A Control Systems Conceptualization of the Goal-Setting and Changing Process

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Most of the research on goal setting has focused on the relationship between goals and subsequent performance. Much less research has been directed at explaining why goal setting works or at integrating it with other motivational theories. In this paper a control systems model of motivation is developed in which a goal is considered a referent or desired state to which performance is compared. Any discrepancy (error) between goals and performance creates a corrective motivation. Predictions based on this model are tested in a classroom situation using a longitudinal research design involving 188 college students. Results support many aspects of the proposed model. It is concluded that goal setting should be viewed as a dynamic process in which both self-set goals and environmental feedback are incorporated into a system that monitors performance relative to a desired state and adjusts subsequent goals, behaviors, and strategies.

Goal setting is a widely used motivational technique (Locke, 1975) that has been consistently supported by experimental research in both laboratory and field settings. Difficult and specific goals lead to improved performance (Latham & Yukl, 1975; Locke, 1968) as long as they are accepted and performance feedback is provided (Erez, 1977; Locke, Shaw, Saari, & Latham, 1981). Unfortunately, with few exceptions (Dachler & Mobley, 1973; Locke, Cartledge, & Knerr, 1970; Mento, Cartledge, & Locke, 1980), there has been little research aimed at explaining precisely why goal setting works or at integrating goal setting with other motivational theories.

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Three factors have helped to limit conceptual progress with respect to goal setting. First, although Locke (1968) argued that goals mediate the effects of knowledge of results, until recently researchers concerned with goal setting have underemphasized the role of feedback (Locke *et al.*, 1981). Similarly, researchers focusing directly on feedback (Ilgen, Fisher, & Taylor, 1979) have been only tangentially interested in goal setting. Thus, the effects of goals have not been well integrated with feedback systems. As Tolchinsky and King (1980) have recently noted, though feedback appears to be a necessary component for goal setting to work, we do not know how feedback operates to improve performance. Second, the association of goal setting with experimental research and applied interventions has fostered an emphasis on static rather than dynamic motivational models. Since most studies begin with an explicit goal-setting procedure (typically some management by objectives (MBO) variation) and end with the collection of subsequent performance data, theoretical work has often implicitly incorporated this simplified cause/effect framework. Third, the nature of the goals on which we have focused may itself be theoretically limiting. The goal-setting literature has focused on isolated, static, and specific goals; however, in many typical situations goals may be imbedded in complex cognitive or motivational systems, goals may change frequently, and goals may be poorly defined. A comprehensive model of the goal-setting process should also be able to handle these types of goals.

The present article seeks to articulate a general, dynamic goal-setting model in which both self-set goals and environmental feedback are incorporated into a performance-monitoring and performance-determining motivational system. More specifically, we will view both goals and feedback as principal components of a motivational control system which affects behavior, goals, and the relevant environment itself, albeit with different time lags. This article also reports results from a study that explored the operation of such a system under conditions where subjects working on familiar tasks could periodically set or revise goals on the basis of repeated performance feedback.

MOTIVATIONAL CONTROL SYSTEMS

The concept of a control system has been used in many different situations, from describing the way an organization controls the behavior of its members (e.g., Lawler, 1976) to simulating the regulation of various physiological processes (e.g., Van Sommers, 1974). Essentially, all control systems models contain the notion of a relevant environment being monitored via some sensor function. The sensor yields a signal which is then compared to a referent, standard, or desired state. Any discrepancy or error between the sensor and referent signals creates a self-correcting

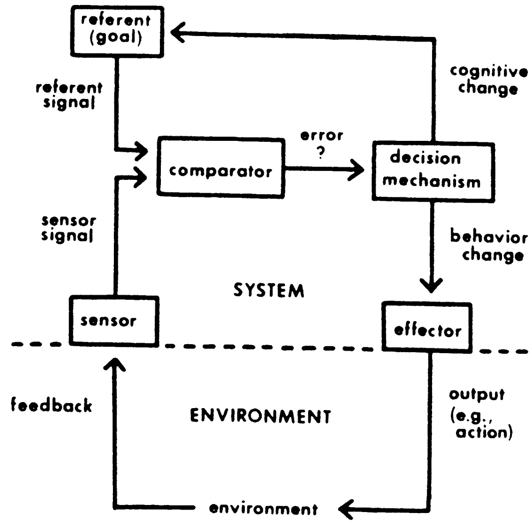

FIG. 1. Control systems model of motivation modeled after Powers (1973).

motivation. Depending on the characteristics of the individual and the situation, a decision is then made as to whether an attempt will be made to modify the environment via some effector function or whether the referent itself will change. Either way, the result is to maintain congruence between the environment and the desired state of affairs. This control systems conceptualization is one of a constant monitoring of the environment and adjustment of subsequent behavior and/or cognitions. The diagram shown in Fig. 1 is a schematic representation of these ideas. It is modeled after Powers (1973) and is discussed in detail below.

