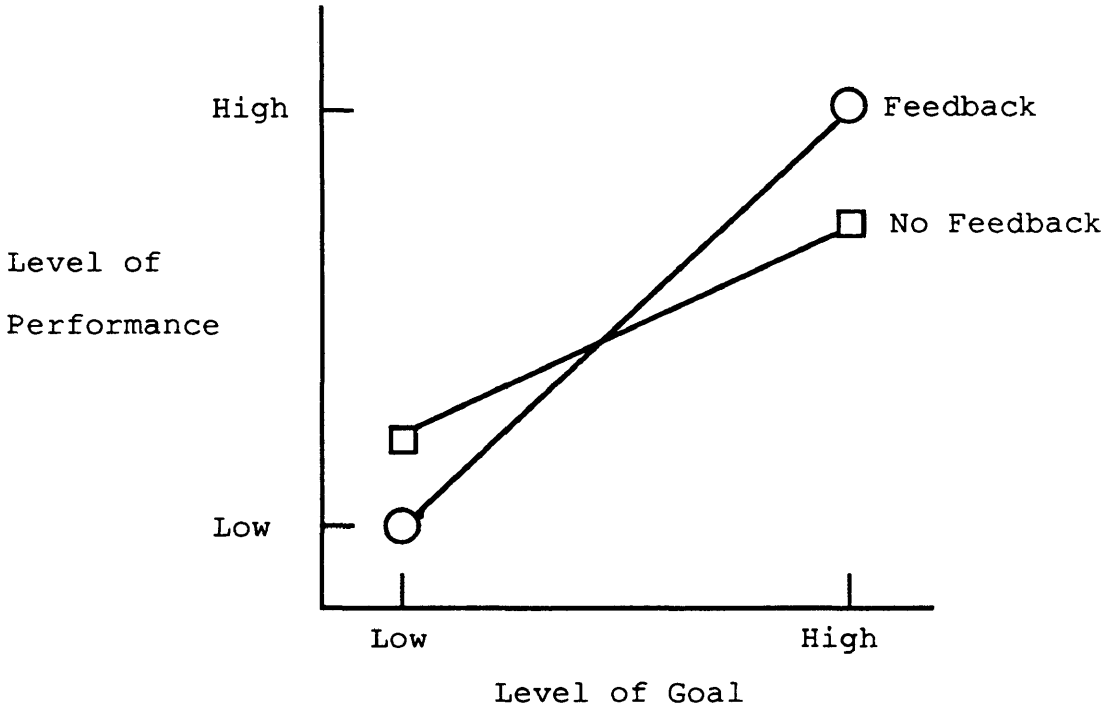

Figure 1. Hypothesized performance interaction between goal level and feedback.

continuum. That is, a low goal without feedback will result in greater performance than a low goal with feedback.

As will be explained in a later section, the mechanism by which feedback is predicted to result in decreased performance under low-goal conditions is Parkinson's law. This decrease is proposed to result from a significant amount of "lengthening" of performance under low-goal conditions, but only when feedback is provided. When no feedback is provided the "lengthening" of performance time to meet the low goal is predicted to be significantly less, resulting in superior performance.

Background

If two people of equal ability are given different goals for the amount of work they must complete in a specified period of time, the person with the higher goal will complete more of the task. For example, if one person is told that he has 1 hour to produce 10 widgets and another person is told that he has 1 hour to produce 15 widgets, the person who has the goal of completing 15 widgets will produce more widgets in the 1 hour. Note that the person need not reach the goal of 15 widgets to still produce more than his "10 widget" counterpart. This example provides a concrete illustration of the basic tenet of goal setting theory: the higher the set goal--the higher the observed performance.

Locke (1968) added a necessary condition to his hypothesized relationship by stating that for the linear relationship between goal level and performance to be observed, the goal had to be accepted by the person. If a person was told that his goal was to produce 15 widgets in 1 hour, but he knew that he could not possibly produce even 12 widgets per hour, he would probably not attempt the goal. In this case, when the goal was not accepted, the linear relationship would not be observed; we would probably expect an inverted-U relationship between goal difficulty and performance (Erez & Zidon, 1984).

Another condition Locke includes as part of his linear relationship is the specificity of the goal which is sought. The specificity of the goal is generally concerned with the difference between "do your best" goals and specific, high goals. Eight studies conducted by Locke and Bryan (reported in Locke, 1968) compared these two types of goals. Locke concluded the following:

> In six of the eight studies the subjects trying for specific hard goals performed at a significantly higher level than subjects trying to "do their best." Thus, a "do best" goal does not tend to produce (under conditions of these studies) the highest possible level of performance. (p. 169)

It is therefore necessary to provide a person with a specific goal (e.g., "produce 15 widgets in the next 1

hour"), as opposed to a non-specific goal ("produce as many widgets as you can in the next 1 hour") to observe the goal-performance linear relationship.

To summarize, Locke's initial formulation in his 1968 article proposed a linear relationship between goal difficulty and performance if the goal set was of a specific nature, and the goal was deemed "acceptable" by the person who would attempt it.

The actual mechanism by which the linear relationship occurs is very interesting and robust (Latham & Locke, 1979). Initial efforts by other authors to explain the process by which higher goals lead to higher performance concluded that the mere presence of a goal served to motivate the person to do better on the task (Locke, 1967). However, Locke's (1967) study, which partialed out the motivational component, showed that the actual relationship is not that simple.

In offering an explanation of how the goal setting mechanism works, Bryan and Locke (1967) gave subjects either a minimum or excess amount of time to complete an addition task. Results showed that subjects given excess time took longer to complete the task than subjects given a minimum amount of time. They concluded that "the effect of the different time limits appeared to be a function of the differing performance subgoals which they induced" (p. 177).

It is plausible to interpret Bryan and Locke's (1967) statement as meaning that a person who has a specific and attainable goal externally set for him will, in turn, use a cognitive strategy by which he successively sets, and meets, his own "intermediate" goals to reach the final goal. For example, a person who is given the goal of producing 15 widgets in 1 hour might cognitively formulate that to reach his final goal he should produce about one widget every 4 minutes. This goal of 1 widget per 4 minutes then becomes the intermediate goal the person tries to meet. Following this logic, it is easy to see how a person would produce more with a 15 widget per hour goal versus a 10 widget per hour goal.

Knowledge of Results

Another much studied variable in the goal-performance relationship is knowledge of results (KR), or performance. Vroom (1964) identified the difference between the informational and motivational aspect of KR. Informational KR gives information as to both the nature and locus of errors; hence the person can easily correct mistakes. The motivational aspect of KR concerns only providing feedback about accomplishment (e.g., percent correct), but not how to improve subsequent performance. Therefore, any improvement in performance resulting from motivational type KR would be mostly due to motivation.

