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A SEQUENTIAL LEARNING ANALYSIS OF DECISIONS IN ORGANIZATIONS TO ESCALATE INVESTMENTS DESPITE CONTINUING COSTS OR LOSSES

SONIA M. GOLTZ

UNIVERSITY OF NOTRE DAME

Reinforcement processes may underlie decisions frequently found in organizations to escalate investments of time, money, and other resources in strategies (e.g., product development, capital investment, plant expansion) that do not result in immediate reinforcers. Whereas cognitive biases have been proffered in previous explanations, the present analysis suggested that this persistence is a form of resistance to extinction arising from experiences with past investments that were variably reinforced. This explanation was examined in two experiments by varying the pattern of returns and losses subjects experienced for investment decisions prior to experiencing a series of losses. Consistent with the proposed explanation, two conditions resulted in higher levels of recommitment during continuous losses: (a) training using a variable schedule of partial reinforcement, and (b) no training on the task. Results indicate that behavior analysis can be used to understand and control situations in organizations that are prone to escalation, such as investments in the research and development of new product lines and extensions of further loans to customers.

DESCRIPTORS: behavior analysis, business problems, extinction, generalization, schedules of reinforcement

These headlines share a theme: "Knowing the Right Time to Bail Out of a Mutual Fund" (Clements, 1991); "Letting the Losses Run" (Wechsler, 1989); "Entrepreneur Remains Undeterred by Venture's Failure" (Gupta, 1989); "How Washington Got Stuck in the Mud of Nicaragua" (Weiner, 1988); and "RJR Nabisco Abandons 'Smokeless' Cigarette" (Waldman, 1989). As evident in the stories beneath these headlines, they refer to situations involving long-term investments that have failed or incurred costs. For example, "The failure is one of the biggest and most expensive new-product flops in decades. The cigarette, which had taken nearly a decade to research and develop . . ." (Waldman, 1989); "Seragen has become a financial black hole, swallowing up some $50 million in university funds and threatening to soak up $100 million more before the leukemia treatment begins to pay off, if indeed it ever does" (Wechsler, 1989); "After years of bloody conflict in America's own backyard, billions of dollars of U.S. military aid, and a near constitutional crisis in Washington, it's still a foreign policy morass" (Weiner, 1988).

Although the topic of recommitment by individuals in organizational settings to costly courses of action is not generally found in the field of behavior analysis, it has intrigued researchers in economics, social psychology, and organizational behavior, generating a substantial body of literature (see Brockner & Rubin, 1985, and Staw & Ross, 1987, for reviews). Three factors characterize the dilemma of interest: (a) an initial investment of resources in a course of action by the decision-maker that results in losses or costs; (b) some degree of continuity over time of the decision dilemma; and (c) unknown consequences for withdrawal from the situation and for persistence in the course of action

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Correspondence regarding this article should be addressed to Sonia Goltz, Department of Management, University of Notre Dame, Notre Dame, Indiana 46556.

(Staw & Ross, 1987). Most studies indicate that continued investing, rather than withdrawal, is the response that frequently occurs in this type of situation (Brockner & Rubin, 1985; Staw & Ross, 1987); thus, the behavior of concern has been defined as "a propensity to increase one's resource allocation following an initial setback" (Conlon & Wolf, 1980, p. 172). This behavior has been variously termed *escalation of commitment, entrapment,* and *sunk cost* (each term being used primarily in a particular academic area; e.g., *sunk cost* in economics and *entrapment* in social psychology). For purposes of the present investigation, the term that is used most often in the organizational psychology literature—*escalation of commitment*—will be used here.

Many proposed explanations of escalation have speculated that it results from cognitive biases. For example, the "self-justification" explanation asserts that people are trying to protect themselves from "psychological costs" associated with failure (Staw, 1976; Staw & Fox, 1977; Staw & Ross, 1978; Teger, 1980). The "reactance" explanation states that individuals are responding to failure as if it were a restriction in one's freedom to achieve desired outcomes (Staw & Ross, 1978); the "framing" explanation suggests that the decision situation triggers risk-seeking rather than risk-averse behavior (Arkes & Blumer, 1985; Northcraft & Neale, 1986). The most well-tested of these explanations, self-justification, has received mixed support (e.g., Davis & Bobko, 1986; Staw & Ross, 1978), and all three explanations can be criticized for treating escalation as a decision error using a retrospective analysis rather than viewing escalation as an adaptive response to very uncertain circumstances (Bowen, 1987).

One basis for viewing escalation as an adaptive response is the possibility that intermittent reinforcement underlies some escalation effects (Staw & Ross, 1978). Although this possibility has been acknowledged, an explanation based upon the individual's reinforcement history has not been developed or validated systematically (Staw & Ross, 1987). The present analysis of escalation incorporated the partial-reinforcement extinction effect and other concepts from the nonhuman and human learning literatures in an effort to examine whether escalation can be explained and predicted using operant principles.

A Learning-Based Analysis of a Typical New Investment Situation

Allocation responses made by individuals can be viewed as economic behaviors that, as Kagel and Winkler (1972) suggested, are analyzable using experimental and applied behavior-analytic methods. One behavior analysis of escalation in human allocation responses has been offered by Platt (1973), who posits the operation of immediate individual reinforcers (e.g., profits for military industrial complexes from selling arms) rather than long-term group reinforcers (e.g., lower national expenses and reduction in world terror because of disarmament) as being instrumental in influencing this type of recommitment behavior. However, as described below, several other principles found in the learning literature can be used to analyze allocation situations and behaviors.

