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Sunk Costs and Financial Decision Making: A Review of the Behavioral Literature

Edward L. Conlon
Marya L. Leatherwood

College of Commerce and Business Administration
Bureau of Economic and Business Research
University of Illinois, Urbana-Champaign
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Edward J. Conlon
University of Iowa

Marya L. Leatherwood, Assistant Professor
Department of Business Administration

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ABSTRACT

Although normative models of financial decision making prescribe that sunk costs should be ignored when allocating resources to a course of action, behavioral decision research suggests that sunk costs have an affect on the behaviors of decision makers who experience them. Three behavioral science models, entrapment, escalation and prospect theory, are reviewed, the conditions under which such biases are likely to occur are identified and several strategies for managing the decision context are offered. The implications of these research findings for future research on the effects of sunk costs are discussed.
ABSTRACT

[The content of the abstract is not legible due to the quality of the image.]
"Bankers, being human, are reluctant to admit mistakes... One way to hide a little mistake is to bury it under a bigger one. So bankers cure a problem loan by lending more money to the source of the problem..."


Much of the scholarly literature in finance is devoted to the development and analysis of normative models. Academics, and financial managers, are rightfully interested in how to make the best decisions and judgments on financial matters. The above quote, however, illustrates a somewhat different concern of a behavioral nature. Unquestionably, the banker described by Mr. Dutcher is aware of the normative guidelines that inform lending decisions and has read the section on sunk costs in his accounting textbook. Why then, would he attempt to "cure a problem loan" by lending more and, eventually, bringing his bank to a state of collapse? Over the last decade, behavioral scientists have been researching questions of this nature. This paper reviews this research, discusses the implications and limitations of this research for financial managers, suggests some ways that contextual biases, such as those our banker faces, may be managed and describes several ways that financial researchers may examine these issues.

In this paper, we are interested in how financial decision makers respond to sunk costs, which are funds committed by the decision maker that cannot be recovered. Three models in behavioral science investigate such responses: The entrapment model, the escalation model and the prospect theory model. We proceed to a review of each.

The Entrapment Model

Entrapment is a process by which resource allocators become "trapped" in a course of action, generally as a result of their decision to enter the
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The Entrapment Model

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course of action in the first place. Entrapment has been studied in laboratory settings using investment decisions that are made over time. In these experiments, subjects are given an initial stake (of two to five dollars) and the opportunity to win an additional sum of money (a jackpot). In one experimental procedure, the "counter" design (Brockner, Shaw and Rubin, 1979; Brockner, Rubin and Lang, 1981; Rubin, Brockner, Small-Weil and Nathanson, 1980), subjects are seated in front of an electronic counter that displays numbers on a screen. Subjects are told that the counter will be set at "1" and increase by one unit each second. The jackpot will be won if the number on the electronic counter matches a number that was randomly generated prior to the experiment, but it is possible that no match will occur and, therefore, the jackpot will not be won. For each unit increment of the counter, subjects must invest one cent of their initial stake. At any time the subjects are free to stop the counter and leave with the remainder of their stake. As such, the entrapment design is a kind of repeated lottery where with each tick of the counter, the subject wagers one cent against the odds of winning the jackpot. The dependent measures of interest are the amount of time and money subjects invest.

Rubin and Brockner (1975) suggest that investment decisions become entrapping because resources (i.e., time, money) are viewed by investors as both investments and as expenses. As time passes, the cost associated with continuing the investment increases, but so does the presumed proximity to the goal (i.e., a return on the investment). Consequently, decision makers' motives for investing may shift from an initial desire to obtain maximum benefits from minimum costs to concerns for (1) achieving the goal, (2) justifying the costs-to-date or (3) saving face with others who observe the decision (Brockner and Rubin, 1985; Teger, 1980). The passage of time, by
increasing perceived goal proximity and the belief one has too much invested to quit (Teger, 1980), contributes to what has been called entrapment (Rubin and Brockner, 1975).

The research findings suggest that three factors contribute to entrapment. First, the investment process affects the amount of resources individuals invest. Investment decisions can be classified as active or passive. Active decisions are those that require continued authorization of expenditures. For passive decisions, the continued outlay of resources is automatic unless the decision maker decides to terminate expenditures. Research has shown that subjects stay in the lottery for considerably less time when the investment process is active (Brockner et al., 1979; Rubin et al., 1980). In addition, when decision makers establish limits on expenditures prior to the investment process, less money is invested than in conditions where no prior limits have been set (Brockner et al., 1979).

Second, the degree to which costs are salient to investors has also been shown to affect resource allocations (Brockner et al., 1981; Rubin and Brockner, 1975; Brockner, Rubin, Fine, Hamilton, Thomas and Turetsky, 1982). When investment costs are made salient by introducing cost-to-benefit ratio charts (Brockner et al., 1981; Rubin and Brockner, 1975), pointing out the risks associated with investing (Brockner et al., 1981) and increasing the rate of decrement on returns (Rubin and Brockner, 1975) allocations to the course of action are reduced. Interestingly, the timing of cost salient information also affects investments (Rubin et al., 1982). Cost charts, introduced midway through the investment process, do not reduce entrapment as effectively as cost charts introduced early in the investment process.

Finally, for some investment decisions, returns on investments depend on attaining other resources such as information, materials shipments, or
manpower. Rubin and Brockner (1975) report when subjects perceive these resources to be readily available, more time and money is invested compared with conditions where these resources are not as likely to be obtained. Thus, in addition to beliefs that the investment is likely to result in a return, the availability of other necessary resources may affect entrapment.

