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Control Theory and Social Behavior in the Workplace

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Recent theoretical statements by Lord and Hanges (1987) and by Carver and Scheier (1981) suggest that supervision in the workplace can be analyzed as a control system made up of supervisors and subordinates. Two experiments are described which raise doubts about this claim. Subjects were engaged as supervisors and asked to provide performance feedback to a subordinate. It was found that subjects did not respond to subordinate work performance in the straightforward way predicted by control theory, but instead responded based on analyses of the context-dependent meanings of that performance. Implications of these results for applying the control system metaphor to social behavior in the workplace more generally are discussed.

KEY WORDS: control theory; social behavior; feedback supervision.

INTRODUCTION

Lee is a journeyman plumber. He is employed by a small firm that installs plumbing and heating systems in new residential construction. While on the job, Lee supervises Perry, an apprentice plumber who has less than a year of work experience. At the beginning of each day, Lee usually assigns Perry several tasks in a nearby work area, and then checks up on him periodically in order to monitor his performance. On occasion, Perry makes an obvious mistake, for example, using a type of pipe that violates local plumbing code. Lee is quick to point out such errors, and he has Perry stop his work in order to make the necessary corrections. At other times, however, Perry does things that, while not conforming exactly to the

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construction plans, are not so obviously wrong either. For instance, in order to get around an obstruction, Perry may choose to move a water line closer than anticipated to an exterior wall, or to relocate a drain pipe. Lee generally keeps track of these changes, sometimes interrupting Perry to give him feedback about what he has done. At other times, however, Lee simply takes note of the change, saying nothing about it to Perry.

In this paper, we take up the nettlesome problem of how best to account theoretically for this variability in Lee's supervisory behavior, the fact that sometimes he gives Perry feedback about his work, and other times does not. Our starting point is a recent suggestion that supervision can be described theoretically as a cybernetic control system (see Lord & Hanges, 1987)—a suggestion that expresses a burgeoning interest in social and organizational psychology in control systems models of individual and social behavior (see Campion & Lord, 1982; Hollenbeck, 1989; Klein, 1989).

Theoretical Background

Lord and Hanges (1987) have suggested that *intra*personal theories of self-regulation and performance control (Campion & Lord, 1982; Carver & Scheier, 1981; Hollenbeck, 1989; Klein, 1989; Miller, Galanter & Pribram, 1960; Powers, 1973a, b) can be extended to explain the *inter*personal management of performance in organized work settings. At the *intra*personal level, control theory describes the self-regulation and control of performance in terms of a linear sequence of machine-like functions that operate in a manner analogous to that of a common room thermostat. This is illustrated graphically in Fig. 1 which is adapted from Lord and Hanges (1987).

The control process begins when performance-relevant information from the environment is registered by a *sensor.* This information is passed to a *comparator,* where it is checked against a *referent goal* held in memory. When this comparison reveals a discrepancy of sufficient magnitude, i.e., above some threshold level, a *decision mechanism* is set into motion to select a strategy to resolve the discrepancy. This can be accomplished either by changing task-relevant behavior (via an *effector function*), by changing the referent goal, or both.

Thus, for example, a plumber might observe the speed with which water runs down a newly installed drain line (the sensor function), and mentally compare the observed flow to an internalized standard of how fast the water *should* drain (the comparator function). If there is a significant discrepancy between the two, e.g., the water runs too slowly, the plumber must decide how to correct the problem (the decision function). For instance, he/she might decide to change the slope of the piping, or to add an air vent in order to facilitate the flow. The implementation of either

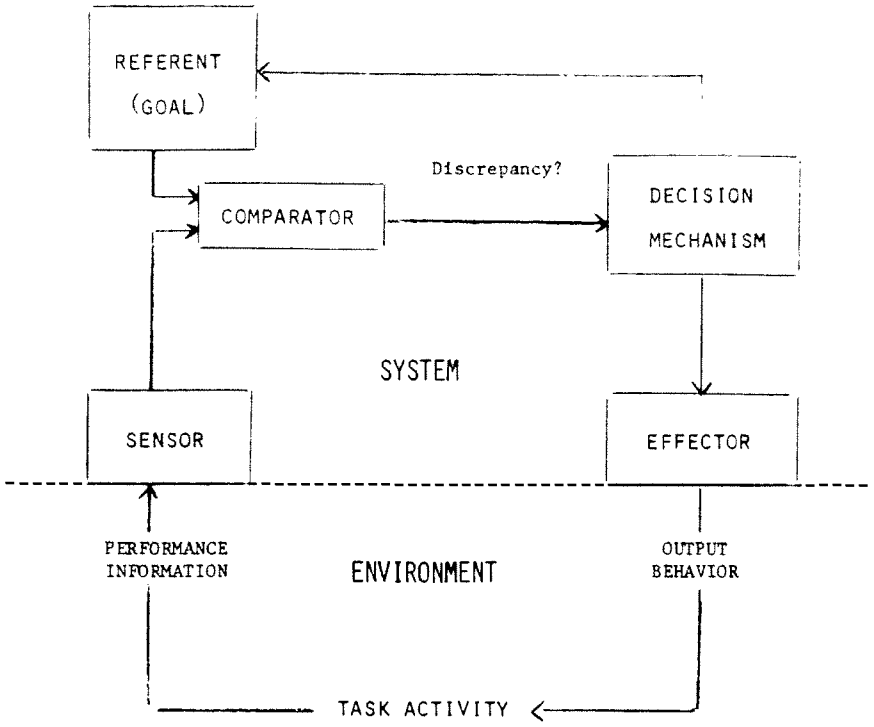

Fig. 1. A control theory model of work motivation (after Lord & Hanges, 1987).

option requires overt behavior (the effector function). Once done, the speed of the drain is again observed, and if the discrepancy has been eliminated, no further action is taken. On the other hand, if the discrepancy persists, i.e., the drain continues to run slowly, further decisions and action will be required.