In the typical new investment situation, and especially in the prototypical escalation experiment (e.g., Staw, 1976), individuals (or groups of individuals) have the opportunity to allocate money, time, or other resources in a course of action about which they have limited information and for which no appropriate behaviors have been developed or prescribed. For example, at the time the ideas for smokeless cigarettes and seragen were initially developed, it is likely that their market niches and potential costs and benefits were uncertain and speculative at best. Therefore, it would have been just as appropriate to choose not to pursue these ideas any further (e.g., not invest in market and development research) as it was to choose to pursue them. Subjects may, in this situation of limited available information, *generalize* responses learned in prior investment-related situations (Skinner, 1965). With regard to the aforementioned situations reported in the news, this analysis suggests that the responses being described were probably much the same as those developed previously to stimuli such as past "product ideas," past requests

for military aid, and past advertisements of mutual funds.

The question then arises as to what these learned responses are and how they were developed. Statements such as "only one in ten such drugs ever receives final FDA approval for commercial sale" (Wechsler, 1989), "where investment returns vary widely" (Clements, 1991), and "he once hit the jackpot as an entrepreneur" (Gupta, 1989) imply experiences of partial schedules of reinforcement for investments. It is possible that most individuals have experienced for most past investments a variable schedule of partial reinforcement (Ferster & Skinner, 1957) and that, because of this experience, nonreinforcement operates as a discriminative stimulus for forthcoming positive outcomes, as proposed in the sequential hypothesis of the partial-reinforcement extinction effect (Capaldi, 1966). As a result, continued investing in the face of nonreinforcement or failure could be a manifestation of the partial-reinforcement extinction effect (Amsel, 1967). Evidence that persistence resulting from a history of partial reinforcement generalizes to new situations (Eisenberger, Carlson, & Frank, 1979; Eisenberger, Heerdt, Hamdi, Zimet, & Bruckmeir, 1979) makes this analysis more credible.

Some subjects' behavior may be based on rule following rather than on direct generalization. Rule following arises from the shared class membership of stimuli in the novel setting and elements of the rule (Hayes, Thompson, & Hayes, 1989). The rule applied in these instances has been derived from an individual's actual history with investment-like situations, which was variable in its pattern of returns. Thus, the behavioral effect is similar to that expected with direct generalization (i.e., continued investing in the face of nonreinforcement). The advice "to just buy and hold a mutual fund" (Clements, 1991) is an example of a rule that may be founded upon a history of variable partial reinforcement for investing.

A behavior analysis for allocation situations, such as the one offered above, can generate testable predictions. One area in which predictions can be derived and tested concerns allocation responses during a period of continuous losses following training on a task using differing schedules of reinforcement. For example, one expects that a variable schedule of returns presented during training on an investment task will result in higher allocations during later continuous losses than a fixed schedule of returns presented during training (either in terms of continuous returns or a regular pattern of returns and losses). This prediction was the focus of investigation in the first experiment.

Another area of potential investigation based upon the present analysis concerns individuals' generalization of reinforcement histories or application of rules to investment situations associated with no clear history or prescribed rules. For example, if one assumes that individuals do not generalize any history of reinforcement to a novel investment situation, one might expect that subjects exposed immediately to a series of losses with no previous training on an investment task will persist only for a brief duration; in other words, they will behave more like subjects trained with a fixed or continuous schedule of reinforcement than like subjects trained with a variable schedule. On the other hand, assuming that responses arise from rules or behaviors learned in previous situations associated with a variable schedule of reinforcement (as proposed in the present analysis) suggests a different set of expectations. One would predict that subjects experiencing no training with a task will respond more similarly to subjects trained on a variable reinforcement schedule than to subjects who have experienced a fixed schedule of returns (continuous returns or a regular pattern of returns and losses). The second experiment, in addition to examining the replicability of results of the first experiment, examined this prediction.

EXPERIMENT 1

Method

Subjects

One hundred sixty-four students enrolled in an introductory psychology course at Purdue University chose to participate in this study for partial course credit.

Table 1
Monetary Feedback Per Trial During Acquisition for Experiment 1 (in Terms of Dollar Amount Gained or Lost for Every $100 Invested)

Trial	Continuous small	Partial fixed	Partial variable	Continuous large	Continuous short
1	+10	−10	−10	+30	+30
2	+10	+30	+30	+30	+30
3	+10	−10	+30	+30	+30
4	+10	+30	−10	+30	+30
5	+10	−10	−10	+30	+30
6	+10	+30	−10	+30	+30
7	+10	−10	+30	+30	+30
8	+10	+30	−10	+30	+30
9	+10	−10	+30	+30	−10
10	+10	+30	+30	+30	−10
11	+10	−10	−10	+30	−10
12	+10	+30	−10	+30	−10
13	+10	−10	+30	+30	−10
14	+10	+30	−10	+30	−10
15	+10	−10	+30	+30	−10
16	+10	+30	+30	+30	−10

Task

The task included the aforementioned factors that characterize a situation with potential for escalation (Staw & Ross, 1987). Each subject performed a dynamic investment decision task on a computer. To influence students to earn as much as possible with their responses, subjects were told they were being "entrusted" with a predetermined amount of "money" to "manage" ($10,000 per decision period) and would be asked to explain the handling of the money at the end of the experiment. Similar to tasks used in past investigations of escalation (e.g., Staw & Fox, 1977), the subject could allocate any portion of the money (from $0 to $10,000, in increments of $100) to a given alternative (in this case a "stock," which could result in gains or losses) and reserve any portion of it for another use (in this case a "money market fund" that did not earn or lose money).

