ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES
Vol. 62, No. 1, April, pp. 38–54, 1995

Escalation and *De*-escalation of Commitment in Response to Sunk Costs: The Role of Budgeting in Mental Accounting

CHIP HEATH

Center for Decision Research, University of Chicago

Research has traditionally assumed that people increase investment (or "escalate commitment") in response to previous investments (sunk costs). This paper presents several demonstrations which show that people will incorrectly *de-escalate* investment in response to sunk costs. I propose that people set mental budgets to control their resource expenditures: they set a budget for a class of expenses and track their investments against their budget. A lab study with real monetary incentives shows support for de-escalation and supports a specific rule for how people set budgets—based on the breakeven of total costs and total benefits. The budgeting process suggests that people are only likely to escalate commitment when they fail to set a budget or when expenses are difficult to track. The later part of the paper organizes the previous literature on escalation around these processes and provides additional experiments to illustrate each point. For example, I argue that previous demonstrations that have shown errors of escalation exclusively involve "incidental" investments that are difficult to track. A study in the current paper shows that people are more willing to invest time than money to salvage a monetary sunk cost and more willing to invest money than time to salvage a sunk cost of time, even when the time and money investments are of equal value. The paper concludes by discussing the rationality of escalation and de-escalation. © 1995 Academic Press, Inc.

Research on individual decision making has concluded that people tend to escalate commitment in response to previous investments. Theorists have assumed that people will respond to previous investments by becoming increasingly willing to invest *additional* resources (Arkes & Blumer, 1985; Brockner & Rubin, 1985; Staw, 1976; Staw & Ross, 1989; Thaler, 1980; Whyte, 1986; Garland, 1990).

There is some compelling evidence for this assumption. One study, for example, demonstrated that people who paid full price for season theater tickets attend more performances during the season than people who were randomly awarded reduced-price tickets (Arkes & Blumer, 1985). This behavior contradicts one of the most basic principles of economics: the idea that decisions should be made "on the margin" (see e.g., Frank, 1991). Marginal decision making tells us that to make a good decision we should weigh future costs and future benefits and choose the action where benefits most outweigh costs. Past costs and benefits are irrelevant to the current decision—they are "sunk." To make the marginal decision about whether to attend a particular theater performance, a ticket-holder should weigh the enjoyment of the play (the marginal benefit) against the aggravation of getting dressed up, traveling to the theater, and spending a few hours that could be spent on other things (the marginal costs). Since the amount paid for the ticket (a sunk cost) should not affect the decision, marginal decision makers ought to attend the same number of performances whether they paid full price or reduced price.

In response to evidence such as the theater ticket study, researchers have proposed a variety of psychological mechanisms to explain why people *escalate commitment* in response to previous investments. For example, researchers have proposed that people escalate commitment: because they want to justify a previous investment that appears to have been in error (Brockner & Rubin, 1985; Staw, 1976; Staw & Ross, 1989; Brockner, 1992), because they do not want to "waste" their previous investments (Arkes & Blumer, 1985), because they become risk-seeking in the domain of losses (Thaler, 1980; Whyte, 1986; Garland, 1990), and because they see a given incremental investment as psychophysically "smaller" when it occurs in the context of larger absolute investments (Garland, 1990; Garland & Newport, 1991). In addition, researchers have attempted to determine which of a large number of procedures are most effective at limiting escalating commitment (Brockner & Rubin, 1985; Simonson & Staw, 1992).

Thanks to Hal Arkes, Joel Brockner, Brian Gibbs, John Gourville, Josh Klayman, Itamar Simonson, Jack Soll, Barry Staw, Dick Thaler, and Amos Tversky for comments on earlier drafts. Address reprint requests to Chip Heath, Center for Decision Research, University of Chicago, 1101 East 58th Street, Chicago, IL 60637.

0749-5978/95 $6.00

Recently some researchers have argued that escalation is not a robust phenomenon. McCain (1986) has argued that escalation occurs only in the very early stages of a project when people are still trying to interpret the feedback provided by early failures. He points out that in Staw's paradigm even though people tend to escalate immediately after bad news, this tendency seems to reverse over time (e.g., Staw & Fox, 1977). McCain replicates this scenario over multiple rounds and shows that people actually tend to de-escalate later in a sequence of investment. Another study by Garland, Sandefur, and Rogers (1990) had professional oil field geologists respond to a survey about escalation and found that they were less likely to invest as sunk costs mounted. These studies provide compelling evidence that escalation may not be a universal phenomenon. However, because these studies (like many demonstrations of escalation such as Staw, 1976; Staw & Fox, 1977) do not specify the costs and benefits of additional investments, it is not clear whether these results are the result of a rational learning process or some other process: are people reacting properly to sunk costs or are they reacting improperly?

The current paper goes one step further than McCain (1986) and Garland *et al.* (1990) by demonstrating that in many situations, sunk costs lead people to *incorrectly* de-escalate commitment to a course of action. Neglecting examples of de-escalation is costly on a theoretical level because it may cause us to misunderstand the way that people make decisions about their investments, and costly on a practical level because it may cause us to give the wrong advice to decision makers—advice on how to limit escalation is only appropriate when escalation should be limited.

I will first present an example of improper de-escalation in Study 1 and will review additional examples that can be found in previous literature on escalation and entrapment. Then I will present a model that predicts when de-escalation will occur and why. I argue that people set budgets for their investments, and they track their ongoing investments against their budget. When total investments exceed the budget, people resist further investments. Study 2 tests the budgeting model in a domain with incentives and direct feedback, and again provides evidence of improper de-escalation. In the second part of the paper, I use the budgeting model to predict when people will escalate and de-escalate commitment. I argue that people will de-escalate commitment when budgets are easy to set and investments are easy to track. In that section, I review previous literature and provide some new demonstrations to show that escalation may occur when either process fails. Finally, I discuss what the examples of de-escalation and the budgeting model can add to a debate on the rationality of escalation.

STUDY 1: AN EXAMPLE OF DE-ESCALATION ERRORS

I present the following brief study to demonstrate errors of de-escalation in response to sunk costs. The study will set the stage for the model of budgeting that I will present in the next section.

The problems in Study 1 ask subjects whether they would like to make an additional investment to complete a project with known future benefits. In all cases, people should make the investment—it produces a high marginal return. Subjects receive information about future costs (Future Investment) and future benefits (Sales Forecast) that is necessary to make a marginal decision, but also receive irrelevant information about sunk costs (Previous Investments). Different groups of subjects will decide whether to invest in a particular project when sunk costs are high and low. Theories of escalation would predict that people will be more wiling to invest when sunk costs are high. However, I argue that people set mental budgets for their investments, and that high sunk costs may cause people to exceed their budget and become unwilling to invest—even though the situations favor continued investment.

Materials and Design

The instructions below served to introduce the investment decisions listed in Table 1.

> The following data is from a commercial real estate project that was undertaken by your company on your advice. You have already invested the amount listed in the "Previous Costs" column. You must now decide whether to complete the project by investing the amount of money listed in the "Future Investments" column. Assume that this amount of money will allow you to complete the project with certainty. If the project is not completed your company will receive nothing. The "Sales Forecast" column lists the value of the project when it is completed. Sometimes this value is known for sure. Sometimes the value depends on factors that are unknown right now, and this column lists the probabilities of various outcomes. If you choose not to invest in the real estate project, money can always be invested in other areas, yielding about 15% a year. (Costs listed are in millions of dollars.)

Two versions of each project were created, one with high sunk costs ("A" version) and one with low sunk costs ("B" version). Actual questionnaires were composed of a mix of high and low sunk cost problems. Subjects saw one version of each of the six problems. Questionnaires were administered in a between-subjects design to 214 undergraduates at Stanford University.