The linkage between goal setting, feedback, and control systems was suggested by Powers (1973). According to Powers, the referent state to which environmental information is compared can be thought of as a goal. Both goals and environmental (task) feedback are compared by the mechanism labeled "comparator" in Fig 1. If a sufficiently large discrepancy or error exists, some form of remedial action is triggered. The dependence of the comparator on *both* goals and feedback is quite consistent with recent goal-setting research demonstrating that neither goals nor feedback, by themselves, significantly affect performance (Erez, 1977; Locke *et al.*, 1981). The rationale for this interaction between goals and feedback in determining performance is clearly depicted in Fig. 1; if either a meaningful goal or feedback is missing, no error can be detected and no error-reducing response will be initiated.

The control systems model shown in Fig. 1 can also be used to explain many other major findings of the goal-setting literature, such as the findings that accepted, specific, and difficult goals produce better performance. The need for goal acceptance can be explained by equating goal acceptance with using a goal as a reference signal in a control system. Without this step, goal setting may have no impact on subsequent behavior. Specific goals produce better performance than ambiguous goals because they permit the use of more precise feedback from the environment (Ilgen *et al.*, 1979). The ambiguous "do your best" goal used as a comparison in many experimental studies of goal setting would not function well as a referent signal. For almost all performance feedback levels, it would indicate no discrepancy and no need for remedial action. Thus, there would be no mechanism whereby low performance produced changes in effort or strategy. Interestingly, one might also predict greater variance in performance with ambiguous goals since the modulating effects of feedback would be absent.

The higher performance associated with difficult as compared to easy goals can also be explained by the proposed control systems model, if one assumes variable performance feedback over time or across individuals. Poor initial performance is more likely to produce a discrepancy signal and remedial responses for difficult than for easy goals. Also, high initial performance may drift downward when easy goals are set, while difficult goals would produce a more rapid detection and response to declining performance. In short, the higher performance associated with difficult as compared to easy goals can be explained by the greater proportion of instances in which difficult goals would indicate a discrepancy and a need for a remedial response such as increased effort.

The control systems model goes beyond the goal-setting literature in explaining motivation in several ways. One extension suggested by the control systems model accrues from recognizing that errors (goal/feedback discrepancies) can be reduced either by increasing performance or by lowering goals. As Campbell and Pritchard (1976) have noted, there is no reason to think of goals as being fixed, although studies of goal setting have typically focused on static or fixed goals. As shown in the control systems model in Fig. 1, goals can be raised or lowered, thus providing an alternative to changing performance as a way to reduce discrepancies with performance feedback.

Recognizing that errors can be reduced by changing goals has two important advantages. First, it can help sharpen the somewhat muddled distinction between goal acceptance and goal commitment found in the existing goal-setting literature (Dossett, Note 1). To do this, we need only conceptualize goal acceptance as the initial use of a goal as a referent in a control system and goal commitment as an unwillingness to subsequently reduce goals to a lower level when confronted with error signals. Thus, commitment to a difficult goal will produce increased effort since it restricts the means of error reduction to only those responses that increase performance. Second, a natural linkage between goal setting and other determinants of motivation is provided by focusing on goal change. Factors such as consistency or size of the goal/feedback discrepancy and one's interpretation of the work environment (valences, expectancies, attributions) may impact on motivation through their impact on goal commitment (or goal change). For example, a potential linkage of the goal-setting and expectancy-valence theories of motivation may be found by linking goal commitment to valences for a particular goal.

Another extension permitted by the control systems model lies in understanding behavior in more complex, real-world situations which typically involve the concurrent attainment of multiple goals. Several tasks may be effectively coordinated through the use of multiple, goal-dependent feedback loops like that depicted in Fig. 1. Powers (1973), Miller, Galanter, and Pribrum (1960), and Carver and Scheier (1981) have all provided detailed discussions of how multiple control systems might be interrelated and hierarchically organized, so we will not dwell extensively on this point. However, we will note that multiple goals could be efficiently managed either by serially attending to goals in order of their priority or by developing tolerances for goal-performance discrepancies that depend on goal priority so that error signals for more important goals would be detected more rapidly.

A third extention stemming from control systems theory pertains to the choice of initial goals. Most goal-setting research focuses only on goals set by experimenters or by organizational superiors; thus, the determinants of initial goals are a moot issue. In many situations, however, one might expect the choice of initial goals to be an important determinant of performance, especially when task feedback is slow or when tasks are not repetitive. Although direct influence attempts from others (organizational superiors, experimenters, friends) may influence choice of initial goals, the control systems literature (Carver & Scheier, 1971; Sibley & McFarland, 1974) suggests three additional determinants of initial goals. First, goals may be set close to levels of past performance on familiar tasks. Second, initial goals may be derived from higher level objectives which are hierarchically organized (e.g., test goals in an academic course may be derived from course goals which are derived from goals for overall grade point average which are derived from career objectives, etc.). Third, as Carver and Scheier point out, initial goals may be externally influenced by social processes such as social comparison or modeling. Consistent with this assertion, Rakestraw and Weiss (1981) have recently shown that the performance level of social models affected the goals experimental subjects set and their resulting performance. This social modeling of goals was especially important for subjects who lacked task experience.