In terms of goal setting Locke is saying that when KR is given it is not sufficient that the person receive KR; it is what the person does with the KR that determines any subsequent improvement in performance. Locke and Bryan (1967) showed that no performance difference was found when groups of subjects receiving KR were contrasted with subjects not receiving KR. However, when subjects were reclassified into "goal" groups (e.g., a group trying to reach the standard set by the experimenter, or a group trying to "do their best") a significant improvement was found for subjects who were trying to reach the standard. The main idea is that it is not sufficient for the person to just receive feedback; the person has to use that feedback as a means of improving performance (i.e., setting and reaching intermediate goals).

Erez (1977) noted that in the goal-performance relationship being addressed by Locke, KR was not considered to be a sufficient condition for goal setting and task motivation to occur. KR was simply seen as a variable which could influence the goal-performance relationship as previously described. She proposed that KR could be considered a necessary condition for the relationship to be observed. That is, goals and KR must both be present, and interact with each other, to produce the goal-performance relationship. In her experiment (1977) she succeeded in demonstrating that subjects' performance with KR was significantly closer to their self

set goals than was the performance of subjects who did not receive KR. Thus, she concluded that KR was a necessary condition for the goal-performance relationship to be observed.

More recently Locke, Saari, Shaw, and Latham (1981), in their extensive review of the goal setting literature from 1969-1980, concluded that neither the existence of a goal by itself, nor KR by itself is sufficient to increase performance. Both are necessary conditions for observing the linear goal-performance relationship.

Parkinson's Law

"Work expands to fill the time available for it's completion." This quote from Parkinson (1957, p. 2), known as Parkinson's law, rings true for many tasks which we encounter in our daily lives. Parkinson's illustration of an elderly lady taking all day to write a postcard perhaps best expresses how people tend to "stretch out" a task so that its completion conforms to the end of the time allotted to do the task.

In an attempt to explain how the underlying mechanism of Parkinson's law operates, Aronson and Gerard (1966) gave subjects either extra time or a minimum amount of time to complete a task; and then observed the time required to complete a subsequent task. The results showed the predicted relationship; subjects initially

given extra time to complete a task subsequently took longer to complete a second task if given excess time. The authors explained the results in terms of procrastinating, in terms of Guthrie's (1935) theory of learning (i.e., learning to spend a long time on a task after initially allowed extra time), and in terms of Festinger's (1957) theory of cognitive dissonance (spending excess time on the task increased it's importance and justified spending a large amount of time on it in the future). However, Aronson and Gerard point out that their experiment did not identify the underlying mechanism of their observations.

Bryan and Locke (1967) offer an explanation of Parkinson's law which does identify the mechanism by which work expands to fill the time allotted. Their experiment, in which all subject's received KR, showed that subjects given an excess amount of time to complete a simple addition task (i.e., adding three two-digit numbers) took longer to complete the task than subjects given a minimum amount of time to complete the task. Their explication was that goal setting acted as the mediating factor between length of performance and the time allotted to complete the task.

I propose that when an excess amount of time is available to complete a task, a person is most likely to set intermediate goals which allow an even amount of task completion per time unit; resulting in a "lengthening" of

the task. Accordingly, a "shortening" of task length would occur when a minimum amount of time was available to complete the task. For example, a person asked to produce 15 widgets in 1 hour will set the intermediate goal of producing approximately 1 widget every 4 minutes (1 widget per 4 minutes X 60 minutes = 15 widgets); provided the goal is accepted. His performance will then be that of taking one hour to produce 15 widgets. If a person is given the goal of producing 15 widgets in 45 minutes, he might set the goal of producing 1 widget every 3 minutes (1 widget per 3 minutes X 45 minutes = 15 widgets); again, providing the goal is accepted. His performance will thus be 15 widgets per 45 minutes compared to 15 widgets per 1 hour.

We can now see how a person may set his intermediate goals based on both his final goal, and the amount of time allotted to reach that goal. Thus, the process by which a person sets his intermediate goals (i.e., intentions) is one explanation of the mediating mechanism through which work expands to fill the time allotted to complete the task.

The application of Parkinson's law to a real world situation was demonstrated by Latham and Locke (1975) where the number of days wood-harvesting crews could sell wood was reduced; thus raising the production goal. The results show the harvesting crews increased output per man-hour when the time restrictions were imposed. The

results also support the view that intentions (goals set by the harvesting crews) were the mediating factor between the increased goals and increased performance.

Hypothesized Internal Processes in a No-KR Situation

Recall that when a high goal is accompanied by KR the outcome is increased performance over either a low goal with KR, or a high goal without KR. The mechanism by which high goals operate to improve performance was explained to be the level of intermediate goals (intentions) set in trying to reach the final goal. Thus, feedback given to subjects enables the setting of more accurate intermediate goals which help facilitate subjects reaching the final goal, and the work "contracts" or "expands" to fill the time allotted.

When no KR is given, the subject is unable to set intermediate goals by the same mechanism (i.e., via external KR) to reach the final goal. However, Ammons (1954) pointed out that when no external KR is available the subject will provide his own "internal" KR (e.g., "I must be about half-way through the task."). It is safe to assume that intermediate goals may be set by the subject, even in the absence of external KR, based internally rather than externally. These intermediate goals will probably not be as accurate as those set when external KR is available since the subject has no external basis for knowing how he is doing. Accordingly, Aronson and Gerard (1966) showed that after performing a task a

subject's future performance on the same task is likely to be quantitatively similar. Integrating the two studies, I feel that the intermediate goals a subject sets in the absence of KR are based primarily on prior experience; and his subsequent performance thus corresponds to this prior performance.

Hypothesized Internal Processes in a No-KR/Low Goal Situation

After prior experience, if a subject is given a low goal ("low" in comparison to the prior experience or performance) and KR, he will set and meet intermediate goals which are based on the KR received in attempting to reach that final, low goal. However, when a subject with prior experience is given a low goal but no KR, he will set intermediate goals based on the prior experience. These intermediate goals, which are based on KR, are probably easier than the intermediate goals based on prior experience, which occur without KR. This is so because the determination of the value of the "low" goal is based on the prior experience (i.e., performance) and is, by definition, quantitatively less than the past performance. Hence, the rate of problem solving needed to reach the low goal will be less than the rate needed during the prior performance. Consequently, the difference between low goal/KR performance and low goal/no-KR performance will be due to a slowing down in performance (i.e., setting of easier intermediate goals)

by subjects receiving KR rather than an increase in performance by subjects not receiving KR.

In terms of Parkinson's law, the work of the low goal/KR subjects will expand to fill the time allotted (via easier intermediate goals), while the work of the low goal/no-KR subjects will stay about the same as in the previous performance (they will set basically the same intermediate goals).