The marginal decision is identical for A and B problems since each requires the same future investment and has the same sales forecast. The only difference

TABLE 1
Study 1: Stimuli and Results

	Previous costs	Future investment	Sales forecast	Refusing to invest (%)
1. A	$6.58	$1.55	$6.66	58%
B	None	$1.55	$6.66	0%
2. A	$9.07	$2.57	$9.16	36%
B	$6.33	$2.57	$9.16	14%
3. A	$8.70	$2.16	$9.45	34%
B	$1.50	$2.16	$9.45	2%
4. A	$9.72	$1.97	$10.09	42%
B	None	$1.97	$10.09	1%
5. A	$9.72	$1.97	20% chance of $12.10 30% chance of $10.00 50% chance of $9.34	48%
B	None	$1.97	20% chance of $12.10 30% chance of $10.00 50% chance of $9.34	2%
6. A	$9.72	$1.97	30% chance of $15.20 50% chance of $10.17 20% chance of $2.23	26%
B	None	$1.97	30% chance of $15.20 50% chance of $10.17 20% chance of $2.23	2%

Note. Previous costs plus future investments exceeds the expected forecast. Problems 4, 5, and 6 each provide the same expected forecast, but the variance of the forecast increases across the three problems. The sample size for "A" problems is 89 and for "B" problems it is 125. All differences are significant at $p < .001$ by χ^2 test.

between the two problems is the sunk cost, which should be irrelevant for the marginal decision. People should make the additional investment: according to the problem, alternative investments make 15% a year while investments that complete a project make from 356 to 512%. However, note that in problems with the high sunk cost, that the additional investment will cause total costs to exceed the total benefits available from the sale of the property. If people set mental budgets, they are likely to set their budget to prevent total investment from exceeding the value of the project. Therefore, mental budgeting may cause people to refuse the final investment to finish the projects.

Results

As can be seen in the last column of Table 1, more subjects refuse to invest in the problem that has larger sunk costs. Thus, these problems all demonstrate *de-escalating commitment* in response to sunk costs. Note that the effect occurs for both certain future payoffs (Problems 1–4) and uncertain (Problems 5–6). It also occurs for a large fraction of individual subjects. Even though virtually everyone invests when sunk costs are not present, 64% of the subjects choose not to invest in at least one of the problems containing large sunk costs, and 40% choose not to invest in three or more problems.[1]

Previous theories would predict that subjects would increase commitment in these problems. The problems involve sunk investments that should produce risk seeking (Thaler, 1980; Whyte, 1986; Garland, 1990) and that should invoke concerns about waste if the project is abandoned (Arkes & Blumer, 1985). The problems involve decisions that were made based on the subject's "advice," and high personal responsibility generally reinforces escalating commitment (Staw, 1976; Staw & Fox, 1977). The problems also involve situations where people are proportionately closer to their goal in the high sunk cost condition, and some theories argue that people are more likely to invest in projects when they have invested a large proportion of their budget (Garland, 1990; Garland & Newport, 1991). These problems support arguments that escalating commitment is not a universal reaction to sunk costs, and provide an explicit demonstration that *errors* of de-escalation are possible.

Evidence of De-escalation Errors from Previous Literature

Previous work has also documented errors of de-escalation; however, because previous research focused on escalation of commitment, the evidence of de-escalation was overlooked. Consider, for example, waiting time games like Brockner and Rubin's "Counter Game" (Brockner & Rubin, 1985), where subjects are told that a jackpot has been randomly assigned to a number on a numerical counter. Subjects could wait to hit the jackpot number, but each digit clicked off by the counter deducted money from an initial monetary stake they had received. In the experiment, no jackpot was assigned to the counter and, if subjects did not quit, the counter ran until their initial stakes were exhausted. Many subjects continued to invest until their available funds were depleted, and Brockner and Rubin counted this as evidence of "entrapment" (i.e., incorrect escalation of investment).

However, in this experiment a rational marginal decision maker should persist because the marginal benefit of an additional investment increases over time. In fact, since many people quit investing despite the rising marginal benefits of investment, these experiments actually provide evidence of errors of de-escalating commitment. In one experiment, for example, the majority of subjects chose to enter the game, but 86% of this group quit before the end of the game (Brockner & Rubin, 1985, pp. 43–46). Other experiments do not record individual quitting points, but the average quitting points provide strong indirect evi-

[1] Similar effects were found in a within-subjects test with the two questionnaires distributed 4 weeks apart.

dence that subjects quit prematurely. Take, for example, the set of Counter Games reported in Table 4.1 of Brockner and Rubin's book on entrapment (Brockner & Rubin, 1985, p. 36). These games used a 600-point counter and subjects received an initial stake of $5.00. Subjects had to pay 1 cent for each counter click, leaving them a 500/600 chance of winning prizes ranging (in different conditions) from $2 to $20. In most conditions, the expected value of the game is positive, and the appropriate strategy is to enter and never quit. However, the average amount invested in these games is quite low, indicating that many subjects quit early. Consider, for example, the average of $3.82 invested in the game with a $10.00 prize. In this game, the average subject quits at a point where expected benefits from a marginal investment are three times what they were when the subject began investing.[2]

These experiments, which have been taken as evidence of "entrapment" (incorrect escalation) actually provide additional evidence of incorrect de-escalation. Although the marginal benefits of an additional investment increase over time, most people stop investing early. These experiments involved monetary payments, indicating that people will improperly de-escalate commitment even when monetary incentives are at stake. These results are also consistent with the hypothesis that participants budget an amount they will spend in pursuing the prize and stop investing once they exceed the budget.

A THEORY OF MENTAL BUDGETING

Because attention to sunk costs can lead to de-escalation, theories about "escalating commitment" are necessarily incomplete, and it seems appropriate to reexamine the way that people react to sunk costs. In this section, I describe a mental budgeting process that can explain the de-escalation in Study 1. Study 2 will test the proposed budgeting process, and the remainder of the paper will use the budgeting process to understand when people will escalate and de-escalate commitment.

At one level, demonstrations of de-escalation may be counter-intuitive, since the organizational behavior literature has emphasized escalation. However, at another level, these demonstrations should be very intuitive: de-escalation seems to be tied to a budgeting process which is pervasive in our investment decisions. In our personal decisions, for example, we allocate specific amounts of money toward this week's entertainment or this month's household expenses, and we resist exceeding our pre-determined expense limits. This kind of budgeting behavior has been documented in descriptions of consumers for over five decades (Bakke, 1940; Rainwater, Coleman, & Handel, 1959; Thaler, 1985; see Zelizer, 1993 for this and other interesting observations about the sociology of money).

The budgeting process I will propose fits into an emerging area of research on how people keep their mental accounts. Other research on mental accounting has concentrated on the way that people "label" and categorize expenses (Kahneman & Tversky, 1984; Heath & Soll, 1993), and on the psychological impact of different methods of combining or disaggregating expenses (Thaler, 1980; Thaler & Johnson, 1990; Linville & Fisher, 1991). The idea of budgeting has been explicitly mentioned as a way to protect oneself from consuming tempting items (e.g., cigarettes or alcohol) and to pre-commit to consume valued items (e.g., the opera or education) (Thaler, 1985) and is implicit in previous work that examined how people manage expenses over time. Shefrin and Thaler (1988) have argued that instead of smoothing lifetime earnings, that people force themselves to live within the income of any given period. Furthermore, people avoid tapping into resources that exist in separate mental accounts: people are quite unwilling to use home equity, for example, to fund current consumption. The idea of budgeting is also consistent with classic work on satisficing (Simon, 1947; March & Simon, 1958), which argued that when decision makers face difficult decisions, they simplify the decision problem by setting targets and constraints and then searching for a solution that satisfies those self-imposed constraints.

In this paper, I argue that people allocate resources by (1) setting budgets for the investments they undertake and (2) tracking ongoing investments against their budget. People decrease investment when total investments exceed their budget.