In summary, the results of this research indicate that less resources are invested when the costs of investing are salient, either through cost/benefit information or a decision process requiring active reevaluation. Furthermore, this research suggests that when decision makers are made aware of the costs associated with investing prior to the investment decision, they are more cautious about investing in a course of action. Consequently, individuals may reduce their allocations or, in some cases, completely avoid investing in the course of action (Nathanson, Brockner, Brenner and Samuelson, 1982).

Although the entrapment literature has examined a number of factors that underlie actual investment decisions, a careful examination of these studies raises some questions. First, most of the studies on entrapment have not provided subjects with information regarding the probability that investments would result in a return (i.e., winning the jackpot). In some studies (e.g., Rubin and Brockner, 1975), payoff probabilities have been explicitly stated, but most studies have either omitted this information or informed subjects that they had "a good chance of winning" the jackpot. If, in the absence of explicit payoff probabilities, the experimental manipulations affected subjective probability estimates of attaining returns, these estimates may account for significant differences in the amount of time or money invested.

Second, the absence of payoff probability information makes it difficult to determine what the normative allocation rule would be for these types of decisions. Although this research implies that "entrapment" is economically
irrational, this conclusion is questionable unless it can be demonstrated that individuals deviated from a normative rule. Consider the situation created by Rubin and Brockner (1975) where the payoff probability was explicitly stated to be .8. If the jackpot was $20.00, the stake was $4.00 and there were 400 ticks on the counter, for any particular tick it would be possible for the subject to calculate the expected value of the wager. For example, on the first tick, the chance of winning the jackpot would be .002 (i.e., $0.8 \times 1/400$) and the expected value of the return would be $.04, against a wager of $.01. On each subsequent tick, the subject behaving normatively should revise the probability of a win by (1) subtracting 1 from the total "pool" of ticks, which has the effect of increasing the odds, and (2) reconsidering the estimate that there is a .8 chance of winning given the evidence (i.e. number of losing ticks) accumulated to that point. At some point in the lottery, the expected value of the win may no longer exceed the additional investment (i.e., $.01). At this point, the normative subject should stop the counter. In those studies that have not given subjects information about the probability of a win, the appropriate stopping point cannot be determined without the assumption of some prior probability that one of the ticks is a winner. Interestingly, subjects following a Bayesian rule for revision, given the evidence, would always experience an increasing expected value and should never leave the course of action. It may also be the case, that in the absence of explicit information, subjects attempt to maximize their earnings. For example, subjects could have used some form of subjective expected utility (SEU) as the basis for their allocations. At a more primitive level, subjects could have used a rough cost/benefit analysis by deciding to invest a portion of their original stake not to exceed the amount of the jackpot. Although an examination of the mean allocations across
conditions indicates that investments on average rarely exceeded the jackpot, the corresponding cell variances indicate that some subjects did not adhere to this rule. Thus, individuals may have revised their estimates of the probability of winning the jackpot during the course of the experiment. Unfortunately, individuals' subjective probability estimates have not been measured during entrapment experiments. Consequently, it is not possible to examine how individuals' perceptions of risk may have affected their investment strategies.

Finally, subjects in these studies were provided an initial investment stake. One could speculate that subjects perceived this endowment as a "windfall". Thus, it may not be valid to assume that individuals will make similar investment decisions if they are either investing their own resources or acting as an agent for another investor.

The Escalation Model

From a financial perspective, investment decisions are future focused. That is, some form of cost/benefit analysis serves as the criterion for allocating resources. Staw and his colleagues (Staw, 1976; Staw and Fox, 1977; Staw and Ross, 1978; Fox and Staw, 1979) suggest, however, that individuals may become psychologically committed to pursuing an investment strategy (Fox and Staw, 1979; Staw, 1976; Staw and Fox, 1977; Staw and Ross, 1978). When a financial setback occurs, decision makers may shift their attention to past events and attempt to recoup losses by allocating additional resources. This phenomenon has been called "escalation" (Staw, 1976).

The theoretical basis for escalation is cognitive dissonance theory (Festinger, 1957). This theory states that individuals, faced with negative consequences arising from their actions, experience dissonance. Unable to change their past actions, individuals reduce dissonance by cognitively
restructuring the outcomes to be more positive. With respect to financial
decisions, this perspective suggests that decision makers, committed by their
previous actions, conclude setbacks are not as bad as they appear and continue
to invest resources.

Escalation has been examined in laboratory settings using simulated
business cases. In one case scenario, the Adams and Smith Financial Decision
Case (Fox and Staw, 1979; Staw, 1976; Staw and Fox, 1977), subjects are
provided earnings/loss statements for two divisions of a firm and either a)
select a division to fund (high responsibility) or b) are told which division
their predecessor selected (low responsibility). Successful outcomes are
manipulated by earnings/loss statements for the following five year period
that indicate the chosen division returned to profitable levels while the
unchosen division continued to decline. Negative outcomes are manipulated by
statements showing the reverse trend. After subjects are provided data for
the division of interest, they decide how much should be allocated to the
division for a second time period. The dependent measure of interest is the
dollar amount of this allocation.

Responsibility for the initial decision and negative outcomes have each
been shown to increase resource allocations (Staw, 1976). Responsibility and
decision outcomes also interact, indicating the highest allocations are made
when individuals are faced with negative consequences resulting from their
decisions (Staw, 1976). The typical pattern of allocations is displayed in
Figure 1. These allocation patterns, however, are not consistent over
multiple time periods. Following the occurrence of a second setback, decision
makers take a more cautious approach and allocate less funds to their
initially chosen division (Staw and Fox, 1977).
Following a setback, individuals may also attempt to justify their decisions to others. Fox and Staw (1979) found that as job insecurity and hierarchical resistance to an investment decision increased, so did commitment to a previously chosen course of action. These results suggest that allocations may be based on attempts to demonstrate the correctness of a previous decision or on beliefs that decision consistency will be rewarded (Staw and Ross, 1980).