After each trial, the subject received information from the computer concerning the dollar gain or loss per $100 invested in the stock (e.g., "Investment in the stock during this period resulted in a gain of $30 per $100 invested"). The particular dollar amount reported to the subject depended upon the condition to which he or she was assigned (see Table 1). The task took place during one 20-min experimental session and continued for 32 trials (16 acquisition trials and 16 extinction trials). After the last trial, the subject was informed of the total dollar amount he or she had gained or lost during the experiment. (Subjects were not told at the beginning of the experiment how many trials would occur or how long the session would last.)

Procedure

Each subject was assigned randomly to one of the five conditions defined below. Experimenters included the author and seven trained undergraduate students. After each subject read an instruction sheet that explained the task, the experimenter showed him or her a demonstration trial on the computer that required the subject to respond with an investment amount. During the demonstration, the experimenter reiterated that investments in the stock could result in losses or gains, and that allocations made to the money market fund would not result in any gains or losses. The experimenter then answered any remaining questions and left the room.

After performing the task, each subject completed a questionnaire that posed general questions concerning thoughts and strategies during the experiment and assessed speculations as to the experimental hypotheses. Finally, the subject was debriefed and thanked.

Dependent Measure

The dollar amounts subjects chose as additional allocations to the stock alternative were examined for escalation during the period of continuous losses, in which all subjects received a loss of $10 per $100 invested in the stock regardless of condition. Dollar amount invested during this phase, which could range from $0 to $10,000 per trial, served as the dependent variable.

Design

A repeated measures analysis of variance (ANOVA) was applied, in which the independent variable was the reinforcement schedule presented during acquisition and the dependent variable was the amount invested during extinction. The following

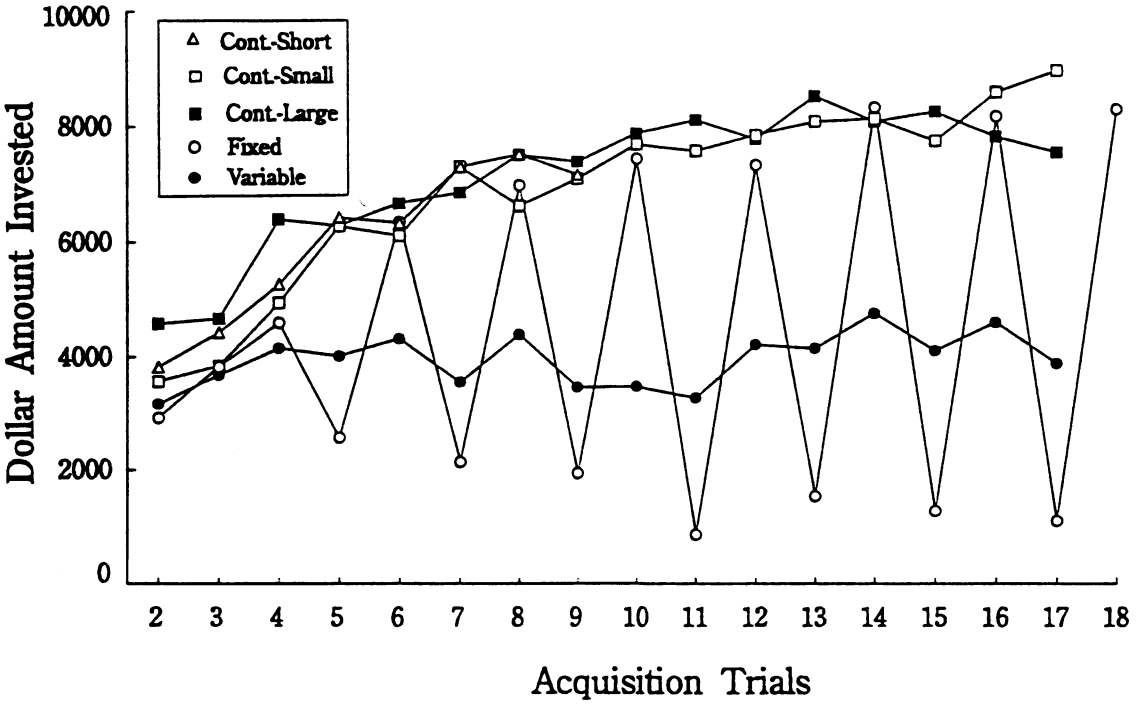

Figure 1. Average amounts invested during acquisition in Experiment 1. Fixed: partial returns–fixed schedule; variable: partial returns–variable schedule; Cont.-Large: continuous returns–large magnitude; Cont.-Small: continuous returns–small magnitude; Cont.-Short: continuous returns–short training.

five reinforcement schedules were used: (a) continuous returns–small magnitude; (b) partial returns–fixed schedule; (c) partial returns–variable schedule; (d) continuous returns–large magnitude; and (e) continuous returns–short training. This design resulted in a 5 (Groups) by 12 (Trials) ANOVA. The monetary feedback per trial for each condition during acquisition is displayed in Table 1.

The partial returns–fixed schedule (n = 33), the partial returns–variable schedule (n = 32), and the continuous returns–large magnitude (n = 32) conditions were established to examine directly the expectation that a variable schedule of returns presented during training would result in higher allocations during a later period of continuous losses than either a fixed partial schedule or a continuous schedule. The remaining conditions controlled for plausible alternative explanations such as magnitude, duration, and return rate. For example, both partial groups had the same rate (50%) and amount ($2,400) of return as the continuous return–short training group. In addition, variables that previously have been found to affect escalation were kept constant. (For instance, all subjects were informed that outcomes were contingent on amounts invested and that they would be asked to explain their handling of the money at the end of the experiment. Also, the framing of the decision situation was the same for all conditions in that all subjects were presented with identical instructions both orally and on the computer.)