The real estate problems in Study 1 and the Counter Games of Brockner and Rubin (1985) lead people to improperly de-escalate investment because they make it easy to set a budget and track expenses. It is easy to set a budget because the problems provide information about the expected benefits of investment (the final selling price of the real estate problems, or the payoff for winning the Counter Game). The information about expected benefits is important because it allows people to use a simple heuristic to set their budget: "invest less than the project is worth." In the real estate problems, a budget that is set using this rule prevents

[2] At the beginning of the game, subjects must make a marginal decision about whether to purchase a click of the counter for one cent. The expected value of that click is 1.67 cents (1/600 * $10), and so it makes sense to pay the penny and turn over the counter. Now consider the decision when $3.82 has been invested, the point at which the average subject quit the game. At this point, subjects must again weigh the marginal cost of an additional click (one cent) against the marginal benefit of taking an additional click. Since the jackpot is on one of the remaining 600 − 382 = 218 slots of the counter, the expected value of an additional turn has now increased to 4.57 cents (1/218 * $10).

people from making the final investment called for by the problem. It is easy to track expenses in both experiments because additional investments require additional monetary payments. Not all investments are so explicit. When theatergoers in Arkes and Blumer's (1985) study make additional efforts to attend a play for which they have paid full ticket price, these additional efforts do require investments of time and energy, but they do not require additional monetary payments. In comparison with monetary payments, the investments of time and energy may be more difficult to track.

Thus, there are two major parts of the budgeting process: First, people set a budget, and second, they track their ongoing expenses against the budget. In the next two sections I elaborate on each part of the process in turn.

Setting the Budget

I assume that when decision makers are confronted with an investment opportunity, they assess the expected benefits of an activity or a project, and then they mentally earmark the money, time, or other resources that they will invest to acquire those benefits.

Earlier research on escalation of commitments shows budget setting is frequent, and that it is effective in limiting escalation. For example, in one of their studies on entrapment, Brockner, Shaw, and Rubin (1979) set out to examine what happens when people are prompted to set an investment limit, and found that people are reasonably good at adhering to their limits. The correlation between commitment limits and quitting points was $r = .95$ ($p < .0001$) in a public limit-setting condition, and $r = .82$ ($p < .0001$) in a private limit-setting condition (Brockner & Rubin, 1985, p. 199). Interestingly, in that study, researchers found that they did not really have to encourage subjects to set a commitment limit—almost 85% of *control* subjects spontaneously set a limit. In fact, this experiment failed to produce a significant difference between the three experimental conditions, although the trend was for public-limit subjects to quit earlier. In his studies of the dollar auction,[3] Teger (1980, p. 40) also reported significant correlations between individually set commitment limits and quitting points. In two individual studies the correlations were moderately strong ($r = .40, p < .001$ and $r = .32, p < .01$), and one study where people were paired with a teammate produced a very high correlation ($r = .83$, $p < .0001$). Teger's reported correlations are particularly striking because the dollar auction involves motives of interpersonal competition not present in Brockner and Rubin's studies.

How do people decide how much to budget? The process is likely to be different for different domains. In determining budgets for personal consumption (like entertainment or clothing), people probably set their budgets by trial and error. They experiment with different allocations, and eventually determine which allocations make them the most satisfied (Heath & Soll, 1995). In investments domains, however, people are likely to use a more straightforward procedure to set their budget; deciding based on the total benefits available how much they can invest in order to achieve a desired "rate of return." While the desired rate of return may differ across people (some people may be willing to invest \$90 to receive \$100, and others may be willing to invest only \$60), the total benefits expected from a project provide a very clear upper bound on a mental budget—people are unlikely to budget \$110 to gain \$100. Thus, I assume in this paper that people set their budget to provide a positive rate of return on their total investments.

As others have noted in the escalation literature (Thaler, 1980; Whyte, 1986; Garland, 1990), Kahneman and Tversky's (1979) value function implies that people may be risk-seeking in the domain of losses—losses will be painful and people may take additional risks and make additional investments to avoid admitting that a sunk investment is "lost." However, although people may be concerned about the loss of a sunk investment, they are also likely to be concerned about the loss of ongoing investments. The positive rate of return hypothesis seems compelling because people are likely to be concerned about the "loss" of marginal investments when total costs exceed total benefits, no matter what the benefits of the marginal investments. For example, Thaler and Johnson (1990) found that decision makers would take risks in situations where a gamble allowed them to break even for a previous loss, but were not as likely to take risks when gambles did not allow a chance to compensate for previous losses. Study 1 demonstrates a similar phenomenon. Problems 4, 5, and 6 have the same expected value, however, Problem 6 shows significantly lower levels of de-escalating commitment. In that problem, one salient outcome provides a return that allows some chance for the payoff to exceed people's total investment.

Additional evidence in favor of the positive rate of return hypothesis can be found in the previous literature on escalation and entrapment. In a reasonably large literature, I could find only two studies where the costs and benefits of investment were clear, where the success of investment was determined in a non-

[3] In the dollar auction, subjects engage in an auction for a \$1 bill. The auction requires the top two bidders to pay their bid, so at any point in the auction, second-place bidders have a \$1 incentive to increase their bid slightly in hopes that their bid will be the final one. In these studies, people often bid \$5 to \$7 for a \$1 bill.

strategic way (i.e., by a chance device rather than by the actions of an opponent), and where researchers recorded the distribution of quitting points. However, these studies provide converging evidence for the positive rate of return hypothesis. Brockner and Rubin (1985, p. 45; describing the results of Brockner et al. 1979) gave subjects \$4 to invest toward a \$2 prize. The success of investments was determined by a Counter Game with a 600-point counter. Teger (1980, p. 27) gave subjects 975 points to invest toward a 500 point prize. The success of investments was determined by drawing numbers from a pack of cards. In both cases, a similar percentage of subjects quit the game before their investments exceeded the value of the prize (65 and 67%, respectively), and in both cases, the median subject quit when he or she had invested about 90% of the value of the prize (450 points in Teger's study, \$1.80 in Brockner and Rubin's study). More generally, Teger reports that about 85% of his subjects shift their strategies when bids in a dollar auction exceed the value of the prize—either by quitting or by changing to a different bidding strategy (p. 23). He argues that the value of the prize provides a focal point in the bidding sequence, a hypothesis consistent with positive rate of return hypothesis.

Thus there is evidence that limit-setting does influence commitment decisions, and some evidence that spontaneous limits are consistent with the positive rate of return hypothesis. Study 2 will manipulate breakevens to systematically examine budget setting and the positive rate of return hypothesis.

Tracking Investments

In the second part of the budgeting process, after the budget is set, people track their ongoing investments against their budget. People's success in tracking their investments is a function of two processes: (1) investments must first be noticed and (2) then assigned to their proper accounts. An investment will have no impact on the budget if either process fails. To describe these processes, I will borrow terminology from financial accounting where the accounting process is also divided into two stages: expenses are first booked (recorded in the accounting system) and then posted (assigned to a specific expense account).[4]

BOOKING. In order for an investment to affect a budget, people must first *recall* or *attend to* it. Booking is a binary process—people either notice an expense or they don't.[5] For example, opportunity costs are probably less likely to be noticed and booked than are out-of-pocket costs. Booking will be affected by the things that normally affect attention, for example, demands on the processing system, and the familiarity of the stimulus (e.g., Kahneman, 1973).

POSTING. Second, people *must classify the investment as relevant* to the mental budget. Fixing a broken transmission during a family vacation would be a very salient expense, but it might not be posted to the vacation account. Posting decisions are more continuous than booking decisions. Some of the transmission expense may be posted to the "vacation account" and some to the "car account." Posting will be affected by issues that affect categorization judgments and judgments of similarity: for example, the relative complexity of the stimulus object and the target, and the other items in the choice set (e.g., Tversky, 1977).

I distinguish these two processes because each depends on a different cognitive system. The process of booking is driven by attention. The process of posting is driven by similarity judgments and categorization. The processes are conceptually distinct because they tap different cognitive mechanisms, however the results of the two processes will often be correlated. For example, people may be more likely to attend to things that are especially good examples of a particular budget, and thus things that are easy to post are also more likely to be booked.