Lord and Hanges extend this basic model to account for the *interpersonal* management of task performance by arguing that in many everyday work settings the various control functions are carried out by different people. For example, there are often times when an individual is unable to perform either the sensor function, e.g., because the task itself does not provide him/her with direct feedback, or the comparator function, e.g., because he/she is new to the job and has not yet internalized the appropriate referent goals (Louis, 1980). On such occasions it becomes necessary to rely on someone else, such as a supervisor, to perform these functions. Thus, when a supervisor obtains information about the performance of one of his/her subordinates (the sensor function), this information is mentally checked against some referent goal (the comparator function). If this comparison reveals a discrepancy, a course of action is

selected to resolve it (the decision function). This might involve giving the subordinate performance feedback (the effector function) in an attempt to modify his/her behavior and subsequent task performance.[5] Alternatively, it could lead to a rethinking of the referent goal, e.g., lowering the standards. Either way, the control process is essentially the same as in the *intra* personal case.

Thus, control theory presents a dynamic account of the joint effects of performance information and referent goals on supervisor's feedback and goal setting behavior, and on subsequent subordinate task performance. Although simple in structure, it specifies a great deal about how supervisors decide to give performance feedback and about how they set goals for future performance. It seems the perfect theoretical account—lean, intuitive, even elegant.

A Counter Argument. We believe that control theory offers an unsatisfactory description of the process of supervision, a process that we believe operates on fundamentally different principles. We argue that the differences between human social systems and control systems are such that they prevent either from serving as an adequate metaphor for the other.

Compare, for example, the classic control mechanism: the thermostat. By this mechanism, room temperature is regulated by registration of, and response to, discrepancies between actual and desired room temperatures. Depending on the direction and magnitude of the discrepancy, the thermostat directs the appropriate air conditioning equipment to resolve the discrepancy. It must be noted, however, that the thermostat has no idea what it is doing, even though it may do it perfectly well. It does not know or care what "temperature" is or what it means to say there is a "discrepancy between actual and desired temperature." It regulates air conditioning equipment automatically, mechanically, and unthinkingly.

The supervisor of course acts in a different and more complicated way. He/she does not respond unreflectively to a performance discrepancy, but rather responds based on an interpretation of what the discrepancy *means,* and this depends on the particular situation in which it occurs. Discrepancies that are "unreliable" or "meaningless" or "beyond the subordinate's control" evoke different responses than those that are "reliable," "meaningful," and "within the subordinate's control." Moreover, performance discrepancies assume different proportions depending on

[5]The subordinate, in turn, will register this feedback, compare it to a goal, e.g., performing well on the job, and, if a discrepancy is perceived, take action to resolve it, e.g., make the changes recommended by the supervisor. Thus, even though an individual may be unable to perform the sensor and/or comparator functions with regard to task-specific information, he/she should be able to process supervisory feedback by referring it to a goal of his/her own (Carver & Scheier, 1981; Lord & Hanges, 1987; Lord & Kernan, 1987).

whether the subordinate is green or seasoned, earnest or lazy, sensitive or thick-skinned, caring or uncaring, or receptive or hostile. Therefore, to understand when and why supervisors give the feedback they do, it is not enough to know that subordinate performance is discrepant from a standard. It is necessary to know also what that discrepancy means. Supervisors do not control discrepancies *per se.*

Another concern about the control system as a metaphor for supervision arises from its implication that supervisors give feedback simply to correct discrepancies between a subordinate's performance and a standard. While correcting discrepancies may indeed motivate some supervisory feedback behavior, there are many situations in which feedback is given even though no discrepancy exists, that is, even when the subordinate's performance exactly matches the performance goal. Indeed, feedback is often given precisely *because* there is no discrepancy, since feedback can have a reinforcing effect, thereby helping to ensure the continuance of the target performance in the future. Control theory has little to say about such feedback. Control systems are generally inactive (except for the sensing and comparing functions) as long as the incoming performance information is congruent with the referent goal. Action is initiated only when discrepancies exist. Supervisors, on the other hand, are active feedback givers, even when discrepancies do not exist.

Conversely, supervisors sometimes may not give feedback even when discrepancies do exist. In cases of extremely fine or poor performance, less feedback may be given simply because the *meaning* of performance is so obvious as to not bear mention. Also, even when supervisors are concerned about discrepancies, they are often reluctant to give the feedback that might otherwise help to correct them (Larson, 1984, 1989). For example, Fisher (1979) and Larson (1986) both found that supervisors not only gave negative feedback, i.e., feedback about goal discrepant performance, less often than positive feedback, i.e., feedback about goal congruent performance, they also were less timely and less accurate when giving negative feedback.[6]

In what follows, we press the case against the use of control theory to describe supervision. Illustrative data are reported from two experiments that suggest supervisors do not respond simply or straightforwardly to

[6]The terms "positive feedback" and "negative feedback" are here used in their colloquial sense, *not* their technical sense. Negative feedback is "bad news" and positive feedback is "good news." This contrasts with the technical meaning of negative feedback as information that reduces a discrepancy and of positive feedback as information that increases a discrepancy. Our use follows Lord and Hanges (1987) and the performance feedback literature more generally. It is unfortunate that the failure to keep these meanings separate has led to confusion.

subordinate performance, as the control theory metaphor would imply, but rather respond based on assessments of what that performance means *in that particular setting.* Although the findings of these studies are not completely new, and indeed are anticipated by research studies of performance appraisal (see Feldman, 1981), by juxtaposing them against control theory we are able to demonstrate some of the limitations of the latter as a description of how human supervision takes place. Based on these findings, we re-examine the use of control theory to describe social behavior in the workplace.