Results

Manipulation Check

To determine whether the contingencies differentially affected investing during training on the task, the dollar amounts invested during Trials 2 through 17 (i.e., acquisition) were examined. A repeated measures ANOVA indicated the existence of a significant main effect of condition, $F(3, 129) = 25.7$, $p < .001$. A significant interaction effect of trial by condition was also found, $F(45, 1935) = 13.6$, $p < .001$. A visual examination of the data (see Figure 1) revealed that subjects responded in patterns characteristic of schedule-controlled behavior. Variably reinforced subjects invested con-

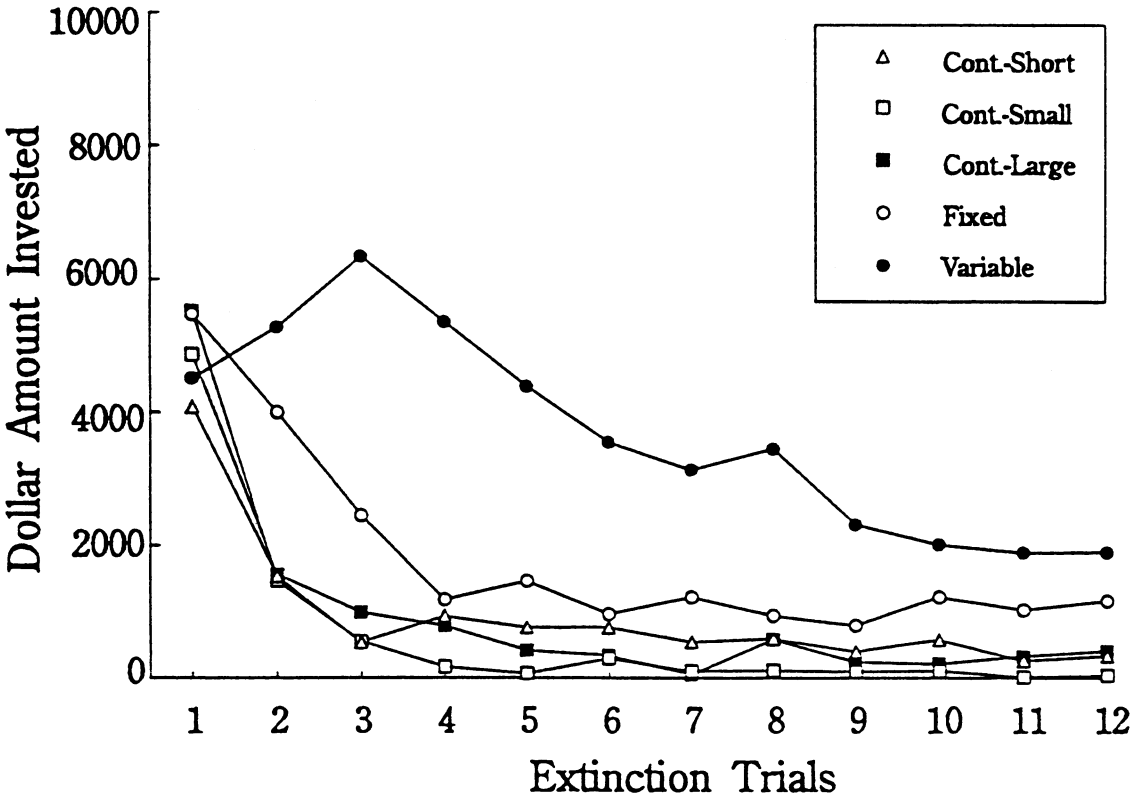

Figure 2. Average amounts invested during extinction in Experiment 1. Abbreviations as in Figure 1.

servatively at a steady rate throughout acquisition; continuously reinforced subjects increased their investments substantially during acquisition; and subjects receiving a fixed schedule of returns exhibited alternating patterns of large and small investments.

Recommitment over Time

To be consistent with the perspective that escalation is a dilemma that occurs over time (Staw & Ross, 1987), the first 12 trials after the change in contingencies (i.e., from acquisition to extinction) were analyzed. (Analyses were limited to 12 trials to enable the use of paired comparisons, as explained later.)

For the continuous returns–small magnitude, partial returns–variable schedule, and continuous returns–large magnitude conditions, contingencies shifted with a loss following subjects' responses on the 17th trial of the experiment. Therefore, responses beginning with Trial 18 and continuing through Trial 29 were analyzed for escalation. Similarly, because subjects in the partial returns–fixed schedule condition were introduced to the change in contingencies following the loss on Trial 18, Trials 19 through 30 were examined for escalation effects. Because subjects in the continuous returns–short training condition encountered the initial loss after their responses on Trial 9, their performances on Trials 10 through 21 were assessed.

An examination of Figure 2 suggests that mean dollar amounts invested during the first 12 trials of extinction decreased almost immediately and quite substantially for all conditions except the partial returns–variable schedule condition, in which the means decreased at a much slower rate. A repeated measures ANOVA confirmed the existence of an Extinction Trial by Condition interaction, $F(44, 1738) = 4.5, p < .001$. Because of this interaction, post hoc paired comparisons were conducted on the

data using four blocked sets of three trials each in order to identify behavior patterns. (Trials occurring at the end of the experiment that did not form a set of three for a blocked trial were omitted so that equivalent numbers of equally blocked trials could be used for each condition i.e., three trials in the first three conditions mentioned above, two trials in the fourth, and 11 trials in the fifth.) These comparisons indicated that the amount invested by subjects in the partial returns–variable schedule condition was significantly higher than each of the other conditions during all blocked periods except for the first and fourth periods, during which it was not significantly higher than the partial returns–fixed schedule condition. Paired comparisons also revealed that the partial returns–fixed schedule condition differed significantly on amount invested from the continuous returns–short training condition during the first blocked period ($p < .05$ for all significant comparisons). No other pairwise differences were significant.