Later in the paper, the expense tracking process will be helpful in predicting when people will escalate investment. The intuition is simple—if people set a budget for their investments, then they are only likely to escalate commitment when expenses are difficult to track. When additional investments are not booked or posted, then people may continue to invest in the hope of salvaging a sunk cost. Before turning to these issues, the next section explores the model of budgeting using an experimental study that involves explicit investments that are easy to track.

STUDY 2: EXPERIMENTAL METHODS AND THEORETICAL PREDICTIONS[6]

In the study below, subjects make investments in projects with known costs and benefits. The experiment involves real money—subjects are paid based on their decisions in the experiment. Because the "success" of investments is probabilistic, subjects face sit-

[4] This process might be modeled, for example, by weighting investments by a factor, α_{ij}, that is a multiplicative function of the salience of the investment (booking) and the relevance of the investment for a given account (posting). This weighting parameter would determine the fraction of an investment that is posted to a particular account.

[5] "Noticing" does not have to happen at the time of a transaction, it may happen during a periodic attempt to recall expenses—for example, we may not individually book the amount of gas expended on separate trips on the weekend, but the separate expenses may be booked when we are forced to refill our gas tank.

[6] This experiment was conducted with the help of Ed Ng.

uations where they must decide whether to repeat an investment in a project where they have invested, without success, in the past. Thus the experimental procedure will allow us to test the prediction of mental budgeting—that people will improperly de-escalate commitment—against the predictions that people will make marginal decisions or that they will escalate commitment.

In addition, this study will allow us to test *how* people set mental budgets. While the experiment holds the marginal benefits of investment constant, different investments break even after a different number of investments. This will allow us to test the positive rate of return hypothesis which claims that people set budgets by weighing total costs against total benefits.

Subjects

Subjects were undergraduates at the University of Chicago. Thirty subjects were recruited in campus dorms and received money for participating in the experiment based on the outcome of their investment decisions. On average, subjects received about $5 for the experiment which lasted about 30 min.

Procedure

During the experiment subjects made investment decisions about 22 real estate properties. Property names were chosen from the Monopoly board game. We chose Monopoly properties because we wanted subjects to think of the various properties as independent investment opportunities. (All subjects were familiar with the board game and the properties.) Each subject received the properties in a different random order.

Each property was described by three pieces of information: a payoff value, a probability value, and an investment fee. The subject had to decide whether to invest the investment fee in exchange for the stated probability of receiving the payoff. For example, Boardwalk had a payoff value of $400, a probability of success of .42, and an investment fee of $147. Here the subject had to decide whether to invest $147 in exchange for a 0.42 chance of winning $400. Probability was operationalized as drawing a number from a bag of one-hundred numbered poker chips (with replacement). The subject received the payoff if the number drawn was lower than or equal to the probability value—in this case from 1 to 42. If the payoff was not received, then the subject could invest again and draw another chip. This process continued until the subject won the property or decided to quit investing.

Subjects kept a record of the payoff, investment fee, and probability of success from each property card. If they decided to invest, they recorded the numbers they drew.

Subjects were given an (essentially) unlimited pool of investment funds—$5000 in Monopoly money. After the experiment, subjects returned the $5000 and kept any residual earnings.[7] The experimenter then converted subjects' residual earnings into cash at the rate of $100 in Monopoly money to $1.00 in cash. The amount subjects received depended on their performance in the experiment.

Before the experiment began, subjects read a complete description of the procedure, played through a sample property, and then took a five question quiz to check whether they fully understood the mechanics of the experiment (including the payment procedure). After the quiz, the experimenter discussed the answers with subjects and answered any remaining questions.

Materials

Twenty-two properties were selected from the Monopoly board game. The payoff values for each property were the property values of the associated Monopoly properties.

Investment fees and probabilities were selected to satisfy two conditions. First, marginal benefits had to exceed marginal costs. In order to simplify matters, we set an expected marginal return of 15% across all properties. Thus any investment made in the experiment (although it might involve very different payoffs, probabilities, and investment fees) had an expected return of 15%. Second, properties had to break even after different numbers of investments. Based on the positive rate of return hypothesis, we expected subjects to be sensitive to the point at which their total investments exceeded the payoff available on the property. We chose investment fees so that after investing for n rounds, the total amount invested would exceed the payoff by 10% (for convenience, I will call this the breakeven point, although it is actually 110% of the breakeven point). We selected breakeven points so that different properties reached the breakeven after two to six rounds of investment. Three properties had a breakeven of two, seven properties had a breakeven of three, five properties had breakevens of four and five, and two properties had a breakeven of six.

Theoretical Predictions

The experimental procedure involves all aspects of marginal decision making. There are well-defined marginal costs (the investment fee) and marginal benefits (the probability of success times the payoff). Since

[7] Although it is possible that this large initial stake might encourage people to feel they are not playing with their own money, any "house money" effects would tend to exacerbate risk-seeking (Thaler & Johnson, 1990), and thus would tend to prevent de-escalation. Thus the experiment provides a conservative test for demonstrating de-escalation.

success is not assured, subjects must occasionally decide whether to invest additional money on a project which has considerable sunk costs (the sum of previous investment fees).

The theories below make explicit predictions about subjects' investment decisions in this experiment. In this experiment, both marginal decision making and escalating commitment predict that subjects will never quit investing (although for different reasons).

Marginal Decision-Making

For each property, the marginal calculation remains constant across investment rounds because the investment fee, payoff, and probability of winning are always constant. Because the marginal calculation is constant, if subjects ever start to invest in a property, marginal decision making would predict that they would always be willing to invest. The experimental procedure ensures that available funds are effectively unlimited, thus liquidity is not a constraint.

Escalating Commitment

Because subjects should become increasingly committed to a property where they have invested more in the past, theories of escalating commitment also predict that subjects should never quit investing once they start investing. In fact, subjects should be increasingly willing to invest additional amounts on a property where they have already invested.

Mental Budgeting

If people set budgets and quit investing when they exceed their budget, then mental budgeting predicts that people will quit (Hypothesis 1) and that they will quit later on properties with higher breakevens (Hypothesis 2).

HYPOTHESIS 1: THE MENTAL BUDGETING HYPOTHESIS. Mental budgeting predicts that subjects will invest on a property only as long as they do not exceed their investment budget. Because success is probabilistic, subjects should frequently exceed their budget, and quit investing. Quitting is a clear sign that subjects are not engaging in either marginal decision making or escalating commitment.

HYPOTHESIS 2: THE POSITIVE RATE OF RETURN HYPOTHESIS. The positive rate of return hypothesis predicts that people will set budgets so that they invest less than the total benefits available on a project. For the current test, I also assume that individual subjects will set their budgets to achieve a constant (positive) rate of return across investments. Because their desired return will be constant across properties, I predict that people will, on average, quit investing later on properties with higher breakevens.

Results

Recall that subjects were free to skip any properties they did not wish to invest in. The rate of skipping was low overall (9.9%) and did not interact significantly with the analyses that follow. Thus, the analyses will focus on situations where subjects started investing, but quit before they received the payoff. Where appropriate, the analyses below were also run controlling for intra-experiment wealth effects. No wealth effects were found, indicating that subjects did treat the properties as independent investment opportunities. We will examine the overall results, then look at a subject-level analysis of investment patterns.

Overall Analysis

Test of mental budgeting. Both marginal economic analysis and theories of escalating commitment predict that subjects will not quit investing once they start. On the contrary, subjects quit investing on 26.7% of the properties they encountered $t(29) = 9.08$, $p < .001$. This figure provides a lower bound on the probability of quitting since it includes situations where subjects win the payoff after the first investment and are never forced to decide whether to invest again. Thus, neither marginal decision making nor theories of escalation seem to describe the data—subjects quit investing in about one of every four properties they encountered in the experiment.

Test of positive rate of return hypothesis. Hypothesis 2 states that we should be able to predict quitting points by looking at breakeven values. To test the positive rate of return hypothesis, we can group responses on properties with the same breakeven value. Figure 1 displays the percentage of subjects who quit investing at various rounds for properties with breakeven points of two to six. Note that subjects become more likely to quit over time, and that the probability of quitting typically peaks at the breakeven point or in the following round.