Subjects assigned high goals will also set intermediate goals based on either available KR or prior experience. Accordingly, high goal/KR subjects' work will "contract," and high goal/no-KR subjects' work will "expand" to meet their respective goals.

Locke, Saari, Shaw, and Latham (1981) alluded to a corollary of the observation that work "expands" when given a high goal but no KR. They suggested that subjects tend to overestimate their performance toward a high goal when they don't know how close they are to that goal. This overestimation leads to less performance and the work "expands." If the hypothesized internal processes suggested here are correct, the opposite effect should occur for low goal/no-KR subjects. That is, they should underestimate how much of their goal they have completed and their work should "contract."

Other Studies of KR and Goal Difficulty

Many studies in which KR (present or absent) and goal difficulty (low and high) were manipulated have been

conducted (e.g., Strang, Lawrence, & Fowler, 1978; Becker, 1978). However, in none of these was there an opportunity for Parkinson's law to operate. That is, none of the studies allowed for a "lengthening" or "shortening" of the task based on intermediate goals. For example, in the Strang et al. (1978) study, subjects were given feedback, via tone intensity, after each response on a task (adding seven single-digit numbers). Since their goal of beating a previously set problem solving time could be reached on each trial, there was no need for subjects to set and meet accurate intermediate goals during the process of achieving the final goal. Accordingly, there was no observed difference between the low-goal group and the control group (no goal/no-KR) since there was no "lengthening" of the task for the low-goal group.

The present experiment differs from the Strang et al., experiment in that the KR will be provided in a manner which allows intermediate goal setting to occur and a decrement in performance to be observed when KR is present with a low goal.

Predictions

Based on the preceding discussion, the theoretical model forwarded by Erez and Zidon (1984) in their investigation of the effect of goal acceptance on the goal-performance relationship will be used in this experiment (See Figure 2). In terms of the present discussion "externally set goals" in Figure 2 are

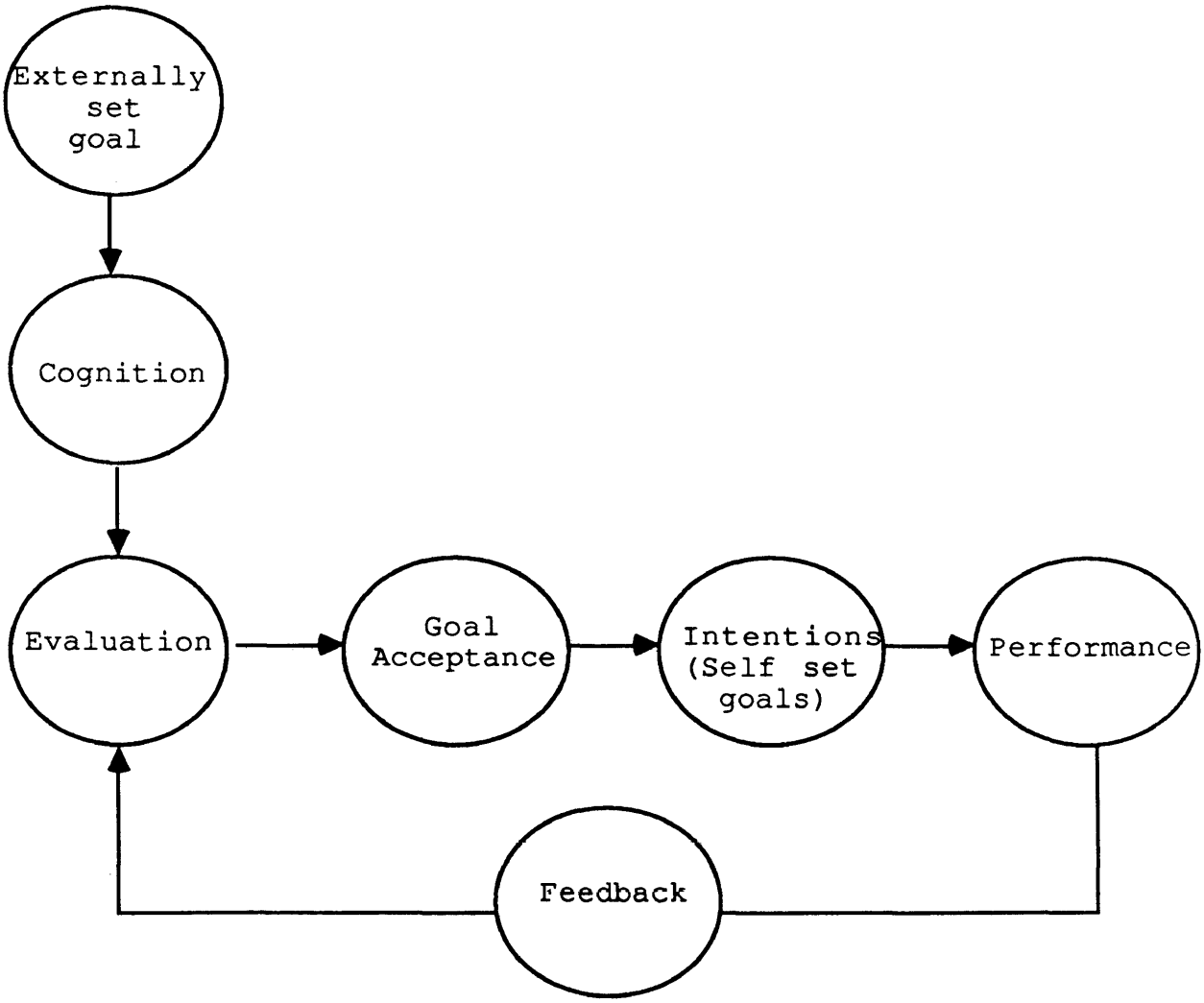

Figure 2. Conceptual model of the goal setting mechanism.

subjects' final goals, and "intentions" are hypothesized to concern setting intermediate goals.

Does KR facilitate performance when the goal is low? It is hypothesized that there will be an interaction such that when the goal is difficult, subjects receiving KR will show higher performance than subjects not receiving KR; and, when the goal is low, subjects not receiving KR will show higher performance than subjects receiving KR (Hypothesis 1 - see Figure 1 again). This prediction holds that KR is not a necessary condition for observing increased performance when the final goal is low. A main effect of goal difficulty is also predicted, where high goals will result in greater performance than low goals (Hypothesis 2).

Since the basis for setting intermediate goals, without KR, is hypothesized to be prior experience, I predict that there will be a significant correlation between baseline session performance (the "prior experience" in this experiment) and criterion session performance, when no KR is provided. I also predict a correlation when KR is provided, but to a lesser degree (Hypothesis 3).