As we demonstrate in detail in the following section, an additional advantage of the control systems model of motivation is that the control systems literature can be used to develop several hypotheses concerning changes in goals and goal-related behavior in task situations. Further, findings from early studies of level of aspiration (e.g., Lewin, Dembo, Festinger, & Sears, 1944) can also be related to the goal-setting and changing process by equating a level of aspiration with the referent or desired goal state. The linkage between goal setting and level of aspiration has also been noted by Locke *et al.* (1981), who see a correspondence between goal acceptance and level of aspiration. We believe that this capacity to assimilate varied literature is a major strength of control theory.

APPLICATION OF THE CONTROL SYSTEMS APPROACH TO THE ACADEMIC SETTING

The control systems model developed and explained above can be applied and tested in the classroom situation. The classroom situation is ideal for this type of motivational research for a number of reasons. First, a student's learning and performance are relatively independent of that of other students in the class. Second, performance can be measured objectively and compared across individuals. Third, there are discrete cycles of behavior and results because tests covering specified material are often given at repeated intervals throughout the course. Fourth, the students receive very clear and immediate personal performance feedback as well as normative data on the rest of the class, which helps to reduce ambiguity. Finally, there are many aspects of this task and environment shared by numerous other tasks: tasks and outcomes are meaningful and familiar to students; tasks are complex and require a combination of ability, effort, and appropriate strategies for successful performance; goals are set and maintained by students; reinforcement may come from intrinsic and/or extrinsic factors; and goals may be part of the complex mechanisms for allocating resources among competing courses, employment, or social activities.

The control systems model presented in Fig. 1 can be applied to the classroom situation by equating students' grade goals to their referent or desired state. Actual test performance then constitutes the sensor signal that is compared to the students' grade goal. If a discrepancy or error is noted, motivation should be created to correct this discrepancy. Depending on the operation of the decision mechanism, there appears to be a limited number of responses a student could make to goal-performance discrepancies: subsequent behavior could be changed by increasing effort or changing study strategies, referents could be changed to bring goals more in line with actual performance, both behavior and goals could be changed, or the student may simply do nothing different and await further (and hopefully more favorable) information from the environment.

To further specify this application of the control systems model, the remainder of this section develops several explicit hypotheses concerning how students set goals, modify goals, or change behavior when confronted with performance feedback. Although many hypotheses may well be consistent with other motivational theories, the control system perspective incorporates them and suggests unique additional hypotheses. Hypotheses deal with parameters affecting either the operation of the goal modification loop depicted in the upper half of Fig. 1 or the behavior (and environment) modification loop depicted in the bottom half of Fig. 1.

Considering initial goal levels first, we see that the control systems literature points to past performance and ability as primary determinants of initial goal levels. Specifically, Sibley and McFarland (1974) discuss the concept of acclimatization (modifications of preferred goal states) and suggest that initial acclimatization will be as near to past acclimatized states (goals) as the environmental conditions will permit. Past performance and ability are highly correlated measures of past acclimatized states. In other words, initial goals will likely reflect the level of past performance and overall level of ability in similar tasks. As noted previously, the control systems literature also points to external factors (social comparisons, higher level goals, social influence) as determinants of initial goals, but due to practical considerations no attempts were made in this study to gauge the impact of such factors on initial goals. Thus, only the following hypothesis concerning initial goals was tested.

Hypothesis 1. Initial grade goals will be positively and significantly associated with both ability and past performance in other courses.

Explicit in the control systems model is the notion that some environmental factor is kept within certain acceptable limits (Stagner, 1977; Van Sommers, 1974). That is, there is some tolerance for a preferred-state/actual-state discrepancy; the actual state must exceed a threshold around the preferred state in order to activate the system. Several studies on the level of aspiration have found that future goals nearly always exceed past performance (Hertzman & Festinger, 1940; Lewin *et al.,* 1944; Simon, Shaw, & Gilchrist, 1954). All this suggests that goals will typically be set at a level slightly higher than past performance and that small failures will not result in an immediate lowering of goals. Thus, the following two hypotheses concerning goal discrepancies were examined.

Hypothesis 2. There will be a positive past performance–future grade goal discrepancy for all time periods (except for those students who received an *A* on the previous test).

Hypothesis 3. Small discrepancies (one letter grade or less) will not significantly affect goals, but larger discrepancies will produce lowered subsequent goals.

Another point of interest concerns the differential effect of success and failure on subsequent goals. Several studies (Festinger, 1942b; Lewin *et al.*, 1944; Pennington, 1940; Simon *et al.*, 1954) suggest that successful individuals (those whose performance equals or exceeds their goal) are more likely to raise than lower their subsequent goals, while unsuccessful individuals will be more likely to lower than to raise their subsequent goals. Thus, the following hypothesis was formulated.

Hypothesis 4. Successful students will be more likely to raise than to lower subsequent goals, while unsuccessful students will be more likely to lower than to raise subsequent goals.