To test the positive rate of return hypothesis, we can regress quitting points on breakeven points. If people set their budgets exactly equal to the breakeven point, then the slope of the regression should be one—people should quit right at the breakeven point. Depending on the overall return that subjects desire, the slope could be less than one, but the positive rate of return hypothesis (assuming constant returns) predicts that the slope should be significantly positive.

People do quit later in response to higher higher breakevens $F(1,150) = 20.85$, $p < .001$, adjusted $R^2 = .116$. The regression also has a significant constant, $t(149) = 2.29$, $p < .02$, an effect not predicted by the positive rate of return hypothesis—indicating that

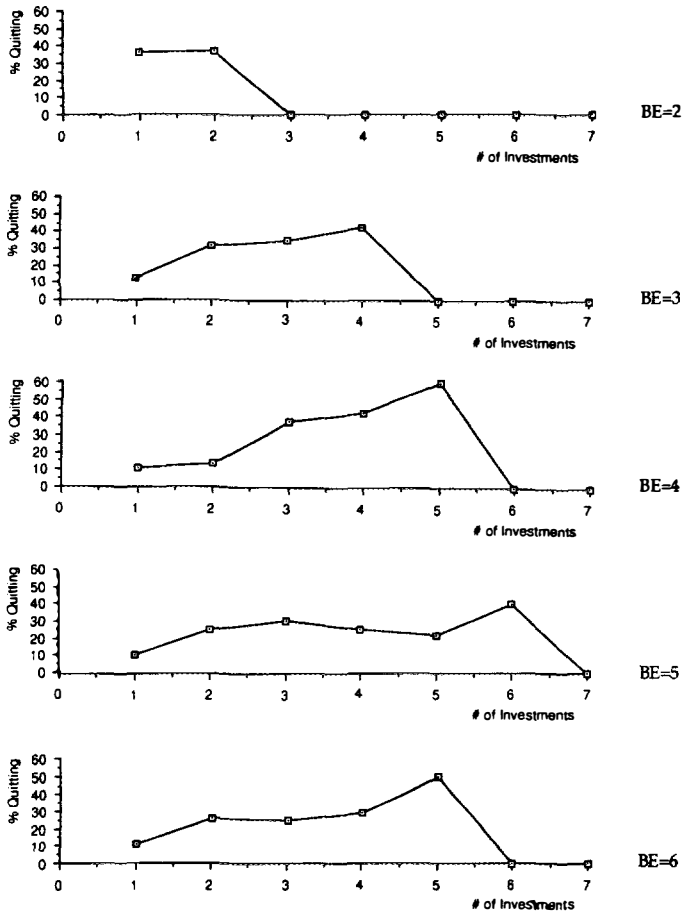

FIG. 1. Quitting points for properties with different breakevens.

there may be some tendency to quit independently of the breakeven point. The regression equation is as follows (standard errors are in parentheses below coefficients).

$$Y = .757 + .362\ BE, \text{ where } Y = \text{quitting point, and BE = breakeven point.}$$
$$(.331) \quad (.079)$$

Overall, this test provides compelling evidence for the positive rate of return hypothesis—subjects responded to higher breakevens by investing longer.

Analysis of Individual Subjects

The analysis above focused on the overall data, collapsing across subjects. Another way of describing the data is to classify the pattern of behavior exhibited by individual subjects.

Both marginal decision making and theories of increasing commitment predict that subjects will never quit investing once they begin. By looking at investment responses across the 22 properties, we can easily separate out subjects who never quit. Only four of the thirty subjects never quit early, and an additional two subjects quit early on only one occasion. Thus 80% of subjects quit early on more than one occasion ($p < .0001$). Since marginal decision making is the optimal strategy, it is not surprising that payoffs for the six who did not quit were much higher than payoffs to the other subjects ($7.35 versus $4.84). This group received, on average, 52% more than subjects who pursued another strategy.

Interviews on debriefing indicated that three of the six subjects who never quit endorsed some version of marginal decision making (e.g., they mentioned that "past costs" should not affect their decision). The other three subjects were presumably escalating commitment. The subject-level analysis thus provides extremely strong evidence of de-escalation: a large majority of subjects de-escalate investment on more than one occasion.

In examining the subject-level data, several subjects exhibited a consistent pattern of behavior that involved de-escalation but that did not match the positive rate of return hypothesis, which predicted that quitting points would respond to breakeven points. Seven out of the 30 subjects (23%) never invested more than twice on any property, no matter what the breakeven point. We can label these subjects "effort budgeters" because they seem to be budgeting based on the number of attempts at investment rather than returns on investment. The decision rule, "invest twice then quit," provides another example of de-escalation, but it is not consistent with positive rate of return hypothesis.

When effort budgeters are omitted from the larger sample, it becomes easier to predict quits based on breakeven points. The resulting regression predicts more of the variance $F(1,94) = 25.31$, $p < .0001$, adjusted $R^2 = .205$, and the constant is no longer positive. This regression yields:

$$Y = .444 + .542\ BE, \text{ where } Y = \text{quitting point, and BE = breakeven point.}$$
$$(.447) \quad (.108)$$

Discussion

This experiment provides substantial evidence that people frequently de-escalate commitment in response to previous investment. The majority of subjects in the experiment (80%) de-escalate investment, and they do it frequently (in more than one of four properties where they begin investing). This behavior contradicts the principle of marginal decision making and it provides an especially striking violation of theories of escalating commitment. Subjects invest multiple times in a property (accumulating sunk costs), then quit investing on that property and immediately invest in another property that has identical returns but no sunk costs.

The positive rate of return hypothesis successfully predicts quitting points, suggesting that people set budgets in response to total benefits. The presence of effort budgeters was not predicted. Although their behavior is consistent with mental budgeting, they seem to follow an absolute stop rule, "invest twice then quit," that does not respond to total costs and benefits as does the positive rate of return rule.

WHEN DO PEOPLE ESCALATE AND DE-ESCALATE COMMITMENT?

Like previous theories, the budgeting model assumes that people attend to sunk costs instead of considering only marginal costs and benefits. However, in contrast to previous theories which predicted escalating commitment in response to sunk costs, the budgeting model can predict both escalating and de-escalating commitment.

In this part of the paper, I use the model to explore when people will escalate and de-escalate commitment. Recall that mental budgeting involves two processes: first, people set a budget; second, they track their investments against their budget and quit investing when their investments exceed their budget. I suggest that people will be more likely to escalate commitment when either process fails.

1. People escalate commitment when they do not set a budget. The success of the positive rate of return hypothesis in Study 2 demonstrates that many people use information about the expected benefits of investment to set their budgets. When information about benefits is not available, people may not immediately set a budget. Many studies of escalating commitment (e.g., Staw, 1976; Staw & Fox, 1977; Arkes & Blumer, 1985, Studies 3–5, Garland, 1990; Garland & Newport, 1991) omit information about future benefits. These situations may cause people to invest longer because they make it difficult for people to use their normal budget setting procedure. However, in demonstrations that omit information about benefits it is difficult to claim that people are making incorrect decisions when they escalate investment. Later in the paper, I will discuss the "rationality" of behavior in such demonstrations.

2. People escalate commitment when they cannot track additional investments. In the theater ticket study of Arkes and Blumer (1985), ticket-holders make additional investments of time or effort to attend plays when they paid full price. However, these additional investments do not involve explicit payments. Such situations make escalation of commitment possible because additional investments may be difficult to track. This is likely to happen when additional investments (a) consist of different resources than an original investment or (b) are incurred in very different transactions. People may escalate commitment in these situations because additional investments are not easily tallied and compared with the budget. Many previous demonstrations of escalating commitment involve marginal investments that are difficult to track (Arkes & Blumer, 1985, Thaler 1985).

The next two sections organize previous research using this framework and present an additional follow-up study on each point.