As a corollary to the hypothesized internal processes when no KR is available, I predict low goal/no-KR subjects will underestimate their performance, and high goal/no-KR subjects will overestimate their performance (Hypothesis 4).

Finally, the rate of problem solving will be assessed on an exploratory basis by measuring the number of problems solved per 3 minutes during the criterion session. This investigation will provide a closer look at the nature of any performance decrement or increment in the experimental conditions.

Chapter II

Method

Subjects

Fifty-two male and female students, enrolled in undergraduate classes at the University of Nebraska at Omaha, were randomly assigned to one of four experimental conditions. All subjects voluntarily participated and received extra credit for their class. It should be noted that 61 subjects took part in the experiment, but nine had to be replaced due to procedural errors by the subject (i.e., hitting a wrong key on the keyboard or responding in an improper sequence, which caused the computer program to stop).

Task

The task was to mentally sum seven single-digit numbers (all integers greater than zero) as they appeared on a Commodore PET computer screen, and to enter the answers into the computer. Performance was measured by the total number of answers given and by the rate of solving problems.

Materials

The seven single-digit numbers to be added were randomly generated and appeared on a computer screen (e.g., "1+2+3+4+5+6+7 =?"), 1 problem per display. Problem numbers, when present, appeared above each problem. The experimental time was continuously present in the upper left-hand corner of the display and ran from

"000000" up to "000500" (baseline session) or "001500" (criterion session).

Procedure

Subjects sat at the computer terminal and were instructed that their task was to mentally sum each row of seven single-digit numbers as they appeared on the screen, 1 problem per display. They were instructed to enter their answer for each problem by (1) hitting the "space bar," (2) pressing the appropriate numbers on the computer keyboard, and (3) hitting the "return" key; which also advanced the screen to the next display. This sequence of responding was also printed on the computer keyboard for later reference.

Subjects were told that their answer would be input at the point of the cursor, which always appeared to the right of the "?" symbol after each problem, and how to use the "delete" key to correct mistakes. They were then told that the elapsed time of the session would be continuously present in the upper left-hand corner of the display, and that there would be a baseline session lasting 5 minutes and a criterion session lasting 15 minutes. The information which was to appear on the display was reinforced by using a piece of paper with a sample display printed on it as a visual aid (See Appendix A for the sample display).

During the baseline session the subject was given the goal of completing as many problems as he or she could

(as accurately as possible) in 5 minutes. No feedback concerning problem numbers was given during the baseline session. The experimenter started the task for the baseline session and left the room.

The computer stopped the baseline session after 5 minutes and provided accurate feedback concerning number of problems correct, number of problems wrong, and total problems completed during the baseline session. The subject was then instructed to call the experimenter into the room.

Meanwhile, the computer determined each subject's goal for the criterion session by using the total number of problems answered during the baseline session (x) as that subject's baseline rate. The computer calculated either a low goal, [(x)(3)(.75)] problems in 15 minutes, or a high goal, [(x)(3)(1.25)] problems in 15 minutes, for each subject.

The experimenter returned and forwarded the screen to present and review the following information: (1) average number of problems solved per minute during the last 5 minutes [total number of problems/5], (2) goal for the next 15 minutes, and (3) number of problems the subject would solve if he continued to work at the same rate during the criterion session.

The experimenter again reviewed how the computer display would appear during the criterion session by using a sample display (see Appendix B); when necessary, showing

where problem numbers would appear (see Appendix C). Subjects were also shown that their goal for the criterion session would always appear in the upper right-hand corner of the display.

The experimenter then told the subject to press the space bar to continue, and left the room. The following questions were then asked by the computer.

A) I intend to reach the goal of completing __ problems in the next 15 minutes.

1 = Strongly disagree

2 = Disagree

3 = Neither agree nor disagree

4 = Agree

5 = Strongly agree

B) I will try to reach my goal of completing __ problems in the next 15 minutes.

1 = Strongly disagree

2 = Disagree

3 = Neither agree nor disagree

4 = Agree

5 = Strongly agree

C) How difficult do you perceive your goal for the next 15 minutes to be?

1 = Very easy

2 = Easy

3 = Neither easy nor difficult

4 = Difficult

5 = Very difficult

The criterion session then began, during which the problem numbers either appeared above every problem (KR condition), or did not appear (no-KR condition).

The computer stopped the task after 15 minutes and asked the following questions:

D) How many problems do you think you completed in the 15 minute period?

E) It was easy to judge how much of the 15 minute time limit I had left to reach my goal.

1 = Strongly disagree

2 = Disagree

3 = Neither agree nor disagree

4 = Agree

5 = Strongly agree

F) During the 15 minute session I was:

1 = Trying to reach the assigned goal

2 = Trying to get as close as possible to the assigned goal

3 = Not trying to reach the assigned goal or to get as close to it as possible

The subject then called the experimenter into the room and the post-criterion session questionnaire was administered (see Appendix D).

Chapter III

Results

Goal Acceptance

After being assigned a goal, subjects were asked to indicate their acceptance of that goal. Since goal acceptance is a necessary condition in Locke's goal-performance relationship, it was decided to drop from further analyses those subjects who did not accept their goal (as measured on two 5-point pre-criterion session questions--see questions A and B). Thus, those subjects who either "disagreed" or "strongly disagreed" with both of the statements about "intending" or "trying" to reach their assigned goal were dropped from further analyses. Of the five subjects subsequently dropped, three had been assigned a low goal, two had been assigned a high goal, and all five later received feedback via problem numbers (the feedback manipulation occurred after administration of the goal acceptance questions).

As a response to a post-criterion session question, 33 of 47 (70.2%) subjects indicated that they were "trying to reach the assigned goal" for the criterion session, 13 (27.7%) were "trying to get as close as possible to the assigned goal," and one (2.1%) was "not trying to reach the assigned goal or to get as close to it as possible." The one subject who reported not trying to reach the assigned goal was not dropped from the data analyses because he or she had "strongly agreed" with both

pre-criterion goal acceptance questions about "intending" and "trying" to reach the assigned goal. It is very possible that the subject was referring to having a self-set goal when responding that he or she was not trying to reach the assigned goal. This subject later reported having a higher, non-specified goal in mind during the criterion session. As a result, this subject was not dropped from the data analyses. Thus, those subjects left in the analyses satisfied the first condition of the goal-setting paradigm; they accepted the goal.