STUDY 1

Study 1 investigated supervisors' tendencies to give feedback to subordinates working on a multiple trial task. Of interest was whether supervisors' feedback was based simply on the discrepancy between subordinate performance and a referent standard, or whether it was based on a more thoughtful assessment of the *meaning* of that performance discrepancy in the context in which it was observed.

Theoretically, one factor that could influence the meaning of subordinate performance is prior performance. For example, an episode of "poor" performance might be taken more seriously if it is worse that the performance preceding it. A downward progression of performance implies even lower performance in the future, and suggests that the poor performance is "real," not just a temporary aberration resulting from chance factors. In contrast, the same "poor" performance may be interpreted differently if it is better than the preceding performance. An upward trend implies better performance in the future, and suggests that the poor performance may be temporary and not worth getting excited about. In this way, the "poorness" of performance might be exacerbated in one case and moderated in the other. It is not just "poor," it is either "truly poor and getting worse" or "not really poor and getting better." On this basis, it might be predicted that supervisors would give more feedback in the former than in the latter case.

Identical reasoning can be applied to "good" performance. "Good" performance is even more so if it is better than the prior performance, and less so if it is worse. Once again then, a person's current performance can have different *meanings.* It is not just "good," it is either "truly good and getting better" or "not really good and getting worse." Here it might be predicted that supervisors would give more feedback in the former than in the latter case. These predictions about supervisor feedback are tested in Study 1.

To test these predictions, subjects were engaged as supervisors of a "subordinate" (actually a confederate of the experimenter) who performed a task over 30 trials. Trial-to-trial performance of the "subordinate" was carefully controlled by a pre-established protocol. In each of the 30 trials a count was made of how many subjects gave performance feedback. These data were analyzed to estimate the effects of three variables on performance feedback: performance on the current trial, direction of change in performance (coded +1 for an increase and –1 for a decrease from the previous trial), and a product term representing the interactive effects of these two variables.[7] Based on the idea that the meaning of current trial performance varies with how it compares to performance on the previous trial, the prediction tested was that the interaction variable would be a significant predictor of supervisory feedback. This contrasts with the prediction from control theory that feedback is governed by comparisons of current performance to a standard.

Specific vs. Nonspecific Goals. A second issue examined in this study was the impact of goals on performance feedback. According to control theory, nonspecific goals inhibit control processes by making performance discrepancies harder to defect, whereas specific goals enhance control processes by making performance discrepancies easier to detect. For example, it should be easier to determine when a plumber has met the goal of completing a task within 3 hours than when he/she has met the goal of completing it "as soon as you can." How is a supervisor to know when the latter goal has not been met? Thus, control theory predicts that supervisors give performance feedback more frequently when referent goals are specific because specific goals facilitate evaluation of performance (Campion & Lord, 1982; Locke, Shaw, Saari, & Latham, 1981).

To test this prediction, goal specificity was manipulated. Half of the supervisor/subordinate work teams were assigned a specific, quantitative performance goal, while the rest were told simply to "do your best."

"Positive" vs. "Negative" Feedback. A final interest of Study 1 was to examine how supervisors used so-called "positive" and "negative" feedback (see footnote 6) when responding to subordinate performance. This was done by keeping separate records of the kinds of feedback (positive or negative) over the course of the experiment.

[7]The performance change variable was coded in this crude way to permit reliable statistical inferences. Although it would have been preferable to score performance change as the signed difference between current and prior trial performances, preliminary analyses revealed that this variable was too highly correlated with absolute performance to allow inferences about their independent effects. We were willing to accept this procedure because it offers a conservative test of the performance change effect, and a test favorable to control theory.

Method

Subjects. Forty students attending a university in New York City (20 males, 20 females) were recruited from undergraduate classes in introductory psychology to serve as supervisors in this experiment. They participated in partial fulfillment of a course requirement. At the conclusion of the experiment, all subjects were thoroughly debriefed and thanked for their participation.

Procedure. Subjects participated in the study one at a time and worked with another student of the same sex who was a confederate of the experimenter. The study was introduced as an investigation of factors that affect the performance of supervisor/subordinate work teams. It was explained that the participants would be assigned randomly to supervisor and subordinate roles, that they would have different tasks to do, and that their performance as a team would be assessed. An apparently "random" drawing was then held in order to assign the two roles. This procedure was rigged so that the subject would always draw the supervisor role while the confederate would always draw the subordinate role. Once roles were assigned, the supervisor and subordinate were seated at separate work stations. These were arranged so that the participants could not see each other directly. Prior to beginning the experimental task, the supervisor and subordinate were instructed to refrain from communicating verbally. This precaution was necessary to insure that all performance feedback would be given using feedback message slips that were provided for this purpose.