Escalation When a Budget Is Not Set

Study 2 and the review of previous literature indicate that people frequently set budgets. However, in certain situations, people may find it particularly difficult to set a budget (e.g., situations where there is no information about expected benefits). For example, in Arkes and Blumer's (1985) paper, several studies (Studies 3–5,8) concern the dilemma of the president of an airline company who must decide whether to invest $1 million of research funds to complete a plane which is inferior to a product just introduced by a competitor. Subjects are told how much money has been invested in the past, but they are given no information about expected benefits. Similar dilemmas have been used in studies by Garland and colleagues (Garland, 1990; Garland & Newport, 1991).

Information about expected benefits is not always necessary for people to set budgets or commitment limits. For example, the effort budgeters of Study 2 improperly de-escalated commitment, but did not seem to respond to information about breakevens, and subjects in McCain's (1986) study de-escalated commitment even in the absence of information about benefits. However, given that many people seem to use information about expected benefits to set their budget, it is not surprising that, on average, people are more likely to escalate commitment when such information is absent.

Studies that omit information about expected benefits raise methodological questions that will be considered below. However, omitting such information will allow us to test the budget setting mechanism of mental budgeting. When information about benefits is completely unavailable, decision makers may not set a firm budget for their investments or they may assume that a project is valuable and set a high budget, anticipating that returns will be even higher. In either case, they are not likely to de-escalate. In Study 3, I omit information about future benefits from the real estate problems of Study 1 and predict that this omission will lead people to escalate commitment.

STUDY 3

The decision scenario and the format of the questionnaires was the same as in Study 1. One group of 162

students completed the decision problems in the same format as Study 1. A second group of 161 students completed a modified version of the problems that omitted all references to Sales Forecasts. Thus this study will provide an independent replication of the results of Study 1 and will extend the results of Study 1 to examine what happens when information about expected benefits is not provided.

Results

Note that the Sales Forecast-present condition replicates the results of Study 1. All problems show errors of de-escalation. When the Sales Forecast is omitted (Table 2), we find escalation of commitment. Note that the average size of this "escalation" effect is much smaller than the "de-escalation" effect found when the Sales Forecast is present ($z = 2.43$, $p < .01$). Thus, in both conditions, people attend to sunk costs, but the size and direction of the responses depend on information about expected benefits.

Discussion

Study 3 demonstrates that information about future benefits influences whether people escalate or de-escalate commitment in response to sunk costs. People tend to increase commitment in response to sunk costs when they do not have information about expected benefits, replicating the effects demonstrated in earlier work (e.g., Arkes & Blumer, 1985; Staw, 1976). In this study, some people may not set a budget at all. Alternatively, in the absence of information about expected benefits, some subjects may set their budget so high that it does not constrain their investments. Evidence for the latter interpretation is provided by Study 4 below. In either case, the findings confirm the fact that mental budgets lead people to de-escalate.

Although Study 3 highlights an important part of the budgeting process, it and other studies that omit information about expected benefits raise important methodological questions. First, the external validity of such manipulations can be questioned. It is not clear how many environments in the world give people *no* information about expected benefits. Second, experiments that omit information about benefits make it difficult to experimentally control the beliefs of subjects about the benefits of future investment. It is easy to control beliefs about benefits when payoffs are explicitly stated (as in Studies 1 and 2) or where future benefits are known from experience (for example, theater goers in Arkes & Blumer's study can estimate the value of another play). It is not easy to control beliefs when information is not stated or known from experience. For example, if subjects assume that other decision makers adhere to some version of the positive rate of return rule, then they may assume that projects have a higher total value when more has been invested in the past. Otherwise, if projects with high sunk costs were not worth more than projects with low sunk costs, then decision makers would have stopped investing before they accumulated the large sunk costs.

The following study demonstrates that in the absence of information about expected benefits, that people may use sunk costs to infer the value of a project.

TABLE 2

Study 3: Percentage of People Who Refuse to Invest When Forecast Is Present or Absent

	Previous costs	Future investment	Sales forecast	Refusing to invest (%) Forecast present	Forecast absent
1. A	$6.58	$1.55	$6.66	51%[a]	13%[a]
B	None	$1.55	$6.66	2%	34%
2. A	$9.72	$1.97	$10.09	37%[a]	8%[a]
B	None	$1.97	$10.09	1%	37%
5. A	$9.07	$2.57	$9.16	42%	9%
B	$6.33	$2.57	$9.16	11%[a]	32%[a]
6. A	$8.70	$2.16	$9.45	41%	18%
B	$1.50	$2.16	$9.45	4%[a]	44%[a]

Note. All differences within a column significant at $p < .01$ by χ^2 test. For forecast present questionnaire, superscript [a] $N = 85$, other Ns = 77. For forecast absent questionnaire, superscript [a] $N = 79$, other Ns = 82.

STUDY 4

The decision scenario and the format of the questionnaires was identical to the Sales Forecast-omitted condition of Study 3. However, instead of asking subjects whether they would invest, subjects were asked to estimate what the project would sell for when it was completed. To avoid the possibility that subjects might defensively over-estimate the value of projects for which they were responsible, instead of telling subjects that the projects were undertaken on their advice, subjects were simply told that the investment information came from real estate projects run by other people in their firm. One hundred and thirty-one students participated in the study.

Results

The results of this study clearly indicate that subjects assume that projects with high sunk costs will produce higher benefits than projects with low sunk costs. It is noteworthy that only 6% of the estimated selling process were less than the total of previous and current investments. On average, subjects assumed that projects would produce an overall return of around 30% on total investment. Given this kind of assump-

tion, it is not surprising that subjects in Study 3 were more willing to complete large than small projects when the Sales Forecast was omitted—they assumed that completing such projects would produce a much higher payoff. This kind of assumption is consistent with mental budgeting—subjects assume that others would only have accumulated large previous investments in a project if the total value of the project was worth more than previous investments (Table 3).

This experiment provides an important methodological warning for researchers on sunk costs. Without providing information about expected benefits, it is difficult to manipulate the magnitude of sunk costs without also manipulating subjects' expectations about the value of a project. I will return to this methodological problem later in the paper when I consider the rationality of demonstrations of escalation and de-escalation.

In sum, these two studies provide some support for the budgeting model and a cautionary note for the interpretation of many previous results of escalating commitment. Study 3 shows that people are more likely to escalate commitment in the absence of information that might prompt them to set a low budget. Study 4 points out that this escalation may be reasonable given that people assume that the benefits of the project will more than compensate for their total investment in the project.

Escalation When Investments Are Difficult to Track

The expense tracking process requires people to notice and book expenses into their mental books and it requires them to categorize and post expenses to appropriate accounts. In this section, I discuss the importance of the expense tracking process in determining whether people will escalate or de-escalate commitment.

In recent work, Heath and Soll (1995) showed that when consumers purchase an item that is prototypical of a particular category of expenses, they are much less willing to purchase future items in that category than when they purchase a less-prototypical item. By controlling for the standard economic effects of satiation and income, we were able to show that consumers actually *underconsumed* items in a category after prototypical purchases. For example, purchasing a sports ticket (a prototypical entertainment purchase) lowered future entertainment purchases more than purchasing a costume for a Halloween party (a less prototypical entertainment purchase), and this effect was not accounted for by satiation effects (having less of a desire to be entertained after attending a sporting event rather than a Halloween party) or income effects (having less money to spend on entertainment items after the purchase). We argue that underconsumption is a byproduct of the budgeting process that consumers use to track their consumer expenses. Prototypical purchases are more likely to be posted to an account than less prototypical purchases. Therefore, they are more likely to decrease the funds that are available in the account.

TABLE 3

Study 4: Estimated Values of Projects When Forecast Is Absent

	Previous costs	Future investment	Total investment	Estimated value
1. A	$6.58	$1.55	8.13	12.24
B	None	$1.55	1.55	4.29
2. A	$9.72	$1.97	11.69	16.60
B	None	$1.97	1.97	4.89
5. A	$9.07	$2.57	11.64	17.11
B	$6.33	$2.57	8.90	13.14
6. A	$8.70	$2.16	10.86	15.50
B	$1.50	$2.16	3.66	6.89

Note. $N = 131$. All differences in Estimated Value column significant at $p < .001$ by t test.