Interestingly, much of the motivating (or performance-increasing) effect of MBO programs may occur from preventing or delaying goal reduction in response to failure. That is, in most MBO programs unsuccessful people cannot lower goals without negative consequences. It should also be noted that success or failure can affect other cognitions such as expectancies (Feather, 1966; Feather & Saville, 1967), but Carver and Scheier (1981, pp. 203–222) argue that a major consequence of high expectancies is the maintenance of commitment to goals (persistence in their terms).

The size as well as direction of a discrepancy should also impact on future goals and behavior. A number of authors (Lawler, 1976; Sibley & McFarland, 1974; Stagner, 1977) have argued that the degree of effort increase or goal decrease will increase monotonically with the magnitude of goal–performance discrepancy. Several studies have found that the more severe the failure (Lewin *et al.*, 1944; Pennington, 1940; Steisel & Cohen, 1951), or the more frequent the failure (Gardner, 1939; Simon *et al.*, 1954), the greater the likelihood that future goals will be lowered. Based on these findings the following two hypotheses were developed.

Hypothesis 5. The magnitude of failure will be positively associated with subsequent increases in effort.

Hypothesis 6. The frequency of failure will be positively associated with (a) subsequent increases in effort and (b) subsequent lowering of goals.

An important contribution of the control systems literature is a concern with the relative likelihood and timing of cognitive and behavioral reactions to goal–performance discrepancies. Sibley and McFarland (1975) have stated that acclimatization (cognitive response through reducing goals) is a slower acting and a more long-term solution to discrepancies, while behavioral and regulatory solutions (effort changes) are faster and more short term. Thus, initial goal–performance discrepancies should produce behavioral change (increased effort), while persistent discrepancies may be required for cognitive changes. An explanation for this phenomena is suggested by Ender and Bohart's (1974) work on causal attributions. They found that, in general, people have a bias toward making effort attributions in achievement-related tasks. Such a bias might easily lead them to increase effort before lowering goals when failure occurs. The following hypothesis was based on this logic.

Hypothesis 7. The proportion of students who decrease grade goals will increase with consecutive failures.

In summary, the seven hypotheses developed above help specify elements of the control systems model presented in Fig. 1. They pertain to the initial referent or goal level (Hypothesis 1), the expected direction of error (Hypothesis 2), the decision mechanism that effects goal change (Hypotheses 3, 4, 6b, and 7), and the decision mechanism pertaining to changes in effort (Hypotheses 5 and 6a).

METHOD

Subjects

The subjects were 188 college students from two introductory industrial/organizational psychology classes who participated in the study for points toward their grades. Their mean age was 20, and 74% were males.

Measures

Grade goals were measured by asking students to report their minimum satisfactory grade for the upcoming test and for the course. Following Locke and Brian (1968), other measures of goals (hoped for, tried for, expected grades) were collected; however, only the minimum satisfactory grade goal was used to test hypotheses because it has been found to be more accurate (Locke & Brian, 1968; Lord & Wexley, Note 2)[1] and more influenced by performance feedback (Festinger, 1942a; Holt, 1946).

Scholastic ability was measured by obtaining *American College Test (ACT) scores*. These scores included English, math, social science, and natural science subscales and a composite score. The *past performance* measures obtained included *grade point average* for the *previous quarter* and *overall grade point average*.

[1] Analyses indicating the greater accuracy of minimum satisfactory grade goals can be obtained from the first author.

Effort was tapped by a number of different measures. Multiple measures were used to try to maximize the accuracy of the self-report estimates of effort. After every test, students were asked to indicate how much *effort* they *felt* they had put in on the previous test. Ratings were made on a 7-point scale ranging from hardly any effort to all one's effort with anchors derived from Bass, Cascio, and O'Connor (1974). Further, two measures of amount of time spent studying outside of class were obtained: after each test students were asked how many hours they spent studying for that particular test (*reported hours studied*); and they also recorded how many hours they studied each day on special forms provided by the experimenter (*recorded hours studied*). Each student was also asked to rate how much *effort* he or she *intended* to put in on the next test on a 5-point scale ranging from much less effort to much more effort. Finally, each student was asked how many *classes* were *missed* during the 2-week period prior to each test.

Three out of these five effort level measures were highly intercorrelated[2]: felt effort, reported hours studied, and recorded hours studied (average intercorrelations ranged from .32 to .62, $p < .001$ across time periods). Therefore, these three effort measures were combined to form a composite index (*composite effort level*) by weighting each measure by the reciprocal of its standard deviation. Coefficient alphas (Cronbach, 1951) for this composite effort index ranged from .71 to .82 across time periods, with a median of .73.

Because change scores are less reliable than raw scores (Cronbach & Furby, 1970; Wall & Payne, 1973), composite change indices were also constructed following a similar procedure. Change in felt effort, reported hours studied, and recorded hours studied were correlated (average intercorrelations ranged from .19 to .43, $p < .05$ to $p < .001$ across time periods) and were therefore combined to form a composite index (*composite change in effort*) by weighting each measure by the reciprocal of its standard deviation. Coefficient alphas for this index range from .52 to .60 across time periods, with a median of .57.