The cause of a setback has also been reported to affect allocations. When an investment decision fails due to the actions of a third party, allocations are decreased (Staw and Ross, 1978) and subjects indicate a greater priority to abandon the project by sale to another investor (Leatherwood and Conlon, 1986). When negative consequences are attributable only to the decision maker's actions (Leatherwood and Conlon, 1986) or to unpredictable events of nature (Staw and Ross, 1978), these results are reversed.

Although responsibility for a decision, job insecurity, hierarchical resistance to an investment plan and setbacks attributable to the decision maker have all been shown to increase resource allocations, most of these case scenarios have not included sufficient information to allow for future-revenue-to-future-cost calculations. Northcraft and Wolf (1984) point out that because of the omission of prospectively relevant information "the economic rationality of further resource commitment is left indeterminable for the decision maker" (1984: 227).

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The omission of prospectively relevant information muddies the interpretation of this research. If, in the absence of prospectively relevant information, responsibility for a decision affects subjects' inferences about future events, these inferences may account for significant differences in allocation decisions. Conlon and Wolf (1980) found that responsibility for a decision reduced individuals' tendencies to use a calculating strategy when making allocation decisions. Thus, responsibility not only may alter subjects' interpretations of negative outcomes but also may affect their perceptions of risk, expected returns or likelihood estimates of future costs.

The external validity of the previous studies may also be limited. Given the ambiguous nature of the information provided in the case scenarios, individuals may have been forced into a retrospective focus. Therefore, it may not be valid to assume that, based on the research findings, individuals would act the same way if prospectively relevant information was provided.

Finally, this research has not examined decision making situations in which the allocation of further resources is explicitly, economically inadvisable. Although one study by Leatherwood and Conlon (1986) provided future-costs-to-future-revenues information to subjects (i.e., net present value), this information indicated that further allocations were economically advisable. Thus, in order to test whether or not psychological motivations outweigh economic concerns, research should be conducted that examines whether or not individuals a) pass up alternatives promising a better ratio of benefits to costs in favor of pursuing a current investment strategy or b) continue to invest when costs exceed returns.

Although future research is warranted before concluding that psychological commitment outweighs economic concerns, these findings have
indicated when the benefits of allocating additional resources are ambiguous, personal responsibility for a decision systematically affects resource allocations. Furthermore, responsibility may alter individuals' perceptions of future risks (Arkes and Blumer, 1985) as well as their evaluations of decision outcomes. Thus, for those decisions where a cost/benefit analysis may be difficult to conduct, as may be the case for decisions involving human resources or social welfare, psychological commitment may significantly affect future decisions.

The Prospect Theory Model

Consider the following scenarios.

Scenario 1. As the president of an aircraft company, you have earmarked 10 million dollars of the company's money to build a plane that would not be detected by conventional radar. When the project is 90% complete, another firm begins marketing a plane that is also not radar detectable and that is faster and more economical than your company's product. Should you invest the last 10% (1 million dollars) to finish your plane?

Scenario 2. As the president of an aircraft company, you have received a suggestion from one of your employees to use the last 1 million dollars of your research funds to develop a plane that cannot be detected by conventional radar. However, another firm has just begun marketing such a plane. It is also apparent that their plane is much faster and economical than the plane your company could build. Should you invest the last million dollars of your research funds to build the plane proposed by your employee?

Arkes and Blumer (1985) presented each of these scenarios to a different group of college student subjects and asked them to indicate what they would do as the president of the aircraft company. On the first scenario, 41 of 48 subjects polled indicated that they would complete the airplane. On the
second scenario, 10 of 60 subjects indicated that they would build the airplane. These results are representative of a series of results presented by Arkes and Blumer that demonstrate a sensitivity of decision makers to the prior expenditures made to a project. Using the same scenario, those authors showed that subjects estimated a larger probability of financial success for the product in the first scenario when statistically contrasted with the second. They also showed that the differences between the responses to the scenarios were not caused by implicit cues about product quality. Subjects behaved the same when the second scenario required a 10 million dollar expenditure as when it required a 1 million dollar expenditure.

In order to combat the artificiality of having college students pretend they are corporate presidents, Arkes and Blumer (1985) also designed an ingenious field experiment to demonstrate the sunk cost effect. The first 60 people who approached the ticket window to buy season tickets to a University Theater's program were randomly chosen to be sold one of three types of tickets: Full price ($15), two-dollar-discount and seven-dollar-discount. Tickets were color coded so that the attendance of these ticket holders at events could be monitored by evaluating the ticket stubs for each event. The data indicated that full price ticket holders attended significantly more of the events held during the first half of the season than the discount ticket holders. This result is consistent with the results of the experiments using the more artificial scenarios, that is, the ticket holders with the greatest sunk costs attended the greatest number of events. It is also noteworthy that the most obvious threat to this study, that ticket holders would sell or loan their tickets to others, would tend to work against the obtained results. Interestingly, the effect of the sunk costs did not persist beyond the first several events.
Although Arkes and Blumer's experiments were conducted in simple contexts, they provide convincing evidence that decisions are affected by sunk costs. Later in this paper, we shall argue that sunk costs will have even more potent effects in most managerial contexts. At this point, we describe a theory to explain the results of these simple studies.