In 11 of the 12 trials, the partial returns–variable schedule condition was found to contain the largest percentage of subjects investing some money in the stock alternative (i.e., \$100 or more). This was significant according to a Friedman two-way analysis of variance by ranks, $\chi^2(4) = 31.3, p < .001$. (Descriptive statistics for subjects who invested in each of the extinction trials can be obtained from the author.)

Immediate Recommitment

Despite the suggestion that escalation is a dilemma that occurs over time (Staw & Ross, 1987), much of past empirical research on escalation has discussed escalation primarily by focusing on responses occurring immediately prior to and immediately subsequent to one failure experience. Consequently, a repeated measures ANOVA was also conducted on responses immediately preceding the first trial of extinction and responses immediately following the first trial of extinction in order to assess escalation. Thus, this analysis included data from the first trial of the 12 extinction trials examined in preceding analyses as well as responses generated on the trial immediately prior to the

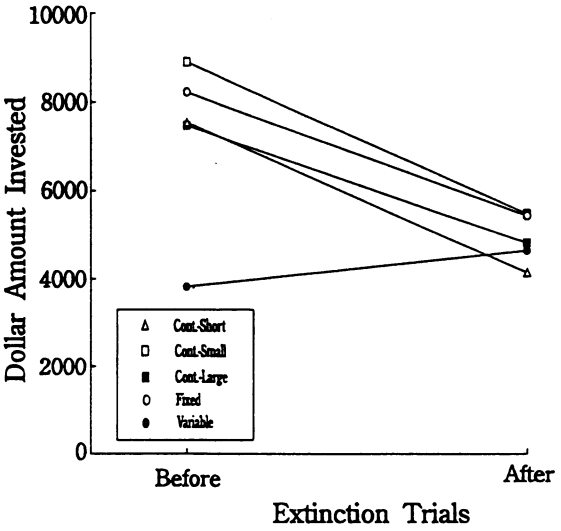

Figure 3. Average amounts invested before and after the change in contingencies in Experiment 1. Abbreviations as in Figure 1.

change in contingencies. Specifically, Trials 18 and 19 were analyzed for the partial returns–fixed schedule condition, Trials 9 and 10 were analyzed for the continuous returns–short training condition, and Trials 17 and 18 were analyzed for each of the remaining three conditions.

As seen in Figure 3, the partial returns–variable schedule group was the only group that escalated, rather than decreased, investments over the course of these two trials. Results of a repeated measures ANOVA confirmed a significant Trial by Condition interaction, $F(4, 159) = 7.2, p < .001$. Because of this interaction, post hoc paired comparisons were performed to examine certain behavior patterns. Significant differences in amount invested occurred between the partial returns–variable schedule condition and each of the other conditions during the trial before the initiation of extinction but not during the trial after the initiation of extinction ($p < .05$ for all significant comparisons). Also, a paired comparison of responses before and after the initial extinction trial within the partial returns–variable schedule condition revealed that the increase in means was nonsignificant.

Allocations made on these two trials were also examined in terms of between-group differences in percentages of subjects increasing allocations, de-

creasing allocations, and investing the same amount. A larger percentage of subjects in the partial returns–variable schedule condition increased their investments (37.5%), compared with 9.1% for the fixed schedule, 9.9% for the continuous returns–large magnitude condition, 13.9% for the continuous returns–small magnitude condition, and 12.9% for the continuous returns–short training condition. The relative numbers of individuals increasing investments, decreasing investments, and making equal investments across these trials were found to be significantly different across conditions in a chi-square test of independence, $\chi^2(8) = 26.4$, $p < .001$. The moderate average change by subjects who increased investments in the partial returns–variable schedule condition (M = \$3,577, n = 13), along with the high individual variability in amounts of increase (SD = \$3,545), may explain why the amount invested did not increase significantly overall, although the percentage of subjects increasing investments was greater in this group than in other groups.

EXPERIMENT 2

Method

Subjects

Participants in this study were 102 students enrolled in a principles of management class at the University of Notre Dame who chose to complete the experimental task for extra credit.

Design

The task, procedures, and dependent measures were the same as in Experiment 1, except the following four reinforcement schedules were used (a) partial returns–fixed schedule (n = 25), (b) partial returns–variable schedule (n = 25), (c) continuous returns–large magnitude (n = 28), and (d) no training (n = 24). The first three conditions were identical to conditions in Experiment 1. In the no-training condition, subjects were not provided with a history of either continuous or partial returns for this task. Instead, on each trial throughout the experiment, these subjects received a loss of \$10 per \$100 invested (i.e., extinction began immediately). All four conditions were included to test the prediction that subjects who have not been trained on a task before experiencing a series of losses will, like subjects who have been trained on the task using a variable schedule of partial reinforcement, allocate more during extinction than subjects who have experienced a fixed schedule of returns (continuous returns or a fixed schedule of partial returns).