Manipulation Checks

After indicating their goal acceptance, subjects were given a question about how difficult they perceived the goal to be (measured on a 5 point scale--see question C). Ratings of subjects assigned a high goal (M=3.54, SD=0.58) were significantly higher (indicating greater difficulty) than ratings of subjects assigned a low goal (M=2.61, SD=0.59); $F(1, 43)=15.71$, $p<.001$. Ratings of subjects who received KR (M=2.81, SD=0.98) were significantly lower than ratings of subjects who did not receive KR (M=3.31, SD=0.93); $F(1, 43)=4.72$, $p<.04$. Since subjects knew whether they were going to receive KR before answering this question, the significant difference between KR groups has implications for the role KR played in the perceived difficulty of the goal. That is, KR subjects may have felt that the goal would be easier

because they would have feedback about their progress toward that goal. On the other hand, no-KR subjects knew that they would not have performance feedback, and felt the goal was more difficult. So, telling subjects that KR was going to be provided may have reduced the perceived difficulty of the goal. However, there was no goal difficulty-KR interaction on this question, so the effect of reducing the perceived difficulty of the goal did not differ between goal difficulty groups. Overall, these results shows that the goal difficulty manipulation [low goal (LG) versus high goal (HG)] was successful.

Further, all subjects assigned a low goal (n=23) surpassed that goal in the criterion session, while only 6 of 24 (25.0%) assigned a high goal performed better than that goal. Thus, the percent exceeding the goal for each goal difficulty group was acceptable, and corresponded to a general definition of a "low" or "high" goal. Together, this manipulation and the goal difficulty ratings provided the second necessary component in the goal setting paradigm, a specific high, or low, goal.

There was no direct measure of the feedback manipulation. However, 19 of 21 (90.0%) subjects who received problem numbers reported looking at them at least once during the criterion session; subjects noticed the available feedback. This measure provides support for the third necessary condition in the goal-setting paradigm being present, feedback.

Therefore, in general, the goal difficulty and feedback manipulations were successful. Subjects perceived the high goal as harder than the low goal and, when available, referred to the problem numbers as a source of feedback.

Performance

For analyses purposes it was decided to statistically control for problem solving ability as a possible source of bias in the data. Since baseline session performance can be taken as a measure of problem solving ability, the total number of problems completed during the baseline session was treated as a covariate in the analyses. It should be noted that since the value of the goal was determined by a numerical transformation of each subjects' baseline session performance, the goal was already adjusted for ability. However, the use of baseline session performance as a covariate (although somewhat redundant) provided a more exact control of ability as a source of variance.

In order to utilize baseline session performance as a covariate some assumptions needed to be tested. Elashoff (1969) identified the critical assumptions for the use of analysis of covariance (ANCOVA). Assumption 1: The covariate is independent of treatment. "To achieve this statistical independence, the X variable should be measured prior to the administration of treatments and treatments should be assigned to groups at

random" (p. 388). This assumption was met because the covariate (baseline session performance) was measured before any experimental manipulation occurred, and subjects were randomly assigned to treatments.

Assumption 2: Treatment-slope interaction. Elashoff (1969) stated that "the standard covariance analyses procedure rests on the assumption that the regression of Y on X is linear, and that the slope is the same for all treatment groups (there is no treatment-slope interaction)" (p. 391). An F-test revealed that the slopes did not differ significantly among the four groups, $F(3,39)=.44$, n.s. Thus, this assumption was met.

Assumption 3: Linearity of regression. "...the standard covariance analysis assumes that the covariate has a linear relationship with the criterion variable..." (p. 390). For this assumption to be valid in this study, there must be a linear relationship between baseline session performance and criterion session performance. Elashoff states that "the simplest check for linearity is a carefully prepared set of X-Y scatterplots for each treatment group. Gross departures from linearity will be easily discovered" (p. 391). Visual inspection of the scatterplots for the four treatment groups yielded no gross departures from linearity, so this assumption is valid. Thus, the critical assumptions of ANCOVA are present, and its use as a statistical technique is justified.

A 2x2 ANCOVA was performed on the data (see Table 1 for means and adjusted means) and revealed a marginal main effect of goal difficulty (see Table 2). As predicted (Hypothesis 2) subjects assigned a high goal completed more problems (adj. $\underline{M}$=82.89, $\underline{SD}$=20.86) than did subjects assigned a low goal (adj. $\underline{M}$=78.20, $\underline{SD}$=15.68). However, there was no main effect of KR and, contrary to Hypothesis 1, there was no goal difficulty-KR interaction. Thus, the number of problems completed depended on the difficulty of the goal, not on the presence of KR or the interaction of KR and goal difficulty.

Since five subjects were dropped from the analyses due to lack of goal acceptance, the design is non-orthogonal. To analyze non-orthogonal designs Applebaum and Cramer (1974) offer the technique of testing each main effect while "ignoring" the other (i.e., testing y=M + baseline session performance + goal difficulty vs. y=M + baseline session performance; and y=M + baseline session performance + KR vs. y=M + baseline session performance) in addition to the usual test "eliminating" the other main effect. These ANCOVA's yielded no change in significance from the previously stated results for the main effect of goal difficulty [$\underline{F}(1,44)=3.74$, $\underline{p}<.060$] or for the main effect of KR [$\underline{F}(1,44)=0.54$, n.s.].

In order to further inspect the criterion session performance, the session was divided into five 3-minute intervals and the number of problems completed in each

Table 1

Observed and Adjusted Means for

Criterion Session Performance

Knowledge of Results	Goal Difficulty Low	High
Present		
obs. M	75.80	86.27
adj. M	78.71	84.06
SD	14.71	22.61
Cell *n*	10	11
Absent		
obs. M	75.15	84.62
adj. M	77.69	81.71
SD	16.96	20.16
Cell *n*	13	13

Table 2

ANCOVA Summary Table

Source	df	MS	F	Sig. of F
Covariate				
Baseline	1	13404.30	195.29	.001
Main effects	2	140.79	2.05	.141
Goal diff.	1	243.20	3.54	.067
KR	1	33.49	0.49	.489
Interaction				
Goal diff.				
X KR	1	5.15	.07	.786
Explained	4	3422.75	49.87	.001
Residual	42	68.64		
Total	46	360.30		

Note: Dependent Variable = Criterion Session Performance
Covariate = Baseline Session Performance

interval was recorded. The means and standard deviations of these intervals (across all conditions) are shown in Table 3. Results from a repeated measures analysis revealed a significant difference among the 5 intervals, $F(4,184)=3.49$, $p<.01$. However, the small magnitude of the difference ($w^2=.005$), suggests that it was due to a slight "warm-up" effect in the first 3-minute interval. That is, subjects may have been getting reacquainted with the sequence of answering problems during the first 3 minutes of the criterion session, causing a small difference in mean number of problems solved. Subjects then performed at a steady rate during the last 4 intervals of the session. Further inspection revealed no significant differences between the interval means for any of the four conditions.