Thaler (1980) suggested an explanation of sunk cost effects, of the type found by Arkes and Blumer, that was based on prospect theory (Kahneman and Tversky, 1979). At the heart of this theory is the value function, illustrated in Figure 2, that maps the dollar amount of gains or losses onto the value (or utility) experienced by the recipient. This empirically derived function, defined over gains and losses with respect to some natural reference point, is concave for gains (v) and convex for losses (v) and is steeper for losses than gains. This value function can be used to explain the sunk cost effects observed by Arkes and Blumer. In the aircraft president example, suppose that the value of the plane to the aircraft company, in the face of competition, is v(g), and that the value of the cost of the plane (i.e. the R&D expenditure) is v(-10M) in the first scenario and v(-1M) in the second scenario. Further, let us assume that v(g) = -v(-1M) so that the allocator would be indifferent to making the expenditure in the second scenario. The value position of the allocator in the first scenario is v(-9M), or the value of the sunk cost. The shift from indifference to action in the case of sunk costs is explained by the convexity of the value function for losses since v(g) - v(-10M) > v(-9M). Thaler (1980) describes this as a kind of "cognitive accounting". In the first scenario, where there are sunk costs, the allocator equates costs to losses and evaluates the situation from a loss position whereas, without sunk costs, the situation is evaluated from a neutral position. The starting position or "frame" (Tversky and Kahneman,
1981) from which the decision maker evaluates the decision is critical. In general, the larger the sunk cost, the greater the impact of any gain on the final value position.

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Insert Figure 2 about here

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Unlike the other escalation and entrapment paradigms which have evaluated a range of context effects on decision makers, the prospect theory paradigm is entirely cognitive. The major consideration of prospect theory is the way that the decision maker edits or frames the situation, that is, does he/she perceive the current position as positive (gain) or negative (loss). By the mechanisms described above, the framing of the situation then affects the net utilities assigned to the various decision alternatives.

Biases Caused by Sunk Costs

As the literature reviewed above indicates, there is evidence that sunk costs have an effect on the behaviors of decision makers who experience them. This section specifically identifies the various effects that have been associated with sunk costs and, using the literature, discusses the conditions under which the effects are likely to occur. We have sorted these effects, or biases, into three categories: Effects on decisions, effects on information creation and search, and effects on information transmission or communication.

Sunk Costs and Decisions

A dominant finding, which cuts across all three paradigms, is that the experiencing of sunk costs is frequently associated with continuation, or even escalation, of allocations to a course of action. It is important to note that this type of effect has not been consistently observed, and there appear
to be several preconditions necessary for the effect to be obtained. These conditions, which we shall discuss below, are (1) the amount and type of information available to the decision maker, (2) the perception that foregoing sunk costs would be wasteful, (3) the relationship between the allocation and some more general strategy of the decision maker, and (4) the salience of opportunity costs.

Information Issues. The quantity and content of the information available to decision makers appears to be a critical feature of escalation and entrapment experiments. The decision maker, in both of these paradigms, is placed in a position of relative "information poverty" where few if any rational guidelines are available. Staw's (1976) experiment provides a good illustration. In this experiment, the individuals who tended to escalate (i.e., the high responsibility - failure condition illustrated in Figure 1) were asked to decide how much to allocate to the R&D efforts of a corporate division. The same division had received 5 million in R&D funds five years earlier, but performance had continued to decline. The only data available to assist allocators in this decision were the sales and earnings of the division since the last allocation was made, and the instruction that a fixed pool of funds is available to fund R&D which, if not used on the corporate division, will be used to fund other projects.

The information given to the allocator in this scenario is insufficient for the him/her to apply normative guidelines to the decision. Even though Staw's results show that allocators who were responsible for a failure tended to allocate greater amounts to the failing project than those who were not responsible, this is not convincing evidence that the allocators were rejecting normative decision rules. Recently, two studies have suggested that this impoverished information environment may be essential for the
demonstration of escalation. In a study by the authors (Leatherwood and Conlon, 1986), the information provided to allocators in a high-responsibility, failure situation was varied. Subjects were required to make additional investments to a real estate project where, in one condition, they had net present value information, and in the other they did not. The NPV suggested project continuation and further investment. We found that (1) the allocations of the subjects receiving NPV information had less variance and (2) were less frequently above the normatively determined amount (i.e. what it should take to finish the project) than those not receiving the NPV information. Conlon and Parks (1986), using Staw's (1976) experimental design, found that subjects who were sensitized to the lack of information available to them tended to withhold funds from the corporate division, rather than escalating like the subjects in Staw's study. Together, these studies suggest that escalation of allocations is most likely when either the risks of escalating are made salient to decision makers, or when justifiable norms for allocations are not available.

Waste Issues. There is evidence that allocators are affected by the extent to which the foregoing of sunk costs is perceived as wasteful. Arkes and Blumer (1985) created a dilemma where subjects were asked whether or not to spend money on a new piece of manufacturing equipment that would be significantly more economical than existing equipment having no salvage value. In the low waste condition, the existing equipment had been owned by the firm for some time. In the high waste condition, the firm had recently purchased the equipment. In the former case, subjects were far more likely to buy the new equipment than in the latter case. It appears that the relative size of the sunk cost affects the willingness of the individual to change a course of action.
Strategy Issues. Sometimes an investment or allocation to a project is closely tied to a corporate strategy or plan. In these cases, the tendency to continue the project is enhanced by the existence of the strategy. Several examples of this were identified by Conlon and Wolf (1983), who used focus group interviews to gather information about the actual sunk cost experiences of managers. These interviews were conducted with small groups of senior managers in a convenience sample of nine corporations headquartered in a single American city. The result of the interviews, which were taped, was the identification of sixteen decisions in which sunk costs were present. More specifically, these were decisions where a resource commitment had been made with disappointing results, and a decision had to be made to continue resource allocation to the course of action.