To meet the objectives of this study, it was necessary to employ a task that was sufficiently brief to allow multiple trials in a short period of time, sufficiently simple to permit easy and rapid assessment of performance by the supervisor, and sufficiently effort-dependent (as opposed to ability-dependent) to suggest to the supervisor that his/her feedback could make a difference and was therefore worth giving. To fulfill these requirements, a simple clerical task was used. The subordinate was given a stack of 30 sheets of paper. On each sheet was printed a 10 × 10 matrix of predominantly alphabetic characters interspersed with a few (7–15) numeric characters. For each matrix, the subordinate's job was to locate and circle as many of the numeric characters as possible within 60 seconds. After 60 seconds, he/she was to place the completed matrix in a basket where it would be picked up by the supervisor, and then proceed to the next matrix in the series.

The supervisor was required to monitor the subordinate's performance and to give performance feedback whenever he/she deemed it appropriate. Performance monitoring involved evaluating the work done on each matrix immediately after receiving it. For this purpose, the

supervisor was provided a master key indicating the correct answers, a calculator, and a form for recording (1) the percentage of errors made on the current matrix, and (2) the overall (cumulative) error percentage for all matrices completed so far. The supervisor was required to keep these records to ensure that he or she was aware of both the subordinate's current performance and the changes in his or her performance over time.

After recording the subordinate's performance for each work period, the supervisor was free to give or not give performance feedback as he/she saw fit. To give feedback, the supervisor selected one of seven different pre-printed messages and placed a copy of the message in a basket near the subordinate's work station. These messages offered either positive feedback ("You did well on the last trial. Keep it up!"), negative feedback ("You did poorly on the last trial. Work harder!"), or encouragement without feedback ("Keep on working as hard as you can"). To help orient supervisors to the real problems of deciding when to give feedback, that is, to discourage them from thoughtlessly giving feedback after every trial or giving no feedback at all, they were advised by the experimenter to give neither too much nor too little feedback, although no indication was given about what constituted either "too much" or "too little."

Independent Variables. Two independent variables were manipulated in this experiment. One was the subordinate's task performance, which was defined as the percentage of errors made during each work period. This was manipulated as a within-subject variable by training the confederate to make a certain number of errors in each matrix. To help accomplish this, a secret code known only to the confederate was embedded in each matrix indicating the number of errors to make. In this way, the observed pattern of subordinate performance was standardized across all supervisors. The mean error rate across the 30 work periods was 9.38%, with a variance of 36.84. The period to period error rate autocorrelation was $r(27) = .03$.

The second independent variable manipulated in the study was goal specificity. This was a between-subjects variable, and was manipulated by telling half of the supervisor/subordinate work teams that their goal was to keep their overall error rate at 10% or less (specific goal condition). The remaining teams were instructed simply to "work as hard as you can" (nonspecific goal condition).

Dependent Variables. The effects of independent variables on supervisory feedback were assessed *for each work period.* Thus, the unit of analysis for testing the study's main hypotheses was the work period, not the subject. Supervisory feedback was measured as the total number of supervisors giving (1) positive feedback, (2) negative feedback, and (3) neutral encouragement during each period. The last variable was included for exploratory purposes.

Results

Preliminary Analyses. To establish that supervisors' feedback was indeed influenced by subordinate performance, an initial analysis was conducted using supervisors as the unit of analysis rather than work periods. Three separate two-way analyses of variance were performed in which work period was a repeated, within-subjects factor, and goal specificity (specific vs. nonspecific) was a between-subjects factor. The three dependent variables analyzed were supervisors' positive feedback, negative feedback, and neutral encouragement. Each of these feedback variables was scored 0 or 1, indicating whether or not a message of that type was given during a particular work period by each supervisor. These analyses revealed significant main effects of the repeated work period factor for each dependent variable ($F(29, 1102) = 17.58, p < .001$, for positive feedback, $F(29, 1102) = 18.87, p < .001$, for negative feedback, and $F(29, 1102) = 3.64, p < .001$, for neutral encouragement), indicating that supervisors' feedback was strongly influenced by subordinates' performance on the task.

Performance Pattern. The main prediction tested in this study was that the effects of subordinate performance on supervisors' feedback would depend on whether that performance was better or worse than the previous trial. To test this prediction, subordinate performance was decomposed into three independent parts: (1) performance on the current trial, (2) direction of change in performance from the previous trial (scored +1 for improvement, −1 for decrement), and (3) a term describing the interaction of these two variables. The number of supervisors giving feedback for each work period was then regressed onto these three performance variables—the work period now being the unit of analysis, not the individual supervisor. The main prediction of the study would be affirmed if the interaction term were statistically significant. This prediction contrasts with control theory, which would predict only a main effect of performance on the current trial.

A least-squares multiple regression analysis found no main effects either for performance on current trial or for the direction of change in performance from previous trial (see Table I).[8] However, the predicted interaction effect was found, indicating that the effects of current performance on feedback were moderated by evaluations of current performance

[8]Although there was some colinearity between these variables (average $r = .38$), it was judged not to threaten statistical inference. Following Maddala (1977), we modeled these variables as functions of each other, and found that the R-square values in no case exceeded those in the regression equations reported. Another threat to statistical inference was autocorrelation on the dependent measure of feedback. This threat was assessed using the Durbin–Watson test statistic, which was found to be in the acceptable range (approximately 2).

Table I. Study 1: Standardized Beta Weights

Independent variables	Dependent variables: Total feedback	Positive feedback	Negative feedback	Neutral feedback
Current performance[a]	-.21	-.91[e]	.67[e]	.46[d]
Performance change[b]	.23	-.01	-.02	.47[d]
Interaction term	-.43[e]	-.40[e]	-.26[c]	.74[e]
Adjusted R-square	.29	.77	.57	.54

[a]Normalized error rate per trial.
[b]Coded +1 for an improvement, -1 for a decrement.
[c]$p < .05$.
[d]$p < .01$
[e]$p < .001$.

relative to immediately prior performance, i.e., whether it got better or worse.