Results

Manipulation Check

To determine whether the contingencies differentially affected investing during acquisition, the dollar amounts invested during Trials 2 through 17 were examined as in Experiment 1. Results were similar to those in Experiment 1, in that subjects responded in patterns characteristic of schedule-induced behavior. A repeated measures ANOVA indicated a significant main effect of Condition, $F(2, 75) = 34.4$, $p < .001$. A significant interaction of Trial by Condition was also found, $F(30, 1125) = 8.7$, $p < .001$.

Recommitment over Time

As in the first experiment, the first 12 trials after the change in contingencies (i.e., from acquisition to extinction) were analyzed. The specific trials used were the same as in Experiment 1 for the three conditions found in both experiments. For the no-training condition, Trials 2 through 13 were used in the analysis because the first experience of the series of losses occurred during the first trial.

Mean responses by condition for these 12 trials are presented in Figure 4. A repeated measures ANOVA indicated the existence of an Extinction Trial by Condition interaction, $F(33, 1078) = 3.2$, $p < .001$. Because of this interaction, post hoc paired comparisons were conducted on the data using four blocked sets of three trials each to explore behavior patterns. These comparisons indicated that the amount invested in the partial returns–variable schedule condition was significantly higher than in the no-training condition during the first blocked period and was significantly higher than in the

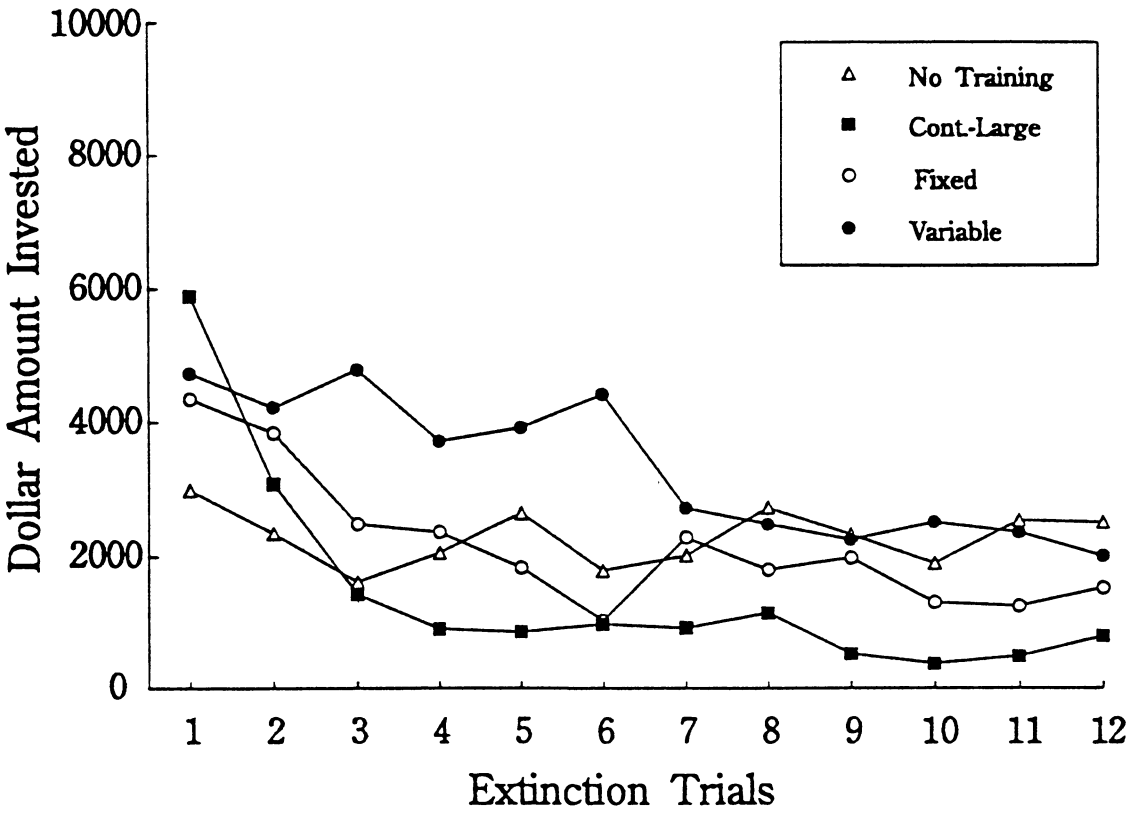

Figure 4. Average amounts invested during extinction in Experiment 2. Abbreviations as in Figure 1.

partial returns–fixed schedule and continuous returns conditions during the second and fourth blocked trials ($p < .05$ for all significant comparisons). No other pairwise differences were significant.

When the percentage of subjects actually investing \$100 or more was calculated for each condition in these 12 trials, the partial returns–variable schedule and no-training conditions contained similar percentages. When compared with the continuous returns and partial returns–fixed schedule conditions, the no-training condition had more subjects investing in 10 of the 12 extinction trials. A Friedman two-way ANOVA by ranks showed this to be significant, $\chi^2(2) = 18.5, p < .001$. The partial returns–variable schedule condition had more subjects investing than did the continuous returns and partial returns–fixed schedule conditions for all 12 trials; this was significant in the Friedman test, $\chi^2(2) = 21.2, p < .001$. (Descriptive statistics for subjects who invested in each of the extinction trials are available from the author.)

Immediate Recommitment

As in Experiment 1, a repeated measures ANOVA was conducted on responses immediately preceding the first trial of extinction and responses immediately following the first trial of extinction. The trials used in this analysis were the same as those used in Experiment 1 for the conditions found in both experiments. Trials 1 and 2 were used in the analysis for the no-training condition.