Finally, contrary to Hypothesis 3, the correlation of baseline session performance to criterion session performance was not significantly different for the two KR groups: KR group ($r=.8888$, $n=26$), no-KR group ($r=.9105$, $n=21$); using r to Z transformations (Cohen and Cohen, 1975), $Z=0.36$, n.s.

Subjects' Perceptions and Self-Set Goals

Twenty-nine of 47 (61.7%) subjects indicated that they either "strongly disagreed" or "disagreed" that "it was easy to tell the amount of time left in the criterion session." Subjects may have felt that calculating the time remaining required too much effort since they would

Table 3

Performance Means for the Five 3-Minute Intervals of the Criterion Session

Interval	M	SD
1	15.36	4.25
2	16.19	3.94
3	16.26	4.03
4	16.40	4.07
5	16.09	3.94

have to subtract the display time from 15 minutes to arrive at the time remaining.

It was predicted (Hypothesis 4) that LG/no-KR subjects would underestimate their actual performance and HG-no-KR subjects would overestimate their performance. As can be seen in Table 4, LG/no-KR subjects actually did underestimate their performance; however, HG-no-KR subjects also underestimated their performance. Overall, performance estimates by subjects who received problem numbers corresponded significantly closer to actual performance (were more accurate) than did the estimates of subjects who did not receive problem numbers: KR - (r=.9848, n=21), no-KR - (r=.6692, n=26); using r to Z transformations - Z=5.17, p<.001.

In response to a question concerning the certainty of reaching their goal, subjects assigned a low goal were significantly more certain (on a 7-point scale--see question 5 in Appendix D) that they had reached their goal than subjects assigned a high goal; low goal (M=2.22, SD=1.35), high goal (M=4.83, SD=1.95); F(1, 43)=3.54, p<.001. This result is not very surprising since 100% of subjects assigned a low goal passed that goal. Also, subjects receiving KR were significantly more certain that they had reached their goal than subjects not receiving KR; KR (M=2.76, SD=2.34), no-KR (M=4.19, SD=1.72), F(1, 43)=11.10, p<.002. Again, this result is to be expected since KR subjects knew how close they were to their goal.

Table 4

Estimated Criterion Session Performance, Actual Performance, and the Significance of Their Difference

Experimental Group	Criterion Session Performance		
	Estimated	Actual	t-test[a]
LG-noKR (n=13)			
M	50.85	75.15	
SD	15.07	16.96	$p<.002$
HG-noKR (n=13)			
M	66.29	84.62	
SD	33.70	20.16	$p<.018$

[a]two-tailed

However, there was no interaction between goal difficulty and the presence of KR [$\underline{F}(1, 43)=.44$, n.s.] on this scale. Thus, subjects' certainty of reaching their goal depended on the difficulty of the goal and on whether they received KR, but not on the interaction of goal difficulty and KR.

Seventeen of 23 (73.9%) subjects assigned a low goal, and 10 of 24 (41.7%) subjects assigned a high goal, reported having a goal other than the assigned goal in mind during the criterion session. The "other goals" most often reported were "a non-specified goal higher than the assigned goal" (n=12) and "increased accuracy" (n=5); various other goals were reported by the remaining subjects (n=7). A Chi square test revealed no significant difference between low goal and high goal groups in terms of percent who had another goal in mind; $X^2(1, \underline{N}=47)=.129$, n.s. Thus, many subjects (27/47, 57.0%) felt that they should try to reach a goal other than their assigned goal during the criterion session. On the other hand, only three of 47 (6.4%) subjects reported setting and using intermediate goals (i.e., trying to complete a self-set number of problems per minute) during the criterion session. Thus, the cognitive strategy of utilizing intermediate goals to reach the final goal was not common in this experiment.

Computer Display

The number of times each subject reported looking at the clock during the criterion session is shown in Table 5. As can be seen, 66.0% (31 of 47) of the subjects looked at the clock in the computer display less than once every three minutes, including 14.9% (7 of 47) who never looked. A total of 38.3% (18 of 47) reported adjusting their rate of problem solving based on looking at the clock. So, a majority of subjects (40/47, 85.1%) looked at the clock, but less than half of these (18/40, 45.0%) adjusted their problem solving rate based on that information. This result indicates that the clock might not have been used as often as expected as a source of feedback about time left to reach the goal.

The number of times each subject reported looking at the problem numbers during the criterion session is shown in Table 6. Again, 66.7% (14 of 21) of subjects who had problem numbers looked at them less than once every three minutes. Forty-three percent (9 of 21) reported adjusting their rate of problem solving based on looking at the problem numbers. Again, a majority of subjects (19/21, 90.5%) looked at the problem numbers, but less than half of these subjects (9/19, 47.4%) adjusted their problem solving rate based on that information. Thus, in general, subjects looked at the problem numbers but did not use that feedback to adjust their work rate.

Table 5

Number of Times Each Subject Reported Looking at the Clock During the Criterion Session

Number of times looked at clock	Frequency	Percent	Cumulative percent
0	7	14.9	14.9
1	2	4.3	19.2
2	8	17.0	36.2
3	8	17.0	53.2
4	6	12.8	66.0
5	9	19.1	85.1
7	1	2.1	87.2
10	3	6.4	93.6
15	2	4.3	97.9
35	1	2.1	100.0
Total	47	100.0	

Table 6

Number of Times Each Subject Reported Looking at the Problem Numbers During the Criterion Session

Number of times looked at numbers	Frequency	Percent	Cumulative percent
0	2	9.5	9.5
1	3	14.3	23.8
2	4	18.9	42.7
3	2	9.5	52.2
4	3	14.3	66.5
5	2	9.5	76.0
6	1	4.8	81.8
7	1	4.8	85.6
10	1	4.8	90.4
20	1	4.8	95.2
every problem	1	4.8	100.0
Total	21		

Chapter IV

Discussion

Does feedback facilitate performance when the goal is low? It was predicted that subjects given a low goal and feedback would not perform as well as subjects given only a low goal. This experiment was conducted to address that hypothesis in a laboratory setting.

In order to test the hypothesis under the goal setting rubric, three conditions had to be met. Subjects had to be provided with a specific goal, they had to accept that goal, and they had to be given feedback about their performance in relation to the goal. Thus, subjects were given a specific (numerical) goal, all subjects included in the analyses indicated acceptance of their goal, and those who were supposed to (feedback was an experimental manipulation) received feedback.

The results of the analysis on criterion session performance did not support the predicted results; there was no goal difficulty - KR interaction in terms of performance. There was, however, a marginal main effect of goal difficulty; subjects assigned a high goal performed significantly better than subjects assigned a low goal. In essence, the results provide support for Locke's basic tenet: the higher the goal the higher the performance.