In four of these cases, the decision to continue a losing course of action was justified using the relationship between the course of action and corporate strategy as a justification for continuing. In one case, a financial service company had opened a branch office in New York City. Over five years, this office lost an average of one million dollars per year. Nonetheless, the company continued the operation of the office because of the importance of "having a New York presence" in its general strategy of moving from a regionally to a nationally known firm. In another example, a high technology firm entered a new product market five years before the market was capable of sustaining a positive cash flow for the product line. Although the company was not aware of this delay going into the venture, continuation was justified by the strategy of the firm to dominate its product markets by establishing a "first mover advantage".

Interestingly, the managers in the New York City office case claimed, although accounting data could not prove it, that the firm's presence in New
York City created client relationships that "spilled over" into products and services that were not handled by the New York office, thus asserting the financial wisdom of the decision as a matter of faith.

**Opportunity Costs.** Recently, Northcraft and Neale (1986) investigated the effects that the salience of opportunity costs had on the tendency of decision makers to escalate. Perhaps not surprisingly, they found that when opportunity costs were made salient, the tendency of allocators to continue a course of action was reduced. Their results suggest that the escalation phenomenon in part reflects the tendency of allocators to ignore opportunity costs.

**Biases in Information Search and Creation**

The presence of sunk costs may also be related to the types of information sought and created by managers. Staw (1981) proposed that escalation occurs as individuals try to justify their past behavior using present actions. That is, they seek to make their past behavior appear rational, a process Staw calls retrospective rationality. This is in stark contrast to prospective rationality, in which decision makers attempt to maximize their future outcomes. In a recent study, one of the authors evaluated this theory by examining the kinds of information sought by decision makers in the escalation context (Conlon and Parks, 1986). Using the same design as Staw (1976), the study allowed allocators to request various types of information prior to making their R&D allocation to the corporate division funded earlier. Based on a prescaling by a separate sample, two of the five types of information files available (i.e., a forecast and a research prospectus) were determined to be future oriented and useful for justifying how much to give to the R&D effort, and three (i.e., an R&D report, a file of memoranda justifying the past decision to invest and a report by the CEO on
past R&D) were determined to be past oriented and useful for justifying the past decision to invest in the previously chosen division. Subjects were told to choose information in the order of its importance to their decision, so that the first file chosen would be the most important. An analysis of these information choices across experimental conditions showed that 75\% of the subjects in the high responsibility-failure condition tended to choose information that was more oriented to justifying the past. Only 20\% of the subjects in the low responsibility or success conditions chose such information.

The implications of this finding go beyond the specification of the information preferences of decision makers. These results suggest that the creation of information within organizations may be biased by sunk costs. To the extent that such information is included in the databases and archives available to aid future decision makers, the sunk costs could have an impact on future decisions that are not directly related to the sunk costs. These biases may also represent a misallocation of the resources spent on the acquisition and processing of information within organizations.

Transmission of Information

In addition to affecting the types of information that decision makers request, sunk costs may also affect the types of information that decision makers communicate to others. Faced with negative feedback about a project's financial progress, decision makers may attempt to justify, either to themselves or to others, the resources already sunk into the project. Consequently, information regarding the project that is transmitted to others may be distorted.

Information distortion can take many forms. First, the amount of favorable and unfavorable information communicated to others may be affected...
by such factors as personal responsibility for the investment decision. A number of studies report that unfavorable information is often omitted or filtered when communicating with supervisors (Caldwell and O'Reilly, 1982; Leatherwood, 1986; O'Reilly, 1978; O'Reilly and Roberts, 1974). The amount of favorable information that is communicated may, however, be increased (Caldwell and O'Reilly, 1982; O'Reilly, 1978; O'Reilly and Roberts, 1974) or reduced (Leatherwood, 1986). The transmission of favorable information may depend on decision makers' beliefs that future setbacks will occur. If decision makers are uncertain about future events, both positive and negative information about the investment may be filtered from others (Leatherwood, 1986).

Information impactedness creates problems since others' evaluations of a project's financial progress will be based on a subset of potentially relevant information.

Second, decision makers may be selective in communicating events that could be the underlying causes of a financial setback. Decision makers, motivated to justify their previous decisions, may cite external events as being the cause of decision failures. Some recent examinations of corporate reports indicate that a firm's financial performance is significantly related to the types of causal attributions included in annual reports to the stockholders (Bettman and Weitz, 1983; Salancik and Meindl, 1984; Staw, McKechnie and Puffer, 1983). While high performing firms cited internal factors as the cause of their financial performance, low performing firms included more external attributions in their reports (Bettman and Weitz, 1983; Staw et al., 1983).

The decision context has also been shown to affect information distortion. When decision makers were constrained from filtering negative information from others, more information about external causes for the
failure was communicated (Leatherwood, 1986). These results suggest that information filtration may be used when decision makers have an information advantage. But, under conditions where the information recipient is privy to information about the investment strategy, the communicator may manipulate causal attributions to justify the previous decision.

Finally, information distortion may result from the communication of information that, by contrast, makes the outcomes of an individual's actions appear more favorable (Campbell, 1958; Leatherwood, 1986). If a setback reduces the rate of return on an investment from 21% to 16%, decision makers may report that another investment is only showing a 12% return. Thus, in comparison, the project with the 16% return may be more favorably evaluated by others.