Although this result was as predicted, its interpretation is complicated by the fact that the dependent variable of total feedback does not distinguish between kinds of feedback given, and thus does not reveal the precise nature of the interaction effect. Theoretically, an instance of poor performance that is worse than the last trial should prompt more "negative" feedback than an instance of poor performance that is nevertheless better than the last trial; and an instance of good performance that is better than the last trial should prompt more "positive" feedback than an instance of good performance that is worse than the last trial. Consequently, separate regression analyses were performed for each feedback type—positive, negative, and neutral encouragement.

The results of these analyses are reported in Table I. As can be seen, supervisors' positive and negative feedback were influenced by subordinates' current trial performance and by the interaction of current performance and the direction of change in performance from the previous trial. The scatterplot for both of these analyses indicated that the interactions were of the type expected. In the case of positive feedback, performance on the current trial evoked more feedback when performance improved as opposed to declined. In the case of negative feedback, performance on the current trial evoked more feedback when performance declined as opposed to improved.

Additionally, Table I indicates that supervisors' use of neutral encouragement messages was significantly affected by all three performance variables. The scatterplot for this analysis indicates that encouragement was most likely to be given when subordinates performed relatively poorly,

but nevertheless showed some improvement over the previous work period.

Goal Specificity. Also contrary to the prediction of control theory, the specificity of performance goals (specific vs. non-specific) had no effect on supervisors' use of performance feedback. For all three feedback types (positive, negative, and neutral encouragement), there were no main or interaction effects with subordinate performance (all Fs < 1.32, p = n.s.).

Discussion

The results of Study 1 suggest that subjects' decisions to give feedback were not determined solely by the level of subordinate performance, but were influenced also by whether or not performance improved or declined from the performance preceding it. For both "positive" and "negative" feedback types, both a main effect of current performance and an interaction between current performance and direction of performance change were observed. There was no evidence of an effect of goal specificity on supervisory feedback.

These results are consistent with the view that supervisors do not respond in a simple way to subordinate performance *per se,* but respond instead based on what that performance means. Apparently, performance that has improved does not mean the same thing or warrant the same feedback as identical performance that has declined. Taken at face value, these results are incompatible with control theory. If supervisors were like thermostats, we would expect them to respond to subordinate performance in a more uniform way, by assigning specific feedbacks to specific performances. To the unthinking thermostat, temperature is temperature, and bygones are bygones. Yesterday's temperature has nothing to do with how room temperature is to be regulated today. Yet to the thinking supervisor, history is crucial for making an interpretation of the present. Insofar as control mechanisms cannot vary their responses with the meaning of incoming performance signals, they are powerless to explain the differential responses observed in this study.

In addition, we must ask why no effects were found for the manipulation of goal specificity. Theoretically, a clear and specific performance standard should evoke more regulatory feedback because it permits easier detection of performance discrepancies (see Campion & Lord, 1982). If we gave a thermostat the specific goal to maintain room temperature at say, 70 degrees, no more and no less, we would expect to find it busier communicating with air conditioning equipment than if we gave the vague

goal to keep the room "reasonably comfortable" (assuming of course that we could communicate such a goal to the thermostat).

Although troublesome, these concerns about control theory can be answered in ways that preserve the theory. First, they can be denied. Perhaps the results of this study cannot be generalized because of the artificiality of the experimental setting and procedure. Or perhaps the requirement that subjects keep account of both current trial performance and performance changes over time led them to believe that they ought to use both kinds of information when deciding to give feedback. Subjects' use of performance information could have been an unintended result of the instructions, and not an indication of the way they give feedback.

Second, it can be argued that the results are not inconsistent with control theory. As the control theory model outlined in Fig. 1 shows, prior performance *can* affect responses to later performance by its effects on the referent goal. Thus, even though work teams were assigned a performance goal at the outset, this goal may have migrated over the course of the task. Although this possibility cannot be ruled out, it is not obvious how it could explain the findings in this study. Performance would have had to alternate regularly between improvement and decline. This was not the case. Over the course of 30 trials, performance continued in one direction about as often as it reversed direction (14 vs. 16 times).

A more compelling defense of control theory would be to propose more complex machinery. In particular, supervisors' behavior could be explained as a two-step control system. In the first step, an initial impulse to give feedback ("positive" or "negative") is established by comparing subordinates' current performance against a referent standard. This impulse, however, is not acted upon until a second comparison is made. Then, current performance is compared to the immediately preceding performance to determine whether feedback is given. Machinery like this *could explain* both a main effect of current performance and why this effect is moderated by the direction of change in performance. However, being *post hoc,* this revision of the control model would have to be tested.

Last, the failure to observe an effect of goal specificity could be because the manipulation was ineffective. This argument cannot be ruled out without an independent manipulation check. Furthermore, after reviewing the experimental procedure, we suspect that even if the manipulation were successful initially, it may have been undermined by the pattern of subordinate (confederate) performance in the task. Even short exposure to the task suggests a 10% error rate as a natural standard against which to judge performance.

STUDY 2

The results of Study 1 indicate that supervisors' responses to subordinates' current trial performance were not straightforwardly determined, but were influenced by how that performance was interpreted in view of prior performance. Different responses were observed depending on whether performance was also an "improvement" or "decrement" from prior performance. This suggest that, unlike control systems, supervisors may not be concerned with performance discrepancies *per se,* but rather with what such discrepancies mean. This is a potentially significant point because control systems are incapable of dealing with meaning (Searle, 1984; 1990).