A possible explanation for why no goal difficulty - KR interaction, and only a marginal main effect of goal

difficulty, were found is that subjects did not use the KR in the predicted manner. It was hypothesized that low goal/no-KR subjects would set intermediate goals based on their baseline session performance, but that low goal/KR subjects would set intermediate goals based on the feedback provided. However, only a few (three of 47) subjects reported using self-set goals as a strategy to reach their final goal. This observation suggests that subjects did not try to complete a self-set number of problems per unit time. Rather, it seems that they simply tried to complete as many problems as they could in the allotted time, regardless of the difficulty of the goal or whether they received feedback; subjects "sprinted" in their performance. This sprinting thus precluded any chance of observing the mechanism by which feedback was predicted to result in low performance for low goal subjects (i.e., a decrease in problem solving rate due to setting of easier intermediate goals). So the process underlying the main hypotheses of this experiment, setting intermediate goals, did not occur.

There are three findings which support the idea that subjects did not utilize the available information in the predicted manner and sprinted in their performance. First, although 40 of 47 subjects reported looking at the clock at least once, 31 said they looked less than once every three minutes and only 18 adjusted their rate of problem solving based on looking. Thus, in general

subjects did not consistently use the clock as a source of information about how much time was left to reach their goal, or as a source to adjust their rate of problem solving.

Second, although 19 of 21 subjects reported they looked at the problem numbers at least once, seven looked less than once every five minutes, and, overall, only nine adjusted their rate of problem solving based on looking. So, it seems that subjects were not concerned with using problem numbers as a source of information to reach their goal.

Third, 27 of 47 subjects (17 of 23 of whom were assigned a low goal) reported having another goal in mind during the criterion session and, overall, 17 of those subjects' goals were higher than the assigned goal ("a non-specified goal higher than the assigned goal" was most common, n=12). So more than half of the subjects were trying to perform better than their assigned goal.

These three results support the explanation that many subjects were simply trying to perform at their highest rate regardless of the presence of feedback or the difficulty of the goal. The fact that a marginal main effect of goal difficulty was found under these conditions attests to the robustness of goal setting theory.

A possible reason why the sprinting effect was encountered is the evaluation apprehension inherent in the experiment. In an experiment on the effect of evaluation

apprehension, White, Mitchell, and Bell (1977) succeeded in separating the effects of having a goal from the effects of evaluation apprehension and social cues. An increase in performance was observed when subjects knew their work was going to be evaluated. They noted that in experimental studies "subjects generally know or expect that their performance will be evaluated by the experimenter" (p. 666). Thus, the evaluation apprehension present in this experiment is a possible explanation for why subjects seemed to perform their best regardless of the experimental manipulations.

Another possible explanation for why subjects "sprinted" is that they had a high level of intrinsic motivation to perform well on the task; were high in terms of need achievement (Miner, 1980). This idea is supported by the fact that subjects were college students, a group which has been shown to posses a high level of need achievement (Atkinson and Raynor, 1974). Since high need achievement people tend to set challenging goals and try to reach those goals (Hampton, 1976), subjects may have used the experimental situation as a chance to perform their best (i.e., sprint).

In terms of the theoretical model of the goal setting mechanism forwarded by Erez and Zidon (1984)--see Figure 2--there is evidence for all of the components being present in this experiment. However, there was not much evidence for the hypothesized occurrence of

intentions (self-set goals) taking the form of intermediate goals. A possible reason for intermediate goals not being set is that if subjects wanted to perform their best under the evaluative circumstances, setting intermediate goals (pacing themselves) would not have been advantageous.

Another explanation of why setting intermediate goals was not a common strategy is the length of the criterion session. Subjects may have felt that the session was not long enough to necessitate using intermediate goals as a strategy to avoid fatigue. So regardless of whether evaluation apprehension is present in a situation, a subject may still pace himself if fatigue is a possibility; it was not likely in this experiment's 15 minute work period.

The predicted results may have been observed if either of two additional experimental conditions were met. First, the apprehension associated with being evaluated should have been avoided. For an experiment conducted under laboratory conditions, avoiding evaluation apprehension may be very difficult. A way to avoid evaluation apprehension would have been to conduct the experiment in a real world setting where performance on the criterion task is not the only task upon which performance is measured. Thus, evaluation apprehension could be less focused on the criterion task. The point of suggesting this additional condition is that reducing

evaluation apprehension might reduce the likelihood of subjects sprinting in their performance, and increase the chances of their pacing themselves by setting intermediate goals.

If avoiding evaluation apprehension is not possible, then a second experimental condition, length of task, might have increased the likelihood of observing the predicted results. The length of the task in this experiment (15 minutes) did not necessitate setting intermediate goals to avoid fatigue since subjects were able to sprint throughout the criterion session. Increasing the length might have made it more likely that subjects would utilize lower intermediate goals to "pace" themselves. This suggested condition is basic to the predictions in this experiment since a decrement in performance (setting of lower intermediate goals) was predicted.

In conclusion, the evidence from this experiment suggests that setting intermediate goals is a strategy which use depends on the situation. As noted, two circumstances which may facilitate setting intermediate goals are when evaluation apprehension is low or task length is long.

Further research might investigate the task length at which task completion warrants (i.e., makes it cognitively advantageous) setting intermediate goals. Further research could also investigate whether there is a

difference across types of tasks (e.g., addition versus proofreading) in terms of the point at which setting intermediate goals becomes advantageous. If this further research did yield a task duration at which setting intermediate goals becomes advantageous, Parkinson's law might be revised to read, "Work expands to fill the time available for it's completion...when advantageous to do so."

References

Ammons, R. B. (1954). Knowledge of performance: Survey of literature, some possible applications, and suggested experimentation. Wright Air Development Center (technical report No. 54-14).

Applebaum, M. I., & Cramer, E. M. (1974). Some problems in the nonorthogonal analysis of variance. Psychological Bulletin, 81, 335-343.

Aronson, E., & Gerard, E. (1966). Beyond Parkinson's law: The effect of excess time on subsequent performance. Journal of Personality and Social Psychology, 3, 336-339.

Atkinson, J. W., & Raynor, J. O. (1974). Motivation and achievement. Washington, DC: V. W. Winston & Sons.

Becker, L. J. (1978). Joint effect of feedback and goal setting on performance: A field study of residential energy conservation. Journal of Applied Psychology, 63, 428-433.

Bryan, J. F., & Locke, E. A. (1967). Parkinson's law as a goal-setting phenomenon. Organizational Behavior & Human Performance, 2, 258-275.

Cohen, J., & Cohen, P. (1975). Applied multiple regression/correlation analysis for the behavioral sciences (pp. 50-52). Hillsdale, New Jersey: Erlbaum.