As can be seen in Figure 5, the average investment decreased substantially from the first trial of extinction to the second trial of extinction for the continuous returns and partial returns–fixed schedule conditions but not for the no-training and partial returns–variable schedule conditions. A significant Extinction Trial by Condition interaction was found in a repeated measures ANOVA, $F(3, 98)$

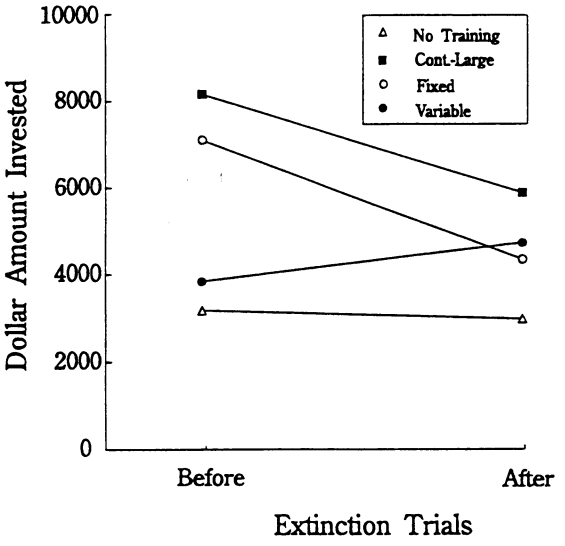

Figure 5. Average amounts invested before and after the change in contingencies in Experiment 2. Abbreviations as in Figure 1.

= 6.7, $p < .001$. Post hoc paired comparisons performed on each of these trials to identify behavior patterns indicated significant differences in investment amount between the partial returns–variable schedule condition and the continuous returns and partial returns–fixed schedule conditions as well as between the no-training condition and the continuous returns and partial returns–fixed schedule conditions on the trial before the initiation of extinction ($p < .05$ for all significant comparisons). Also, paired comparisons of responses before and after the initial extinction trial revealed that the increase in investment amount within the partial returns–variable schedule condition was nonsignificant, as was the decrease within the no-training condition.

As in the previous experiment, allocations were also examined by studying between-group differences in percentages of subjects increasing investments, decreasing investments, and investing the same amounts across these two trials. Larger percentages of subjects in the partial returns–variable schedule condition and the no-training condition increased their investments (44% and 33.33%, respectively), compared with 16% in the partial returns–fixed schedule condition and 7.14% in the continuous returns–large magnitude condition. The relative numbers of individuals escalating, decreasing, and staying constant were found to be significantly different across conditions in a chi-square test of independence, $\chi^2(6) = 13.59$, $p < .05$. The moderate average change by subjects in the partial returns–variable schedule condition who increased investments (M = \$3,064, n = 11), along with the high variability in individual amounts of increase (SD = \$2,768) in this group, may explain why the amount invested did not increase significantly overall, although the percentage that increased allocations was greater in this group than in other groups. The small average change by subjects who increased investments in the no-training condition (M = \$875, n = 9, SD = \$540) compared with the higher average change by subjects in this group who decreased investments (M = \$980, n = 10, SD = \$578) may explain why the amount invested did not increase significantly overall, although the percentage who escalated was substantially greater in this group than in the partial returns–fixed schedule condition and the continuous returns–large magnitude condition.

DISCUSSION

The present investigation contributes to the literature on escalation of commitment by demonstrating the utility of a learning-based analysis, a perspective in which escalation is viewed as an adaptive response rather than as a dysfunctional behavior. The present analysis suggests that recommitment responses in the face of failure are based on the larger context of a series of investment-like experiences rather than on the outcome of any one investment experience. It may be that these responses arise from a number of learning effects, including sequential learning and the partial-reinforcement extinction effect. Varying the patterns of outcomes received during training on the task in two separate experiments supported this explanation. Experiences with a variable schedule of returns resulted in a greater degree of recommitment during continuous losses than experiences with continuous or fixed returns. Furthermore, the lack of significant

differences in responding among the continuously reinforced subjects in Experiment 1 (i.e., small magnitude, large magnitude, and short training) suggests that return rate, magnitude, and length of reinforcement history are factors that are not as significant in producing escalation as is the sequential nature of the reinforcement history.

The present analysis also suggests that, given no direct experience with an investment situation, individuals generalize responses or rules learned during previous similar situations. Assuming that most allocation situations are associated with a variable schedule of reinforcement, one would expect to see persistence during a series of losses for investing. Results of the second experiment lend some support to this explanation. Subjects not trained on the task before experiencing continuous losses responded to extinction more like those who had been trained with a variable schedule of returns than like those who had been trained with either continuous returns or with a fixed schedule of returns.

Although subjects receiving no training with the investment task invested persistently, these subjects did not respond as similarly to subjects in the partial returns–variable schedule condition as was expected. One possible explanation is that the no-training subjects might have been generalizing a pattern that had a smaller rate of return than did subjects in the partial returns–variable schedule condition, who had experienced a one-to-one ratio of returns to losses for investment in the stock. Another explanation is that subjects' behavior is governed by a rule that generates responses different from those expected from direct generalization. Future investigations might explore (a) what rates of returns are encountered in different decision-making situations (e.g., investing in research and development, buying stocks, etc.), (b) how and when these rates are converted to rules, and (c) how direct generalization and rule following differentially affect investment decisions.