The underconsumption effects that were shown by Heath and Soll (1995) parallel the de-escalation effects in the current studies, and they highlight the important role of the expense tracking process. In situations where marginal investments are unusual, people may not post their marginal investments. When investments are not posted, people may escalate commitment because additional investments do not cause them to exceed their budget.

Two important aspects of investments that strongly affect where investments are posted are the *type of resource* involved, and the *timing and format* of investment transactions. An investment of time may not be considered when tracking investment on a project where most of the costs are monetary. An investment of money may not be considered in a situation where most of the cost is time. The *timing and format* of a transaction are also important. Even two monetary expenditures may not be posted to the same account when they are made in different kinds of transactions or at different times. Completing a paper may require us to pay subjects to participate in experiments and a research assistant to enter the data, but the two expenses may be posted in different mental accounts.

When they total their investments, I propose that decision makers are most likely to book and post investments that are the same type of resource as a sunk investment and that are made in transactions with similar timing and format. Investments that meet these two criteria receive full weight in the summation of total costs. I will call these investments *explicit* expenses.

I will call expenses that differ from sunk investments on *both* the resource and transaction dimension "*inci-*

dental expenses." Incidental expenses have no impact on the ongoing summation of expenses, either because they are not booked (we may, for example, overlook the opportunity costs of our investments) or because they are not posted (dissimilar resources or unusual transactions may be placed in their own unique account or assigned to an overhead account rather than to the account for a specific investment project).[8]

Explicit and incidental investments are ideal types: incidental investments are completely unrelated to a target account, and explicit expenses are completely related. I introduce them here because they provide a reasonable way to describe previous demonstrations of escalation. If we eliminate questionable demonstrations of escalation that do not provide information about the benefits of investment, a review of the literature makes it clear that the remaining demonstrations of escalation exclusively involve *incidental* marginal investments.

In the Arkes and Blumer (1985) study, for example, theater-goers make additional efforts to attend a play for which they have paid full ticket price. Attending a play requires the expenditure of resources (time, attention, gasoline) and is thus a form of "increased investment," but the additional investments are incidental—they do not involve overt transactions, and they are a different type of resource than the original investment. In Thaler's (1980) anecdotes, tennis players who pay their large tennis club dues will play tennis despite the pain of tennis elbow, and basketball fans who pay for their tickets will brave a snowstorm to attend while equally rabid fans who received free tickets will stay at home and listen to the game on the radio. In each of these cases, people who have paid a monetary sunk cost invest additional incidental resources which differ in currency and timing from the sunk investment. Northcraft and Wolf (1984) labeled this kind of behavior "recovery through use." Consumers tend to call it "getting your money's worth." Since additional investments are incidental, they do not increase the costs associated with the target account, and they may provide some benefits.

In situations like those described by Thaler and Arkes and Blumer, people may not think to convert investments of gas, time, and physical pain into their monetary equivalents, and they might find it difficult to make the conversion even if they thought to do it. Study 5 examines people's willingness to make incidental investments in a situation where translation is relatively easy. Although we do not habitually trade off *anxiety and money* or *cultural sophistication and time*, we must often trade off money and time.

[8] Some expenses may also be inherently difficult to budget and to total, for example, frustration or pain. These expenses will also be incidental.

STUDY 5

This study manipulates whether a budget is monetary or time-based by manipulating whether the sunk investment and the payoff are expressed in terms of dollars or time. In different conditions subjects have either invested little time/money or they have invested so much that their investments threaten to exceed the value of the payoff. In each case, subjects must decide whether to invest either time or money to complete the project. Since projects must be completed, and since "time is money," subjects should simply make whichever investment is less costly. All time versus money tradeoffs imply an hourly wage rate. For example, some projects allow people to trade off time against money at the rate of $7 per hour. Although the implicit wage rates used in the problems were selected to be within the range of hourly salaries for students, some subjects will treat their time as worth more than $7 per hour, and some subjects might treat their time as worth less. Those whose time is worth more than $7 per hour should invest the money to complete the project and others should invest time. In either case, the sunk investment should be irrelevant to the decision about whether the time or the money investment is less costly.

Mental budgeting predicts that people will budget less than the total benefits available. Furthermore, it predicts that when people are close to exceeding a budget they will prefer to make an incidental investment rather than an explicit one—to invest time when the budget is expressed in money, and to invest money when the budget is expressed in time.

In the following choices people must decide whether to invest time or money in order to achieve a goal. Subjects received one of the two introductory paragraphs along with the common, third paragraph.

Money frame: While you are in school, you take on projects as an independent consultant. The table below lists the payoff from six projects you are working on, as well as a monetary amount that you have already invested in each project.

Time frame: While you are in school, you take on projects as an independent consultant. The table below lists six projects that, when finished, will save you time on other consulting projects. The table lists the amount of time you have already invested in each project.

Each project can be finished by investing a certain amount of time yourself or by investing additional money [for example, renting more sophisticated equipment or paying someone else to perform some specialized work]. Assume that if you invest money then the time investment is zero, and vice versa. Each project must be finished in order to protect your reputation as a consultant. For each project, decide whether you would prefer to make the investment of time or the investment of money, and circle the appropriate option.

TABLE 4

Study 5: Stimuli and Responses

Amount invested in the past	Invest money? Or time?	Payoff	Percentage of subjects investing time	Change
Money frame				
A. $37 ($123)	$49 or 7 h	$150	37 (81)	+44*
A'. $206 ($455)	$147 or 21 h	$500	31 (49)	+18*
B. $8 ($31)	$30 or 5 h	$65	55 (75)	+20*
B'. $95 ($170)	$48 or 8 h	$225	27 (49)	+22*
C. $0 ($84)	$25 or 4 h	$90	57 (80)	+33*
C'. $0 ($100)	$50 or 8 h	$125	27 (64)	+37*
Time frame				
A. 5.3 h (17.5 h)	$49 or 7 h	21.5 h	61 (49)	−12
A'. 29.4 h (65 h)	$147 or 21 h	71.4 h	64 (58)	−6
B. 1.3 h (5.2 h)	$30 or 5 h	10.8 h	66 (61)	−5
B'. 15.8 h (28.3 h)	$48 or 8 h	37.5 h	55 (40)	−15*
C. 0 h (13.4 h)	$25 or 4 h	14.4 h	58 (42)	−16*
C'. 0 h (16 h)	$50 or 8 h	20 h	56 (49)	−7

Note. Subjects chose whether to invest the amount of money or the amount of time listed in the second column on a project with the payoff listed in the third column. The experiment varied the sunk cost presented in the first column. The fourth column lists the percentage of subjects choosing to invest time for each of the two different historical costs. *N*s for each questionnaire greater than 105.

* Differences significant at $p < .02$ by χ^2 test.

Materials and Design

Four different questionnaires were constructed. Two involved a time frame (sunk costs and payoffs were expressed in terms of time), and two involved a money frame (sunk costs and payoffs were expressed in monetary terms). Four hundred and seventy-two subjects, undergraduates at Stanford University, participated by filling out one of four questionnaires. Each of the six problems implies one of three time/money tradeoffs ($6/h, $6.25/h, or $7/h). For example, in question one, subjects would be indifferent between making the time or money investment if they were willing to work for $7/h. Sunk costs and payoffs in the money frame of the problem can be equated to the sunk costs and payoffs in the time frame by dividing by this wage rate. For high sunk cost problems, the sum of the sunk cost and the required explicit investment approaches or exceeds the payoff available. Each questionnaire mixed high and low sunk cost problems.