An even more compelling demonstration of this point would be to show that supervisors do not respond to performance *unless* it is meaningful. Study 2 attempts such a demonstration. Using a procedure very similar to Study 1, subject–supervisors were exposed to a series of subordinate performances (once again manipulated through a confederate) that differed between two conditions only in the way they were arranged. Half of the subjects were assigned a pattern of performance like that of Study 1 (level performance condition). This pattern was highly variable with little or no detectable trend. The remaining subjects were assigned a different pattern of performance (improving performance condition). This pattern was less variable and had a clearly detectable trend.

Because the pattern of subordinate performance in the level performance condition closely resembled that in Study 1, it was expected that feedback would again be given according to how current trial performance was interpreted in light of performance on the previous trial. However, a different tendency to give feedback was expected in the improving performance condition, where current trial performance would be more predictable. In this condition, each instance of performance is part of a trend toward improvement, and as such should be less surprising and therefore less meaningful to the supervisor whose expectations it confirms. Being less meaningful because it is expected, current trial performance should evoke less feedback. The more meaningful variable in this case, and the one having more impact on feedback, should be the direction of performance change because it bears more directly on the overall trend.

In addition to the performance pattern manipulation, an important procedural change implemented in Study 2 was to give subjects a more realistic supervisory role. Unlike Study 1, supervisors were not required to keep a separate written record of the subordinate's performance. Furthermore, they had to perform another task of their own while monitoring the

subordinate's work. These changes were introduced to help eliminate demand characteristics as an alternative explanation for the results, and to make the supervisors' role more representative of supervisory roles in actual work organizations. Finally, all supervisor/subordinate work teams were assigned the specific goal of keeping their overall error rate at 10% or less.

Method

Subjects and Procedure. Twenty-six students (9 males; 17 females), again attending a university in New York City, served as supervisors in this experiment. Subjects were again paired with a confederate of the same sex. Except for the modifications noted previously, and a few minor changes to be outlined presently, the procedure was the same as that used in Study 1. One minor change was that supervisors were no longer required to keep a separate record of the subordinate's performance, i.e., percent errors, during each work period, nor were they required to compute a cumulative error rate. Instead, they had only to count the raw number of errors made on each matrix and record that number on the matrix sheet itself. Supervisors were also told the following:

> ... If you have time during each one minute work period—after the puzzle is scored—then we would like your assistance with one additional task. We want to determine which numerals, 1 through 9, are most easily recognized in this matrix configuration. Therefore, we would like you to examine each puzzle page individually, and to indicate which numeral seems to occur most frequently. Indicate your answer by writing that numeral at the bottom of the page.

These changes were intended to create conditions more like those prevailing in actual work organizations, where supervisors typically have only limited access to information about subordinate performance, and limited time to think about how best to give performance feedback. The only other change was to extend the task to 32 work periods, an increase of two periods over Study 1.

Independent and Dependent Variables. As before, the primary independent variable was the subordinate's performance in each work period. All subjects were exposed to the same set of performance scores. However, these scores were arranged into two different patterns, to which subjects were randomly assigned. One pattern was marked by high period-to-period variability (var. = 40.32) and low autocorrelation ($r = -.10$), indicating no overall performance trend (level performance condition). The other pattern was marked by low period-to-period variability (var. = 8.94) and high autocorrelation ($r = .71$), indicating an upward trend in performance (improving performance condition). Performance feedback was operationalized as in Study 1. Finally, a brief, post-experimental questionnaire was

given to assess subjects' perceptions of how subordinate performance changed over time.

Results

Preliminary Analyses. Responses to the post-experimental questionnaire were analyzed to check the effectiveness of the performance pattern manipulation. As expected, a one-way analysis of variance showed that supervisors in the improving performance condition saw more of a trend toward improvement in subordinate performance than did supervisors in the level performance condition (F (1,24) = 26.80, $p < .001$).

It was also of interest to determine whether supervisors exposed to different patterns of performance gave different amounts of feedback to the subordinate. A one-way analysis of variance, in which the dependent variable was the total amount of feedback given by each supervisor, i.e., positive and negative feedback combined, revealed no significant difference between the two groups (F (1,24) = 1.24, p = n.s.). Thus, whatever differences existed in supervisors' tendencies to give feedback in the two treatment conditions, they could not be explained in terms of the total amount of feedback given.

Performance Pattern. The main predictions of this study were tested using the same multiple regression procedure as in Study 1, again, with work period as the unit of analysis. These regressions were run separately for the level and improving performance pattern conditions (see Table II).

Replicating Study 1, supervisors' use of both positive and negative feedback in the level performance condition was influenced by the subordinate's current trial performance. Moreover, the significant interaction term in the negative feedback analysis, along with the scatterplot for that equation, suggests that negative feedback was again given more often when the current poor performance was worse than the preceding performance. Unlike Study 1, however, a similar interaction was not observed in the case of positive feedback. Additionally, neutral encouragement feedback varied only with current performance.

A very different pattern of results was obtained for the improving performance condition. Unlike both Study 1 and the level performance condition, positive feedback was affected only by the direction of performance change. It was not affected by current performance or by the interaction of current performance and performance change. Negative feedback and neutral encouragement feedback were influenced by none of the three performance variables.