Performance was measured by assigning letter grades for each test based on predetermined point–grade equivalents. Each of the five course tests were multiple choice and contained 45 items. Test scores and grades were fed back at the first class period following each test.

Procedure

Data were collected on six different occasions throughout the 10-week academic quarter. Students were told that the purpose of the research was to study factors which influenced test performance. They were asked to

[2] Intercorrelations of effort measures can be obtained from the first author.

complete five questionnaires: one at the beginning of the quarter and one after each of the first four examinations spaced 2 weeks apart. Only partial data were collected after the fifth exam because the quarter was over. Students were also asked to keep a daily record of hours actually spent studying on forms that were collected at the time of the fifth, and last, examination. Extra credit points were given as an inducement for participation and the students were assured that, since the class was not graded on a curve, participation could help everyone. Further, the students were guaranteed that the information collected was confidential and would not be shown to the class instructor on an individual basis.

The first questionnaire, given at the beginning of the quarter, measured overall and previous quarter grade point average, grade goals for the first test, and intended effort for the first test. The next four questionnaires, given after test performance had been fed back for each test, measured grade goals for the next test, felt effort expended for the previous test, reported hours studied for the previous test, and intended effort for the next test.

Because pilot work indicated that students often cannot remember their ACT scores accurately, students were given two options for reporting their scores: they could turn in a photocopy of their score reports sent to them by the Educational Testing Service, or they could obtain their scores from their advisor and record this information on special forms together with their advisor's verification.

It should be noted that grade goals for the fifth and final test were in most cases not analyzed for a number of reasons. First, by the fifth test the students were relatively certain of their course grade, and the grade goals they set for the fifth test were affected by this information. Second, the grade for the fifth test may have been affected by the anticipation of the extra credit points given for participation in the study. Finally, no feedback was given separately for performance on the fifth test since the quarter had ended.

RESULTS

The means and standard deviations for the grade goal measures for each test are presented in Table 1. As can be seen, there is no sign of severely skewed distributions or severe restrictions of range, in that goals averaged approximately the B level with standard deviations slightly greater than half of a letter grade.

Test of Hypotheses

The first hypothesis predicted that the level of initial grade goals would be significantly and positively associated with both ability and past performance. As can be seen in Table 2, this was found to be the case for

TABLE 1
MEANS AND STANDARD DEVIATIONS OF GRADE GOALS

Test	n^a	$\bar{X}$	*SD*
1	171	2.25	.62
2	169	2.12	.61
3	157	2.15	.65
4	156	2.09	.66
5	160	2.12	.69

Note. A = 1, B = 2, C = 3, D = 4, F = 5.
[a] Sample size may vary slightly due to missing data.

nearly all measures. To determine the multiple correlation between the initial grade goal and the past performance and ability measures, a regression was performed using the two past performance measures and the four ACT subscales. The resulting multiple correlation was highly significant ($R = .50$, $F(6,117) = 6.50$, $p < .001$).

The second hypothesis predicted that future goals would exceed past performance. To test this hypothesis, the grade goal set for the next test was subtracted from the grade obtained on the previous test. Given the scoring of grade goals (A = 1, B = 2, C = 3, D = 4, F = 5), a positive difference reflects future goals being higher than past performance. As can be seen in the left half of Table 3, these differences were positive for each time period and were always significantly greater than zero. Students' *minimum* acceptable grade goal averaged about one letter grade above their previous test performance.

TABLE 2
CORRELATIONS BETWEEN PAST PERFORMANCE, ABILITY, AND INITIAL GRADE GOALS

	n^a	Initial grade goal *r*
Past performance		
Last quarter's GPA	167	.33**
Overall GPA	170	.37**
Ability (ACT scores)		
Composite	132	.29**
English	144	.21*
Math	144	.10
Social science	132	.27**
Natural science	132	.33**

[a] Sample size may vary slightly because of missing data.
* $p < .01$.
** $p < .001$.

TABLE 3
RELATION BETWEEN PERFORMANCE, GOAL DISCREPANCY, AND GOAL REDUCTION

	Past performance–future goal discrepancy			Difference in proportion reducing goals			
Time period	n	$\bar{X}$	SD	n	χ^{2a}	n	χ^{2b}
Test 1 performance/ Test 2 goal	141	1.04***	.97	88	7.65**	110	2.58
Test 2 performance/ Test 3 goal	122	.67***	.96	100	2.61	118	9.22**
Test 3 performance/ Test 4 goal	137	1.16***	1.15	81	8.27**	110	0.52
Test 4 performance/ Test 5 goal	124	1.24***	1.20	92	0.01	112	0.02

[a] Comparison of success vs failure by one letter grade.
[b] Comparison of success or failure by one letter grade vs failure by two or more letter grades.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

The third hypothesis predicted a tolerance (no change in goals) for performance slightly below goals. In the right portion of Table 3 adjustments in goals of those students who succeeded (performance equaled or exceeded goals) were compared to those who performed below their grade goal by one letter grade. More specifically, the percentage of students who succeeded and lowered goals (e.g., 0% for the first time period) was compared to the percentage who failed by one letter grade and lowered goals (e.g., 18.4% for the first time period); the chi-square tests used to determine whether these percentages were significantly different are reported in Table 3 for each time period. Contrary to the prediction, significant differences were found for the first and third time periods. When students who failed by two or more letter grades were compared with other students, a significant difference in the proportion lowering goals was found only for the first time period. On the whole, this hypothesis was not supported. While there may indeed be a threshold within which small failures are unimportant, our choice of one letter grade to represent this threshold seemed too large.