Results of the present investigation also indicated that escalation occurs over time. Many past escalation investigations have reported between-group differences on a second allocation decision only and have not examined the significance of within-group changes (e.g., Staw, 1976; Staw & Ross, 1978). However, the present investigation found more evidence of differences in recommitment behaviors between groups when allocations made both immediately before and immediately after the first experience of a series of losses were compared than when only allocations occurring after the initial experience of extinction were examined. The difference in results might be attributable to a difference in methods. Previous studies on escalation (which usually consist of only two trials) have artificially imposed the amount invested on the initial trial (e.g., $10 million in Staw, 1976; $48 million in Staw & Ross, 1978) for subjects in *all* conditions, only allowing them to choose in which of two alternatives to invest the money. Only during the second trial are subjects given a dollar range from which to choose (e.g., from $0 to $20 million in Staw, 1976; from $0 to $70 million in Staw & Ross, 1978).

The question of the meaningfulness of previous findings of escalation is raised by results in the present investigation. Unlike previous studies, subjects in the present experiments were free to invest any amount within the same range on every trial. Under these conditions, a between-trial examination of the condition that escalated (partial returns–variable schedule) revealed a nonsignificant increase. However, interesting differences in *patterns* of investing did appear. A significantly larger percentage of subjects escalated in this condition than in other conditions, and the small increase across trials in the variable condition became meaningful in light of the large decreases in each of the continuous conditions and in the fixed condition.

These results also contained interesting differences in individual responding. For example, in Experiment 1, subjects in the partial returns–variable schedule condition were almost evenly divided among responses of increasing, decreasing, and staying constant. In addition, in both investigations, several individuals in the continuous reinforcement conditions escalated. Some individual differences in persistence may be developed through differing schedules of reinforcement experienced in childhood (Amsel, 1979). Another possibility is that

with longer or more variable training schedules, individual differences during extinction will decrease. This latter explanation is especially likely if individuals are acting according to sets of rules they bring to the experimental situation, given that results of some investigations indicate that rule control may override schedule effects even when the latter are strong (Baron, Kaufman, & Stauber, 1969; Harzem, Lowe, & Bagshaw, 1978).

The proposed analysis should be viewed as an elementary model that can be expanded. First, the role of other factors found to affect escalation, such as competition and framing (e.g., Northcraft & Neale, 1986; Teger, 1980), should be addressed before concluding that behavior analysis can provide a complete picture of resource allocation responses. In addition, there are a number of areas of behavioral research not considered in the present analysis that may be useful in understanding recommitment responses. For example, an expanded model might consider the behavior analysis of framing effects (e.g., Rachlin, Castrogiovanni, & Cross, 1987; Rachlin, Logue, Gibbon, & Frankel, 1986), in which discounting of delayed rewards is thought to account for some escalation responses, and the similar explanation that short-term individual consequences rather than long-term group consequences control responses in escalation situations (Platt, 1973). An expanded model could also investigate the possibility that responsibility effects thought to arise from self-justification (Staw, 1976) might result from providing outcomes highly contingent on behavior versus outcomes not contingent on behavior. Another area of possible expansion involves the investigation of discrimination and generalization gradients with regard to investment stimuli. For example, in a new investment situation, some past investment-type stimuli and not others may be found to be similar enough that responses developed to them will be generalized.

Although the current analyses advance our understanding of these phenomena, they do not examine directly whether behavior analysis can be effective in tempering escalation in actual situations when it is undesirable and increasing escalation when it is desirable. To sustain the dual efforts in applied behavior analysis of both investigation and improvement, as suggested by Dietz (1978), this issue should be addressed by future research. The present results suggest that employees (e.g., bank loan officers) could be trained with continuous reinforcement contingencies to decrease recommitment in decision-making dilemmas such as answering requests for the extension of credits to clients delinquent on past loans. For decision-making positions in which payoffs for investments are usually delayed and in which escalation is desirable (e.g., a director of research and development), decision-makers could be trained using variable reinforcement. These implications contrast with strategies previously offered in the escalation literature (e.g., Staw & Ross, 1987), such as reducing organizational penalties for failure (i.e., decreasing the magnitude of aversive consequences for failure) and reducing the ambiguity of negative feedback (i.e., increasing the discriminability of these stimuli). In future research, behavior analysis could be used to compare directly the effectiveness of these various strategies.

The present analysis offers most of the aspects of an applied behavior analysis (i.e., applied, behavioral, analytic, technological, conceptual, effective: Baer, Wolf, & Risley, 1968, 1988) but does not explore conditions controlling the generalization of effects, thus leaving doubts as to the external validity of the findings. A current analysis of the generalizability of laboratory findings in the field of organizational behavior suggests that experiments are important in identifying essential features of behavioral phenomena (Locke, 1986). The present investigation has identified some essential features that may control escalation. It remains for future investigations to examine whether these features are essential enough to control allocation behaviors in the field (e.g., with "real" money, lengthened investment periods, and actual investors) and when the allocation behavior differs from an investment of money.

Consideration of type of allocation behavior offers a number of interesting avenues for the application of behavior analysis. The escalation literature typically refers to product development and

other financial investments, such as Lockheed's costly Tri-Star Jet program, British Columbia's $300 million loss in Expo '86, and the nonperforming loans to Latin America of large banks (Staw & Ross, 1987). However, there are a number of situations in which the allocation response does not involve an investment of money. For example, supervisors evaluate more highly the performance of employees they originally hired than employees hired by others (Bazerman, Beekum, & Schoorman, 1982). Other escalation situations that do not necessarily involve money include waiting after being placed on hold for a telephone call and continuing to work in a nonrewarding job (Staw & Ross, 1987). These and other situations in organizations prone to escalation represent a setting that could benefit from the understanding attained and performance improvements made possible by the application of behavior analysis.

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