Table II. Study 2: Standardized Beta Weights

Independent variables	Dependent variables: Positive feedback	Negative feedback	Neutral encouragement
Level performance condition			
Current performance[a]	−.59[c]	.56[c]	.76[c]
Performance change[b]	.22	−.14	.10
Interaction term	.12	−.44[c]	−.05
Adjusted *R*-square	.51	.62	.48
Improving performance condition			
Current performance[a]	.23	.27	.09
Performance change[b]	.69[c]	.01	−.35
Interaction term	.01	−.24	.04
Adjusted *R*-square	.41	.02	.05

[a]Normalized error rate per work period.
[b]Coded +1 for an improvement, −1 for a decrement.
[c]$p < .001$.

Finally, the regression equations from the two experimental conditions were compared to see if their structures could be distinguished statistically. Tests of structural homogeneity indicated significant differences for all three types of feedback (all Fs (1,56) > 4.56, $p < .001$). For positive feedback, treatment differences were found for current performance and performance change. For negative feedback and neutral encouragement, a treatment difference was found only for current performance.

Discussion

The results of this study partially replicate and extend those of Study 1. As in Study 1, subject–supervisors in the level performance condition were responsive to current trial performance. In addition, they were more likely to give negative feedback when current trial performance declined from the previous trial. Again, it appeared that supervisors' feedback was not determined by performance *per se,* but by how that performance was interpreted.

Of greater interest is the finding that subjects in different treatment conditions used different information when deciding to give feedback. Subjects in the level performance conditions were influenced by current trial performance, and in the case of negative feedback, were influenced also by the interaction of current trial performance and direction of performance change. In contrast, subjects in the improving performance condition

were not influenced by these factors, and in the case of positive feedback were influenced instead by the direction of performance change. This result extends the findings of Study 1 by showing in a different way that it is the meaning of performance, not performance *per se,* that determines if and when supervisors give feedback. In particular, this result suggests that the pattern of performance over time can influence the meaningfulness of both current trial performance and direction of performance change. If trial to trial variation in performance is high and the autocorrelation between trial performances is low, then current trial performance is more meaningful and direction of performance change is less meaningful. Conversely, if trial to trial variation in performance is low and the autocorrelation is high, then direction of performance change is more meaningful and current trial performance is less meaningful.

This finding is more difficult to assimilate within the framework of control theory. Subjects in this study responded to subordinate performance in entirely different ways as a consequence only of how subordinate performances were sequenced. Unlike Study 1, where it is possible to argue that the use of performance information might have been shaped in an unknown and unforeseen way by the experimental procedure itself, such an argument cannot plausibly explain this result because subjects in both treatment conditions followed the same experimental procedure. Moreover, this result cannot be attributed so easily to dynamic changes in the referent goal, since the difference in feedback is in the logic used, and not the amount given. Most important, it is difficult even to imagine a control mechanism that could produce this pattern of results, let along a control mechanism that is psychologically credible. Such a system would have to know how to use performance information of one kind, e.g., current trial performance, in order to decide how best to go about the task of using performance information to control behavior. To do this, it would have to know that alternative kinds of performance information could be used for the same purpose, and the conditions under which one should be preferred to another. Finally, and most importantly, to do these things it would have to know the difference between "performance" and "information about performance." But this is something that a control system cannot "know" because it is an element of meaning.

GENERAL DISCUSSION

Control Theory Revisited

Our aim in this paper has been to raise the question of how best to conceive and talk about supervision in the workplace. We have argued that

recent theoretical treatments in terms of control theory are unsatisfactory because they do not take into account the meanings that are given to work performance prior to giving feedback. Consistent with this argument, the results of two experiments suggest that supervisors do not respond to subordinate performance *per se,* but rather to the meanings that they give to performance in different settings.

On reflection we find that the trouble with this or any other application of control theory to human social behavior (see Campion & Lord, 1982; Carver & Scheier, 1981) is basic and cannot be remedied by expansion or amendment of the theory. The problem is that the concepts of control theory are the wrong kind. They are appropriate to describe machines, not human minds. We find that language of this kind is suitable for talking about physical systems, but unsuitable for talking about mental systems (see Searle, 1984, 1990; but also Hofstadter & Dennett, 1981).

To talk about something as a control system is to remark about its physical properties, i.e., movements of matter and energy. The inputs to such a system are physical movements such as electrical impulses in computing machines or combustible fuel in engines. The internal workings and outputs of a control system are transformations of these inputs, such as the display of symbols on a cathode ray tube, or the transportation of an automobile. In contrast, to talk about something as a mind is to remark about its mental properties, i.e., movements of ideas or meanings, not matter or energy. The inputs to a mind are ideas, and the outputs are transformations thereupon. Talk about minds is fundamentally different from talk about machines.

As Marken (1988) has pointed out, control theory presupposes that something is controlled, just as evolutionary theory presupposes that species have evolved. Yet, at the level of meanings, as opposed to physical quantities, this essential first-fact has never been demonstrated. Nor is it clear that it ever could be. For control to occur at this level there has to be discrepancies of meaning to be controlled. Yet, such discrepancies are hard to conceive. We understand a discrepancy to be a difference defined by a particular metric or dimension. A meaning, however, can vary on any number of dimensions, and thus there may be any number of ways to define a discrepancy, e.g., how does one measure a discrepancy of work ethic, or self esteem, or commitment? What is more, many meanings seem not to be reducible to definite dimensions or attributes at all.