Information distortions may occur for a number of reasons. First, information distortion may be the result of a perceptual bias. That is, decision makers may pay more attention to confirming versus disconfirming evidence. As a result, more positive and less negative information may be communicated to others. Alternatively, responsibility for a decision may result in more optimistic projections of future returns (Bazerman, Beekun and Schoorman, 1982). Thus, decision makers may minimize the value of negative information and search for external causal events that are likely to be short term. Finally, decision makers may distort information in order to justify the correctness of their decision to others. Consequently, responsibility for a decision that has suffered a setback may result in attempts at impression management with others through information transmission.

Managing the Decision Context

This section of the paper describes several strategies for structuring and managing decision contexts to avoid some of the biases associated with
sunk costs. These strategies involve: Improving the recognition of sunk costs, providing appropriate incentives, providing appropriate information, and utilizing organizational structure.

The Recognition of Sunk Costs

According to Kaplan, "sunk costs are those costs unaffected by the choice from the present set of alternatives" (1982, p.28). One of the problems faced by elementary cost accounting students and experienced managers is recognizing that sunk costs are not irrelevant, but they are already accounted for by normative (prospective) models and that any further consideration of those costs would be equivalent to "double counting" or overweighting their influence on decisions. For example, it is certainly relevant that the aircraft company in Arkes and Blumer's scenario had spent 9 million in research and development on a "radar proof" airplane, but the relevance of these costs is captured in the sales potential and costs of manufacturing the airplane. Hopefully, the expenditure has created assets in the form of plans, knowledge and capabilities that will be reflected in the costs and market potential of the product. Any further consideration of the amount spent on R&D, beyond this asset value, is normatively inappropriate.

Why do students and managers have trouble treating sunk costs in the normatively appropriate way? One problem is that project evaluation is sometimes confused with the periodic evaluation of a project's performance. In the former, the overall feasibility (ex ante) or wisdom (ex post) of the project is questioned. In the latter, the question is one of project continuation. It can be economically rational to discontinue a project that would yield overall positive returns or to continue one having overall negative returns depending on the best use of current funds. Independently of how a manager's performance is evaluated or how his incentives are determined,
it may be difficult to ignore the overall performance of a project when making
day to day decisions about continuation. Northcraft and Wolf (1984) discuss
how, when unexpectedly high costs are incurred early in a project's life
cycle, decision makers may attempt to "recover" those costs through further
allocation. This notion of recovery is equivalent to an attempt to improve
the overall performance of a project by remaining in a project at the point
where much of the costs have been experienced and revenues are beginning to
accrue.

One way to reduce the confusion that occurs between overall project
performance and periodic evaluation for allocation decisions is to carefully
structure the information available to allocators. Northcraft and Wolf (1984)
suggest the use of time adjusted rates of return (TARR) (Horngren, 1982) to
guide decisions based on periodic performance evaluations. TARR considers
only the future cashflow implications of continuing a project, and sucessfully
separates the decision to continue a project from the overall project
performance. The impact of the sunk cost on project performance is given by a
comparison of the overall performance of the project with an organizational
goal or expectation for the project. The impact of sunk costs that is
relevant to current decisions is given by TARR. A limitation of TARR is the
requirement that all future costs and benefits be quantified. This may be
particularly troublesome for projects whose benefits are largely social, are
diffuse, or where the completion of the project is a necessary event in a
broader strategy that chains a number of projects together in a temporal
sequence. Even when TARR can be calculated, we feel that the control of
decision biases attributable to sunk costs depends on how the decision makers'
incentives are tied to performance.
Providing Appropriate Incentives

The effects of incentive structures on individuals' decision behaviors have been examined in the literature on agency relationships. Agency theory (Demski, 1980; Demski and Feltham, 1978; Ross, 1973) addresses the problems that are likely to arise when one party, an agent, is given authority for decisions that affect a principal's profits. When information between the principal and the agent is symmetric (i.e., the principal observes the actions of the agent via monitoring systems or task design), problems of agent negligence or face saving are not expected. In these cases, the principal can take recourse if the agent shirks or attempts to conceal information. Thus, the principal, presumably lacking psychological commitment to any particular investment decision, will be able to assess the expected benefits to be derived from investments and provide checks and balances against the agent's investment decisions.

For many cases, however, information will not be shared between the two parties (i.e., asymmetric). Consequently, if the agent distorts information, either through communications or by assembling an incomplete or biased information base, the principal will not be privy to the information that may allow for a more objective assessment of costs and benefits.

In the case where information asymmetries arise, some agency theorists recommend that contractual arrangements be used to motivate agents to exert additional decision effort or to minimize face saving attempts. By implementing outcome controls that couple agents' financial rewards with the financial outcomes of their decisions, agency theory implicitly assumes that agents will be more objective in calculating future returns since their future financial outcomes are contingent on the benefits derived from their
investment decisions. Outcome controls, however, may not always reduce the biases that may arise following setbacks that create sunk costs.

As discussed in the previous section, TARR provides a clear specification of when a financial setback is likely to constitute a rational decision to terminate or abandon a project. However, as noted by Northcraft and Wolf (1984), finishing a project efficiently based on a TARR for periods later in the project's life cycle may not offset the project's overall subpar performance. Stated differently, even if a project is destined to lose money overall, there may be a point in the project's life cycle after which the TARR obtained by additional allocations will be greater than what could be obtained by alternative investment opportunities. Thus, as pointed out by Northcraft and Wolf (1984), if agents can get the project to that point in its life cycle, their periodic performance reviews will look good for the remainder of the project. Consequently, if the principal rewards the agent for turning a loss into a success versus holding the agent accountable for an entire project, suboptimal investment decisions may result. Prior to implementing incentive structures that couple an agent's rewards with decision outcomes, managers should carefully consider what investment outcomes are desirable.