Results

Table 4 shows that people prefer to make incidental rather than explicit investments. Subjects show a strong preference for time investments in the money frame and a weaker preference for money investments in the time frame.[9] The results in Table 4 are between-subjects. Similar results have been found in within-subjects tests, with about 80% making the predicted switch in two or more of the six problems. The results of this questionnaire thus suggest that people prefer to make incidental investments to salvage sunk investments, even when there is a direct mapping between the incidental and explicit investment.

Discussion

While demonstrations in the previous literature support the notion that people will make incidental investments in order to salvage a historical investment, Study 5 indicates that people prefer to make incidental investments even in a situation where there is a simple translation (through the wage rate) between the value of incidental and explicit investments. The fact that results are weaker for time budgets than monetary budgets is perhaps not surprising—people are probably more accustomed to budgeting monetary investments than time investments. This experiment provides a stringent test of the escalation-under-incidental-investments hypothesis because it should be fairly easy to translate between time and money—life cir-

[9] These results cannot be accounted for by liquidity constraints. Liquidity constraints might prevent the marginal investments of time and money from being equal in the high and low sunk cost condition—after a high monetary investment people might not have the monetary resources to make the marginal investment to complete the project. To examine this possible alternative explanation I regressed the percentage of subjects investing time (using a logistic transformation) against (a) the absolute sunk cost and (b) the ratio by which total costs would exceed total benefits if the additional investment were made (as a proxy for the mental budget). In the monetary problems, both effects are significant, but the absolute value of the monetary investment actually has a negative effect on the propensity to invest time. For the time problems, only the mental budgeting effect is marginally significant ($p = .06$). These results argue against a confounding effect of liquidy constraints.

cumstances frequently encourage us to make tradeoffs between these resources. In situations where translations between resources are more unusual (e.g., pricing the pain of tennis elbow or the effort of dressing up to attend a theater performance), people are probably even more likely to escalate investment by making incidental investments. Combined with analogous evidence (Heath & Soll, 1995) from studies of the budgeting process for consumer expenses, there is strong evidence that de-escalation is more likely when expenses are easy to post.

THE RATIONALITY OF BUDGETING, ESCALATION, AND DE-ESCALATION

There has been a protracted debate in the escalation literature about whether escalation is rational or irrational (Northcraft & Wolfe, 1984; Bowen, 1987; Brockner, 1992). Some authors have noted that many traditional demonstrations of escalation are difficult to interpret because they involve situations where people should rationally escalate investment (Northcraft & Wolfe, 1984).

Demonstrating that people are making *errors* of marginal decision making requires two things: (i) people must be confronted with investments that have identical marginal costs and marginal benefits, (ii) yet change their investment decisions when a sunk cost is present. Current evidence of errors of marginal decision making consists of two kinds of demonstrations: errors of de-escalation when marginal costs are explicit (Studies 1 and 2 of the current paper, Counter Games of Brockner & Rubin, 1985) and evidence of escalation when marginal costs are incidental (Study 5; Arkes & Blumer, 1985).

There is currently no evidence that people will make errors of escalating commitment when marginal investments are explicit. Unlike incidental expenses, explicit expenses increase total costs, and increased costs force decision makers against their budget limits. If people engage in budgeting, escalating commitment with explicit investments is not impossible as long as they are inside a budget limit. However, I will make the potentially controversial claim that the literature provides no clear demonstration of such errors because previous demonstrations of "escalating commitment" with explicit investments did not provide relevant information about marginal costs and benefits.

Study 4 indicates that when researchers omit information about benefits (e.g., Staw, 1976; Staw & Fox, 1977; Arkes & Blumer, 1985, Studies 3–5, Garland, 1990; Garland & Newport, 1991) their studies may not control subjects' expectations about the benefits of a marginal investment. Subjects may assume that benefits increase as sunk costs increase. For example, in Arkes & Blumer's (1985) decision problem (later used in Garland, 1990; Garland & Newport, 1991) subjects must decide whether to invest $1 million to complete a plane which is inferior to a product just introduced by a competitor. Subjects are more likely to invest the $1 million when they have already invested $10 million in the project than when they have invested nothing. However, this result does not provide evidence of an error of marginal decision making because the scenario does not adequately control beliefs about expected benefits. Subjects may reasonably believe that completing an $11 million project will provide better barriers to entry and more opportunities for competitive gain (despite the current superiority of the main competitor's design) than completing a $1 million project.

Other studies, although they control for expectations about benefits, do not control for expectations about costs. Staw's studies (Staw, 1976; Staw & Fox, 1977) manipulate whether subjects are personally responsible for sunk investments or whether they inherit sunk investments from another person. This manipulation probably controls expectations about future benefits since it manipulates personal responsibility rather than the magnitude of sunk costs, but it does not control expectations about future costs—high responsibility subjects are likely to face greater potential penalties from the social environment. Research by Staw has pointed out that decision makers may face social penalties for inconsistent behavior (Evans & Medcof, 1984; Staw & Ross, 1980) or may be penalized when their choices lead to poor performance. Escalation of commitment by high responsibility actors is clearly bad for the organization, but is probably rational for the individual; since high responsibility subjects may be penalized more for failure, they may overinvest in hopes of turning the situation around. Recently, economists have modeled exactly this kind of escalation in rational models (Kanodia, Bushman, & Dickhaut, 1989; Prendergast & Stole, 1995).

Thus, there is strong evidence that people are not marginal decision makers. The evidence consists of errors of escalation when marginal investments are incidental (Thaler, 1980; Arkes & Blumer, 1985), and errors of de-escalation when marginal investments are explicit (the current Studies 1 and 2). There are *no* compelling demonstrations of errors when marginal investments are explicit.

SUMMARY: ESCALATING AND DE-ESCALATING COMMITMENT

I have proposed that people set mental budgets for their investments and resist exceeding their budgets. This paper has provided several demonstrations of de-

escalating commitment that are interpretable within this framework. Previous theories of escalating commitment cannot account for these demonstrations.

The model of budgeting has been useful in distinguishing situations where people are likely to escalate and de-escalate commitment. The budgeting model argues that people set budgets and then track their investments against their budget. Study 3 demonstrated that when budgets are difficult to set because information about expected benefits is omitted, that people tend to escalate commitment. While this confirms an important part of the budgeting model, this and other demonstrations that omit information about expected benefits raise methodological questions of external validity and experimental control. Study 5 demonstrates that when investments are difficult to track because they are incidental rather than explicit, that people are likely to escalate commitment. While explicit investments force people up against their budget limits, people may undertake additional incidental investments in hopes of redeeming a sunk cost.

Previous research has attempted to find ways to limit *escalation* of commitment (Brockner & Rubin, 1985; Simonson & Staw, 1992). The current results indicate that concern about escalating commitment may be premature. Organizations (and general social rules) encourage decision makers to set limits and budgets. In organizations, it is not clear which is the greater evil: giving up too late or giving up too early. There are many situations where escalation is rational. For example, when benefits come from completing a project, investments toward the end of a project produce increasingly high marginal returns. In situations where there is learning, previous investments may decrease marginal costs and increase marginal benefits by moving people down a learning curve. Mental budgeting predicts that in such situations people are more likely to make errors of de-escalating commitment than escalating commitment—they will frequently exceed their budget and quit a time when marginal costs are declining and marginal benefits are increasing.

One research challenge will be to document de-escalation in the real world. Field research on de-escalation of commitment must deal with one of the perils of interpreting history: the historical record is more likely to record the presence than the absence of events. History documents engineering projects which were pursued too long. It is less likely to document projects that should have been pursued but weren't. Despite the bias in historical records, we should be able to uncover evidence of de-escalation in organizations. Anecdotal evidence indicate that decision makers in organizations abandon R&D projects because they have "spent too much money" on the project or abandon organizational change efforts because they have spent "too much time." These statements provide evidence of mental budgeting when they are made without reference to marginal costs and marginal benefits.

Like previous research, the current results suggest that it is important to train people in the principles of marginal decision making. But instead of training people to avoid a "foolish consistency," we may also want to train people to avoid a foolish *in*consistency.

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Received: February 16, 1993

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