Further, even where a meaning is defined explicitly, as it is in this and other empirical studies of control theory, the notion of its being "controlled" remains vague and problematical. Psychological theories of control, such as those proposed by Lord and Hanges (1987) and Carver and Scheier (1981), permit variability both in the meaning, i.e., performance,

and in the referent standard that establishes this meaning, i.e., the goal. Thus, it is theoretically possible for actual performance to fluctuate, even wildly, but for its meaning to remain "in control" as long as there are parallel fluctuations in the referent standard. The question arises of what performance control means when performance is subject to question and re-definition.

The fundamental differences between physical and mental systems, which are alluded to in this research, suggest that there is a basic problem of using control theory to describe human behavior. Human actions are *not* exclusively movements of matter or energy (although they obviously involve these things), but are also and more essentially movements of meaning. And because meanings matter in human action in ways that they do not in mechanical control systems, human action does not unfold the same way. By confusing talk about physical systems with talk about mental systems, applications of control theory to social behavior push the theory beyond its proper bounds as a description of physical systems.

This problem is difficult to spot because the distinction between mental and physical is often buried within complex and/or vague theoretical arguments. Typically, this distinction is represented as a hierarchy (see Powers, 1973b; Carver & Scheier, 1981). At the most elementary level, control consists of physiological events such as synapses and muscle twitches. At higher and more inclusive levels of analysis, control remains a physical event, but deals with behaviors and sequences of behavior that are more organized and coordinated. Finally, at the very highest and most inclusive level of analysis, control is transformed into a mental event that consists of meanings and relations. For example, in the control system proposed by Carver and Scheier (1981, pp. 127-136), control is organized hierarchically as seven levels, starting at the bottom with simple physical actions, e.g., the muscle mechanics involved in making a cup of coffee, and rising sequentially all the way up to complex mental events, e.g., deciding to be a gracious person in the company of others. In this way, the two ways of talking about systems, physical and mental, are encompassed within a single framework. This gives the impression that they are logically related, that the former is subordinate to the latter, and that it is no problem to translate between the two.

But this is misleading, because there is no telling *how* mental events can control physical events lower down the hierarchy. When we look more closely, we find that there is a definite discontinuity in the flow and logic of this hierarchy which occurs between level six and level seven, where concrete bodily activities, e.g., of making coffee, are subordinated to abstract rules and procedures, e.g., the idea to provide guests with refreshments. Up to this point, each ascending level in the hierarchy was formulated as

a structuring of parts into wholes. Simple concrete acts are encompassed with larger complexes or patterns. But at this point, the composition scheme breaks down and is abandoned. The actions at level six are not parts of the ideas at level seven, and there is no stating how they are related. At this point, we arrive at the decisive gulf between physical and mental which, since Descartes, no one has quite figured out how to traverse. And, at this point, we come to the problem that has exercised us in this paper, namely, that of describing mental events using the language of physical events.

In the end, we find ourselves in essential agreement with an argument against psychological applications of control theory that was raised some 40 years ago by Weber (1949). According to Weber, these applications, when taken to their logical conclusion, leave us with a concept of the person that is unrecognizable and hardly adequate to account for the richness and excitement of much human behavior:

> These views miss what, for want of a specific term, we might call the instinct for adventure. ... When an adult thinks, his sole motive is not to get rid of irritants which interrupted his favored state of mental coma (p. 236).

In light of all we have learned since Weber's time, e.g., from studies of sensory deprivation, it seems sure that people are not control systems, but just the opposite. Human life also has to do with seeking stimulation, with being creative and finding novelty, and indeed with creating homeostatic crises to keep things interesting. We think that a strong case can be made for the idea that human mentality is actually a defense against control systems, that mentality is our answer to life-threatening problems inherent in control systems that function too well and maintain too rigid a status quo. If there is anything to this argument at all, then we risk misunderstanding ourselves by supposing that our minds also answer to the hard logic of control.

Implications for Research

Although the tone of this paper is admittedly negative, its intent is constructive. Once we see why the language of control theory is not a good way to talk about social behavior in the workplace, we can begin to develop other ways of talking that may afford greater insight. This paper shows in particular that theories of supervision based on the metaphor of control theory are inadequate because they do not take into account the meanings that supervisors give to subordinate performance. Only by taking these meanings into account is it possible to make sense of the fact that supervisors respond to performance in different ways in different situations. We

need to learn more about how supervisors find meaning in subordinate performance. Particularly welcome would be more research on basic processes of performance categorization and evaluation (Feldman, 1981; Ilgen & Feldman, 1983) and attribution (Lord & Smith, 1983).

The two experiments reported in this paper point to a few factors that may generally affect how supervisors interpret and react to subordinate performance. In Studies 1 and 2, subordinate performance evoked different responses when it followed an inferior as opposed to a superior performance. In Study 2, subordinate performance evoked different responses depending on how it was patterned over time. When variable and without a discernible trend, supervisors gave feedback based both on the level of current performance and immediate past performance. However, when stable and with a discernible trend, supervisors gave feedback based only on whether or not there was a change in the overall trend of performance. Certainly, there are other factors besides these that affect how supervisors interpret and respond to subordinate performance, e.g., extenuating circumstances, social cues, job demands, and perceptions of subordinates (Larson, 1989). Future research should explore these as well.

Finally, returning to our two plumbers, Lee and Perry, and to the question raised at the outset, we conclude that the variability in Lee's behavior in giving feedback cannot be described adequately by control theory. Control theory proceeds from the misplaced assumption that the pattern of social behavior that occurs in supervision takes the same form as a physical control system. It does not. To understand Lee's behavior, we must consider what makes him human, namely, his possession of a mind and his concern for meaning. And this requires an altogether different theoretical vocabulary.

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