Outcome controls may also affect the budgeting and accounting techniques that agents use for calculating costs and benefits. Some techniques may indicate gains that reflect favorably on the decision maker. However, these gains may be of a short-run nature. A recent study by Hill (1986) indicates that management may be sensitive to these aberrations and, in the case where responsibility centers are implemented, internal audits may be increased to ensure that the reported financial data are in the firm's long-run interests.
Finally, coupling an agent's financial outcomes with investment returns may exacerbate cognitive biases. The prospect theory model proposes that the utilities for gains are treated differently than for losses. If agents are risk averse toward gains but risk prone toward losses, a financial setback that threatens loss of personal income may lead to greater efforts to turn a setback around by escalating resources to the investment strategy.

This section has noted some of the potential problems that could arise from implementing incentive systems that may not be aligned with the organization's best interests. The behavioral research suggests that individuals become psychologically committed to pursuing an investment strategy and, as a result, perceptual biases, information biases and information distortion may result. Ultimately, incentive systems that reduce these biases are desired. In order to reduce these effects, incentive systems should be considered that reward agents for considering various investment alternatives, obtaining and sharing relevant information about investments along with realizing good returns from their investment decisions. By focusing attention on decision processes in addition to decision outcomes, agency problems of this nature may be minimized.

**Providing Appropriate Information**

Providing certain types of information to agents may also reduce the biases that may result from sunk costs. The research on entrapment indicates that cost/benefit information reduces the amount of time and resources that individuals expend (Rubin and Brockner, 1975). In addition, the point at which this information is provided during the decision process also has been shown to affect resource allocations. Cost/benefit information has been shown to be more effective when provided prior to the investment process than when provided at the middle or later stages of the decision. Thus, in order to
reduce the biases that may result from sunk costs, agents should be aware of the costs and the expected benefits of additional expenditures. This information should be made salient prior to selecting an investment strategy and should be updated at regular intervals, especially prior to additional expenditures.

If agents are responsible for gathering and compiling this information themselves, computer assisted systems that allow for a number of cost/benefit calculations should be accessible to reduce the time necessary for such efforts. A system that incorporates TARR would also aid agents in determining if current rates of return are biased in favor of continuing the investment while the overall returns are less than the investment costs.

Finally, managers should affirm the utility of considering this information. That is, if a setback renders an investment suboptimal in relation to an alternative investment strategy, agents should be assured that the corporation values this information and their communication of this data.

Utilizing Organizational Structures

In addition to providing appropriate incentives and information to assist agents in their investment decisions, various organizational structures may also minimize agency problems. Although hierarchical control over investments will reduce agents' abilities to become entrapped by their previous decisions, hierarchical controls are costly and time consuming. If upper management is required to continually evaluate and approve expenditures, the opportunity cost of this attention will be high.

Internal and external auditing procedures have been a common practice for many financial institutions. These procedures ensure stockholders and upper level managers that agents' decisions are in their best interests. However,
these practices are not free and the costs will be borne by the firm or by the shareholders.

Williamson (1975) contends that worker peer groups can provide similar benefits to the organization that are traditionally derived from hierarchical controls or costly auditing procedures. Worker peer groups, or teams, provide a number of efficiencies in the decision process. First, the cost of providing information to agents is economized. Policies regarding incentive structures, evaluation procedures, the value of cost/benefit information or the benefits to be derived from an investment strategy can be communicated more efficiently to teams than to individual agents.

Teams not only allow for providing appropriate information in a more efficient manner, but may also reduce information distortions. Given that teams change the "ownership arrangements" (i.e., access to investment information), individual agents will be constrained from nondisclosure or distortion of relevant information. Holmstrom (1982) has shown that competition among agents, such as would result from teams or multi-agent settings, has merit as a device to extract information. Thus, information impactedness may be reduced through the use of investment teams.

In summary, the formation of teams for investment decisions may be an effective way to reduce the biases arising from sunk costs. As long as team members are engaged in a common investment strategy or an integrated set of investment strategies, team members will be able to mutually monitor one another. Because the team, rather than any individual agent, is better able to bear risks, the team approach may be preferred by individual agents as well. Finally, the team approach allows for better ex ante screening of information in addition to ex post monitoring for information distortion or omission.
Research Directions

It should be evident to the reader that most of the research on responses to sunk costs has been conducted by behavioral scientists, rather than financial researchers. This trend has had several implications for this review. The most important of these is that the experimental contexts used to produce and evaluate sunk costs effects may or may not resemble the decision making contexts assumed by financial theorists when they develop and prescribe normative approaches to financial decisions. The financial theorist may wonder if the sunk cost phenomena revealed by the behavioral literature are applicable to most prototypical financial decision making contexts. Our response to that question would be to concur that much of the research may have been "contextually naive" or "normatively naive", but also to stress that there is no prima facie case for assuming that the escalation, entrapment and prospect theory effects would not generalize to investment decisions, loan decisions, merger and divestiture decisions and many of the other contexts of interest to the financial researcher. We believe that financial researchers should begin to conduct their own investigations of the phenomenon. These investigations are likely to be more tightly tied to particular decision contexts and are likely to use non-laboratory methodologies. The authors know of only a few studies which have attempted to investigate a variety of sunk cost decisions in real contexts. One study already mentioned, by Conlon and Wolf (1983), suffers from the problem of non-comparability of contexts. The 16 decisions identified in that study were distributed across issues of merger and acquisition, capital improvement, new product development and business expansion. In contrast, the financial researcher interested in mergers and divestitures might exclusively study real instances of those decisions and
compare cases with sunk cost considerations with those having no sunk costs. A field study by DeBondt and Majkeja (1985) is an example of such work. These authors investigated the impact of sunk costs in the electric utility industry and were unable to provide strong support for a sunk cost effect. The financial researcher's familiarity with particular decision contexts should produce stronger evidence and insights into the nature of sunk cost effects, as they occur in the field, than those offered in previous research.