The fourth hypothesis predicted that successful students would be more likely to raise than to lower goals, and unsuccessful students would be more likely to lower than to raise goals. Table 4 presents the test of this hypothesis. Successful students (i.e., those that met or exceeded their grade goal) did more frequently raise than lower their subsequent goals for three of the four time periods and for all the time periods combined. Of those students who failed, however, significantly more lowered than raised their subsequent goals only for the second time period and when all the time periods are combined. The curious aspect about these results is the number of students who raised goals after failure (see Table 4). This finding will be investigated further in supplementary analyses.

Hypothesis 5 predicted that the magnitude of failure would be positively associated with subsequent increases in effort. To test this hypothesis, magnitude of failure, defined as the letter grade difference between the student's goal on a particular test and his or her performance on that test, was correlated with the five different effort measures (see Method) for each time period. Positive correlations in Table 5 represent increases in effort or reductions in classes missed. For all time periods, intended effort and the composite change in effort measure were significantly related to the magnitude of failure. Correlations with measures relating to classes missed were only significant for the fourth time period.[3]

To investigate the relation between frequency of failure and increased effort (Hypothesis 6a), the number of failures was correlated with a 0/1 dummy variable computed for each effort measure (felt effort, reported hours studied, recorded hours studied, the composite of these three measures, and classes missed) representing whether a student increased effort at some point over the four tests. This correlation was significant only for recorded hours studied ($r = .16, p < .05$) and the composite effort measure ($r = .18, p < .05$). In short, there was some support for the prediction that frequent failure led to increased effort.

Hypotheses 6b and 7 were concerned with reductions in grade goals. Data relevant to these hypotheses are presented in Table 6. Results show that students with one or more failures were much more likely to lower goals at some later point in time than were students with no failures ($\chi^2 = 9.53, p < .05$); however, except for this difference, the number of failures seemed to have little impact on goal reductions. Consecutive failures, on the other hand, were more uniformly related to goal reduction. To explore the relation between consecutive failure and goal reduction more fully, a time period was selected where a student could have failed at least three

[3] Although not one of our hypotheses, a moderating effect of students' goal modification strategies on the relationship between magnitude of failure and changes in effort might be expected because lowering goals and increasing effort are alternative responses to failure. More specifically, the relationship between magnitude of failure and subsequent increases in effort may be stronger for those who maintain the same goals after failure than for those who lower goals after failure; this relationship may be even stronger yet for those who increase goals in response to failure. Additional analyses provided some support for this expectation; however, due to the small cell sizes for people who increased or decreased goals and the inconsistency of the results over time, these analyses are not formally presented.

TABLE 4
RELATIONSHIP BETWEEN SUCCESS VS FAILURE AND RAISING VS LOWERING OF SUBSEQUENT GOALS

Time period	Success				Failure			
	n	% Raising	% Lowering	χ^2	n	% Raising	% Lowering	χ^2
Test 1 performance/ Test 2 goals	19	100.0	0.0	19.00***	30	46.7	53.3	.13
Test 2 performance/ Test 3 goals	19	78.9	21.1	6.36*	24	25.0	75.0	6.00*
Test 3 performance/ Test 4 goals	11	100.0	0.0	11.00***	23	30.4	69.6	3.01
Test 4 performance/ Test 5 goals	11	45.5	54.5	.09	23	39.1	60.9	1.08
All time periods combined	60	83.3	16.7	26.60***	100	36.0	64.0	7.84**

* $p < .05$.
** $p < .01$.
*** $p < .001$.

TABLE 5
CORRELATIONS BETWEEN MAGNITUDE OF FAILURE AND SUBSEQUENT INCREASES IN EFFORT

Effort measure	Time period		
	Test 2	Test 3	Test 4
Intended effort	.20* (82)	.22* (68)	.45** (85)
Composite effort level	.05 (61)	.01 (54)	−.06 (76)
Composite change in effort	.23* (61)	.31* (54)	.24* (74)
Classes missed[a]	.02 (66)	.01 (59)	.20* (81)
Change in classes missed[a]	.03 (66)	.08 (59)	.18* (81)

Note. Number in parentheses indicates *n* size.

[a] Signs of correlations have been reversed since decreases in classes missed reflect increased effort.

* $p < .05$.