Elashoff (1969). ANCOVA: A delicate instrument. American Educational Research Journal, 6, 383-401.

Erez, M. (1977). Feedback: A necessary condition for the goal setting-performance relationship. Journal of Applied Psychology, 62, 624-627.

Erez, M., & Zidon, I. (1984). Effect of goal difficulty on the relationship of goal difficulty to performance. Journal of Applied Psychology, 69, 69-78.

Festinger, L. (1957). A theory of cognitive dissonance. New York: Harper & Row.

Guthrie, E. R. (1935). The psychology of learning. New York: Harper & Row.

Hampton, D. R. (1976). Selection and motivation. Human Resource Management, 15, 22-29.

Latham, G. P., & Locke, E. A. (1975). Increasing productivity with decreasing time limits: A field replication of Parkinson's law. Journal of Applied Psychology, 60, 524-526.

Latham, G. P., & Locke, E. A. (1979). Goal setting - A motivational technique that works. Organizational Dynamics, 8, 68-80.

Locke, E. A. (1967). Motivational effects of knowledge of results: Knowledge or goal setting? Journal of Applied Psychology, 51, 324-329.

Locke, E. A. (1968). Toward a theory of task motivation and incentives. Organizational Behavior and Human Performance, 3, 157-189.

Locke, E. A., & Bryan, J. F. (1967). Goal setting as a determinant of the effect of knowledge of score on

performance. Unpublished results, American Institutes for Research.

Locke, E. A., Saari, L. M., Shaw, K. N., & Latham, G. P. (1981). Goal setting and task performance 1969-1980. Psychological Bulletin, 90, 125-152.

Miner, J. B. (1980). Theories of organizational behavior. Hinsdall, Illinois: Bryden Press.

Parkinson, C. N. (1957). Parkinson, the law (p. 2), rev. ed. Boston: Houghton Mifflin Company.

Strang, H. R., Lawrence, E. C., & Fowler, P. C. (1978). Effects of assigned goal level and knowledge of results on arithmetic computation: A laboratory study. Journal of Applied Psychology, 63, 446-450.

Vroom, V. H. (1964) Work and Motivation. New York: Wiley.

White, S. E., Mitchell, T. R., & Bell, C. H. (1977). Goal setting, evaluation apprehension, and social cues as determinants of job performance and job satisfaction in a simulated organization. Journal of Applied Psychology, 62, 665-673.

Appendix A

000500

1 + 2 + 3 + 4 + 5 + 6 + 7 =

HIT THE SPACE BAR WHEN READY TO ANSWER

000500

1 + 2 + 3 + 4 + 5 + 6 + 7 = ?

ENTER YOUR ANSWER AND HIT THE "RETURN" KEY

Appendix B

001500

GOAL =
IN 1500 MINUTES

1 + 2 + 3 + 4 + 5 + 6 + 7 =

HIT THE SPACE BAR WHEN READY TO ANSWER

001500

GOAL =
IN 1500 MINUTES

1 + 2 + 3 + 4 + 5 + 6 + 7 = ?

ENTER YOUR ANSWER AND HIT THE "RETURN" KEY

Appendix C

001500 GOAL =
IN 1500 MINUTES

PROBLEM #19

1 + 2 + 3 + 4 + 5 + 6 + 7 =

HIT THE SPACE BAR WHEN READY TO ANSWER

001500 GOAL =
IN 1500 MINUTES

PROBLEM #19

1 + 2 + 3 + 4 + 5 + 6 + 7 = ?

ENTER YOUR ANSWER AND HIT THE "RETURN" KEY

Appendix D

INTERVIEW:

1) RELAX AND THINK ABOUT THE LAST 15 MINUTES. I AM GOING TO ASK YOU SOME OPEN ENDED QUESTIONS, AND SOME WHICH YOU SHOULD ANSWER YES OR NO.

2) ANSWER YES OR NO:

BESIDES THE GOAL THAT WAS ASSIGNED TO YOU FOR THE 15 MINUTE SESSION, DID YOU HAVE ANY OTHER GOAL IN MIND DURING THE SESSION.

_____NO

_____YES - ELABORATE

3) ANSWER WITH A NUMBER:

A) APPROXIMATELY HOW MANY TIMES DID YOU LOOK AT THE CLOCK DURING THE 15 MINUTES SESSION? _____

OPEN ENDED QUESTION:

CAN YOU RECALL WHEN YOU LOOKED AT THE CLOCK?

OR, CAN YOU PERHAPS RECALL HOW MUCH TIME WAS LEFT WHEN YOU LOOKED?

ANSWER YES OR NO

B) DID YOU ADJUST YOUR RATE OF PROBLEM SOLVING BASED ON LOOKING AT THE CLOCK?

_____NO

_____YES - ELABORATE

IF KR

4) ANSWER WITH A NUMBER:

A) APPROXIMATELY HOW MANY TIMES DID YOU LOOK AT PROBLEM NUMBERS DURING THE 15 MINUTES SESSION?_____

OPEN ENDED QUESTION:

CAN YOU RECALL WHEN YOU LOOKED AT THE PROBLEM NUMBERS; OR, CAN YOU PERHAPS RECALL HOW MUCH TIME WAS LEFT WHEN YOU LOOKED?

ANSWER YES OR NO

B) DID YOU ADJUST YOUR RATE OF PROBLEM SOLVING BASED ON LOOKING AT THE PROBLEM NUMBERS?

_____ NO

_____ YES - ELABORATE

5) PLEASE READ THE FOLLOWING QUESTION AND TELL ME THE NUMBER WHICH CORRESPONDS TO YOUR ANSWER.

RATE HOW CERTAIN YOU ARE THAT YOU REACHED YOUR GOAL FOR THE LAST 15 MINUTES.

1 = VERY CERTAIN THAT I REACHED THE GOAL

2 = CERTAIN THAT I REACHED THE GOAL

3 = SOMEWHAT CERTAIN THAT I REACHED THE GOAL

4 = DO NOT KNOW IF I REACHED THE GOAL

5 = SOMEWHAT CERTAIN THAT I DID NOT REACH THE GOAL

6 = CERTAIN THAT I DID NOT REACH THE GOAL

7 = VERY CERTAIN THAT I DID NOT REACH THE GOAL

RATING = _____

ANSWER YES OR NO

6) DID YOU HAVE ANY INTERMEDIATE, OR SUB-GOALS IN MIND DURING THE 15 MINUTE SESSION?

_____ NO - OR DO NOT UNDERSTAND: THEN PROVIDE AN EXAMPLE ("COMPLETING 4 PROBLEMS PER MINUTE TO REACH MY GOAL.")

_____ YES - ELABORATE