Since most of the research conducted by financial researchers involves the prediction and explanation of phenomena through the use of economic models, it is useful to ask how the sunk cost phenomenon might be investigated within such research methods. The tactic used by most financial researchers who have investigated behavioral phenomena (e.g., de Bondt and Thaler, 1985; Shefrin and Statman, 1985; Shiller & Pound, 1986) has been to observe behavioral outcomes and to systematically compare them with the outcomes that would be predicted by established financial models. The test of the "behavioral effect," then, involves the comparison of the observed pattern of residuals (i.e., observed outcomes - expected outcomes) with the size and signs of the residuals that would be predicted by the behavioral effect. A good example is de Bondt and Thaler's (1985) examination of stock market overreaction to unexpected or dramatic news events. Using CRSP data, they compared the returns, residualized by the capital asset pricing model, of two stock portfolios over 36 months. The "loser" portfolio consisted of stocks which had experienced extreme capital losses in the pre-portfolio formation months, and the "winner" portfolio consisted of stocks which had experienced extreme gains in that same period. The data revealed that the cumulative average residuals of the "loser" portfolio dramatically exceeded those of the winner portfolio over the 36 month period. In other words, the null
hypothesis was that the returns of the two portfolios, once adjusted by the Capital Asset Pricing Model (i.e., the normative model), would be equivalent. The size and direction of the obtained difference was consistent with the overreaction hypothesis which was based on the behavioral theory that forecasters would tend to underweight base rate data and overweight recent or dramatic information when predicting the future.

A similar strategy could be used by financial modelers to explore sunk cost effects. Just as de Bondt and Thaler operationalized differences in information by forming and classifying two a priori portfolios, financial researchers could parameterize sunk costs by partitioning a class of firms or individuals according to the degree of experienced sunk costs. In the weakest instance, this would result in a categorical distinction (i.e., sunk costs present vs. sunk cost absent) and in the strongest, a ratio measure of the extent of these costs (i.e., a continuous variable). Once parameterized, sunk cost effects could be evaluated in combination with the more traditional economic predictors of firm or individual behavior. The effective use of this research strategy requires that the normative (or traditional) model is properly specified and is not confounded with the sunk cost distinction. In particular, it should not be possible to argue that the sunk cost parameter acts as a surrogate for parameters left unspecified (e.g., risk) by the economic model. A good example of this concern, and its treatment, is discussed by de Bondt and Thaler (1985).

It is likely that the most important limitation on sunk cost research, using traditional econometric methods, is the relative unavailability of data. Most obvious examples of sunk costs apply to particular projects or types of investments. Ideally, the researcher should be able to determine the amount invested in a particular course of action and its result in terms of

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asset creation or some other value metric. When firms are the unit of analysis, an adequate methodology may require going beyond standard financial tapes to obtain these values. Researchers interested in sunk costs at the firm level should attempt to find industries that have established accounting and reporting standards for particular types of expenditures. Often industry publications or annual reports will contain useful data. Researchers interested in individual investor behavior may rely either on specialized, archival data bases (e.g. Sheffrin and Statman, 1985) for analyzing whole classes of investors, or questionnaire data (e.g., Shiller and Pound, 1986) for examining the actions and attitudes of specific investors.

Financial researchers should also be interested in how financial information may contribute to sunk cost effects. The research reported here on entrapment and escalation suggests that the effects of sunk costs may be reduced by providing information such as cost/benefit charts and net present value data. Are there situations where particular types of financial data may actually contribute to escalation? The distinction between project review and periodic review suggests such a context. It is possible for periodic review data (e.g. TARR) to suggest continuation where the project review would suggest otherwise? The question concerns whether continuation would really be desirable. It is arguable that in the short run, stockholders and other important constituencies may be more interested in the overall performance of projects than in the financial wisdom of the last dollar spent. The overall policy implications of how sunk costs are managed need to be addressed by financial theorists. Financial researchers may find it necessary to conduct experiments, much like those described earlier in this paper, in order to evaluate information issues. The external validity of such research could be
enhanced through careful task design and the use of financial managers as subjects.

Finally, we want to encourage financial researchers to consider how to better control the responses of decision makers under sunk cost conditions. In this paper, we have suggested that information and incentives may be the key ways to achieve control. Financial researchers should work on the precise ways in which incentives should be structured and information should be produced to control the tendency to throw "good money after bad".
Footnotes

1. The Adams and Smith financial decision case (Staw, 1976; Staw and Fox, 1977; Fox and Staw, 1979; Conlon and Parks, 1986), the World Bank case (Staw and Ross, 1973; Conlon and Wolf, 1980), Conwood, Inc. (Leatherwood and Conlon, 1986).
References


Figure 1

Typical Results of an Escalation Experiment
(From Staw, 1976)

Allocation in Millions

High Responsibility

Low Responsibility

Failure
Success
Figure 2

An Hypothetical Prospect Theory Value Function
(Adapted from Kahneman & Tversky, 1979)