** $p < .001$.

times (the period after test 3). The increase in the proportion of students lowering goals with consecutive failures was significant ($\chi^2 = 7.73, p < .05$). In addition, the number of consecutive failures correlated .28 ($p < .01$) with a 0/1 dummy variable representing goal reduction.

Supplementary Analysis of Course Goals

As shown in Table 4, an interesting finding was that 36% of all those who ever changed goals after failure actually increased their goals for the next test. This seems to suggest that some students viewed individual test

TABLE 6
RELATIONSHIP BETWEEN NUMBER AND CONSISTENCY OF FAILURES AND THE PERCENTAGE OF STUDENTS LOWERING GOALS

Number of failures	Failures and goal reduction		Consecutive failures and goal reduction	
	n	%	*n*	%
0	21	14.3	25	0.0
1	22	50.0	16	18.8
2	18	55.6	12	25.0
3	34	47.1	30	26.7
4	19	52.6	—	—

goals in terms of a means–ends strategy (March & Simon, 1958) in that they attempted to compensate for past failure by raising goals for future tests. The notion of certain goals being means to obtain other goals is similar to what Powers (1973) calls a hierarchy of goals. Success or failure for lower order test goals may provide feedback signals for higher order course goals. Powers argues that "the appropriate time scale for higher order systems will be slower than that for the lower" (p. 354). In the present situation, one cycle through the test goal-setting process was faster than one cycle through the course goal-setting process (2 vs 10 weeks, respectively). Strategy differences may be more likely with lower order test goals given their shorter time perspective. Because students' course goals were also measured after each test, those hypotheses dealing with the relationship between failure and subsequent goals (Hypotheses 3, 4, 6b, and 7) were also analyzed with respect to course goals.

Considering Hypothesis 3, which predicted that there would be a threshold value for failure, analyses with respect to course goals indicate that in no time period did those who failed by one letter grade lower goals significantly more often than those who succeeded. Moreover, in three of the four time periods, students who failed by two or more letter grades did lower their subsequent course goals significantly more often than did both those who succeeded or those who failed by one letter grade. Thus, while a threshold value of one letter grade was too large for test goals (see Table 3), it was about right for course goals.

Hypothesis 4 dealt with the relationship between success vs failure and raising or lowering subsequent goals. Table 7 shows the analysis of this hypothesis using course goals. As with test goals, success more often led to a raising of course goals and failure to a lowering of course goals. It is interesting to note that course goals were changed far less often after failure than test goals (52 vs 100, respectively), and fewer students raised course goals after failure as compared to test goals (13.5 vs 36.0%, respectively). Thus, students' response to failure was more consistent with our predicted response (lowering goals) for course than for test goals.

The effects of number and consistency of previous failures on *course* goals were also more in line with predictions than were analogous results for *test* goals (Hypotheses 6b and 7). As shown in Table 8, both the number of previous failures (Hypothesis 6b) and the consistency of previous failures (Hypothesis 7) are more uniformly related to increasing percentages of students' lowering subsequent course goals. In short, it appears that students adjusted long-term goals (course goals) to be consistent with their performance but used short-term goals (test goals) for more strategic purposes. That is, they may raise short-term goals after failure as a means of compensating for prior, substandard performance.

TABLE 7
RELATIONSHIP BETWEEN SUCCESS VS FAILURE AND RAISING VS LOWERING OF SUBSEQUENT COURSE GOALS

	Success				Failure			
Time period	*n*	% Raising	% Lowering	χ^2	*n*	% Raising	% Lowering	χ^2
Test 1 performance/ Test 2 goals	20	100.0	0.0	20.00***	8	50.0	50.0	0.0
Test 2 performance/ Test 3 goals	8	62.5	37.5	.50	9	11.1	88.9	5.44*
Test 3 performance/ Test 4 goals	5	60.0	40.0	.20	23	4.3	95.7	19.17***
Test 4 performance/ Test 5 goals	15	93.3	6.7	11.27***	12	8.3	91.7	8.33**
All time periods combined	48	87.5	12.5	27.00***	52	13.5	86.5	27.77***

* $p < .05$.
** $p < .01$.
*** $p < .001$.

TABLE 8
RELATIONSHIP BETWEEN NUMBER AND CONSISTENCY OF FAILURES AND THE PERCENTAGE OF STUDENTS LOWERING COURSE GOALS

Number of failures	Failures and goal reduction		Consecutive failures and goal reduction	
	n	%	*n*	%
0	25	0.0	32	0.0
1	24	20.8	18	22.2
2	26	34.6	13	38.5
3	27	37.0	21	42.9
4	13	84.6	—	—

DISCUSSION

In summary, support was obtained for six of the seven hypotheses. Initial goal levels were related to past performance and ability. Future test goals were set at a level significantly higher than past test performance, although little evidence was obtained for the notion of a threshold performance level below which test goals were lowered. Both the magnitude and frequency of failure were associated with subsequent increases in effort. Success tended to be more often followed by a raising and failure by a lowering of subsequent goals. Further, goal levels were found to be influenced by frequent and consecutive failures. Finally, since strategy differences may have existed in the setting of test goals, those hypotheses dealing with goal changes were analyzed using longer term course goals and clearer support was obtained.

These findings lead to several conclusions concerning the control systems model depicted in Fig. 1. First, the comparator or discrepancy-detecting component did seem to be central in triggering a change in behavior or cognitions. Magnitude and number of failures were associated with increased effort, and number and consistency of failures were associated with goal reduction, especially for course goals. Second, dynamic factors were important in understanding students' response to failure. That is, the number of failure feedback cycles was an important determinant of the nature of students' response. As Sibley and McFarland (1975) suggested, behavioral responses (increased effort) and strategic responses (increasing *test* goals) occurred relatively fast, while more cognitive changes (lowering *course* goals) were slower, being more common after multiple or consecutive failures. The number of students raising test goals after an initial failure was particularly noteworthy because it suggests that short-term goals may fulfill strategic functions in attaining more important long-term goals.

Third, though it was not our intention to investigate decision-making processes, the importance of dynamic factors in determining the nature of students' responses suggests how the decision mechanism in Fig. 1 may operate. That is, it may be characterized by relatively simple, sequential testing of alternative responses to failure. (For a detailed discussion of how such a choice process may work, see Simon (1955).) Subjects may merely "try out" well-known responses (study more, go to class more) when confronted with failure. Though such responses may be preceded by cognitively more demanding choice processes such as those characterized by VIE theory (Vroom, 1964), there is no compelling reason to assume extensive analysis precedes students' response to failure. In fact, the cognitively simpler mechanism we have suggested has several advantages. First, it requires less processing of information before decisions are made. Second, if one selects more familiar responses first, a search for new responses or strategies would only be required after repeated failures. Finally, it would work well in both new and more familiar situations. That is, under conditions of uncertainty (March & Simon, 1958) trying a familiar response may be a means of gathering information about the environment as well as a means for altering outcomes.

The control systems model we have presented in Fig. 1 assumes that students are pursuing some desired outcome (grade goals). This implies that concepts such as valence (Vroom, 1964) would be important in explaining goal setting or goal changing. Exploring the relation of extrinsic factors to goal choice is an obvious area for future research. However, it should also be noted that intrinsic factors associated with setting and pursuing goals may be very important. For example, Deci and Ryan (1980, p. 41) argue that stimulus events which are moderately discrepant from one's internal standards are internally motivating. Thus, a small goal–feedback discrepancy may make familiar tasks more challenging and enjoyable. This conclusion is consistent with the upward bias in goals found in the level of aspiration literature and this study (see Table 3), as well as with the tolerance for small discrepancies between performance and course goals found in this study.

Although not the specific focus of the present study, an additional advantage of the control systems model is that it maintains a separation of the activational component of motivation from the alternative selecting component. When a discrepancy between actual and desired states occur, the motivational system becomes activated, but a decision mechanism that selects among alternative responses may not come into play. A well-rehearsed, preprogramed routine that does not involve the alternative selecting mechanism may simply be called up. Thus, the model separates the activational and directional aspects of motivation offering the possibility that different motivational theories might explain each aspect. For example, as Carver and Scheier suggest (1981, pp. 203–222), expectancy theory may relate more to selecting responses than to detecting discrepancies.

There are at least two implications of the present study for applied goal-setting interventions. First, the goal-setting process should be viewed as a dynamic process where specific performance feedback is necessary to assure adequate behavioral adjustments. Second, depending on the nature of the situation, lowering goals and changing strategies (besides effort increases) may also be likely consequences of goal–performance discrepancies.

A number of areas for further research are suggested by the present study. First, further enlightenment is needed on the nature and extent of goal-setting strategy differences. Possibly individual difference measures, like need for achievement or locus of control, could help distinguish between those who have the propensity to raise goals after failure vs those who lower goals after failure. Second, future research may fruitfully attempt an integration between short- and long-range goals. A more complete knowledge of how multiple goals relate to one another is essential to obtaining a real understanding of the goal-setting process. Third, future research may extend the control systems conceptualization of this study to an industrial setting where people are held accountable for their goal attainment as they typically are in MBO programs. Fourth, subsequent research may attempt a more integrated model that incorporates more comprehensive and explicit mechanisms for selecting initial goals and responding to error signals. Such mechanisms should incorporate valences for goals, expectancies for goal attainment, and other individual difference factors that may influence the goal-setting and changing process. This area of research could possibly lead to a viable simulation of the goal-setting process.

Finally, it should be noted that the control theory offers potential for resolving "meta-theoretical issues" such as the conflict between alternative paradigms like goal setting and behavior modification (see Locke, 1980). We have argued that the effects of goal setting can be explained by the type of control systems model depicted in Fig. 1. Recently, Carver and Scheier (1981, pp. 341–348) convincingly argued that many learning theorists (Mischel, Bandura, Kanfer) have evolved toward the cybernetic perspective of control theory. Thus, it seems possible that control theory could eventually provide a model of behavior that would be espoused by both goal-setting and behavior-modification theorists.

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