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Although an important aspect of managing new product introductions is to recognize and quickly take action when a product launch has failed (i.e., "pull the plug"), senior managers in a new product launch setting tend to remain committed to a losing course of action. The authors investigate this issue with controlled experiments, using senior level executives as subjects. Their results suggest a strong bias toward continued commitment to failing new products. Consequently, the authors devise and test the effectiveness of five decision aids aimed at reducing this bias. Improving the quality of the information environment does not greatly reduce bias, nor does precommitment (at time of launch) to self-specified decisions rules. The most effective methods of reducing commitment to a losing course of action appear to be either precommitment to a predetermined decision rule or introduction of a new decision maker at the time of the stop/no stop decision. Of these two methods, the latter produces marginally less commitment to a losing course of action. However, none of the tested decision procedures completely reduces commitment to a losing course of action relative to the control condition.

Pulling the Plug to Stop the New Product Drain

Many new products fail. Furthermore, the new product failure rate of approximately 35 to 45% has not changed greatly over the last 25 years (*Business Week* 1993; Wind 1982).[1] Perhaps because of this high failure rate, most research to date on new product introductions has focused on improving the initial go/no go decision and reducing the probability of failure after launch. We take a different approach. Rather than attempt to reduce the new product failure rate, we assume that new product failures are a byproduct of doing business in an uncertain world. Thus, some new product failures are inevitable. Furthermore, we posit that how a firm fails matters. Quick recognition of a product failure versus a lingering product death can have significantly different financial implications. Consequently, we focus on the "how to fail" question and investigate how companies can better deal with new product failures by enhancing the quality of the stop/no stop decision.

To understand the importance of this research better, imagine the following scenario: Suppose that a company decided to launch a new product two years ago. The company now reevaluates its initial decision and compares the value associated with continuing to market the new product to that of discontinuing the new product offering. Twenty capital budgeting experts study the two values of these options and unanimously recommend pulling the product. Next, 195 senior managers are given this same choice under a variety of information settings, and only 64 recommend pulling the product.

This "hypothetical" scenario is exactly what we find in our research. On the basis of this evidence, we conclude that "pulling the plug" on new products is problematic for companies. Anecdotal evidence about product failures spanning many decades also supports this conclusion. An example from the 1950s is the prolonged failure of the Edsel. After meeting with market failure on an initial $250 million investment, Edsel production continued for two and one-half years, burning up an additional $200 million in capital (Whyte 1991). An example from the 1980s and into the 1990s is that of the NeXT desktop computer. Introduced in 1988, the product was shipped until 1993 despite poor market performance. Over this period of time, NeXT eroded $200 million in investment funds (*Business Week* 1993). Additional examples reside in the public domain. Furthermore, conversations with senior managers lead us to believe that proprietary examples of lingering failure outnumber the publicly revealed examples.

[1] Discussion at the Innovation in New Product Development Conference suggested that, if anything, this failure rate is increasing.

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Our general goal is to gain a better understanding of the deviation between actual and normatively appropriate behavior. In particular, we pursue three goals: (1) demonstrate that managing new product failures deserves greater attention, (2) gain a better understanding of why the withdrawal decision is problematic, and (3) identify procedures that improve the stop/no stop decision.

We begin by discussing the well-known phenomenon of commitment to a losing course of action, with particular emphasis on the context of managing a new product introduction. We then review general strategies for reducing escalation of commitment (in our case, increasing the probability of the stopping decision). We discuss implementing these generic de-escalation strategies through several decision approaches and present our associated hypotheses. We follow this with a description of our proposed decision approaches. A unique feature of one proposed strategy is a decision aid that is based on an a priori determined withdrawal rule. We describe the experimental procedures used to test our hypotheses and then present results from our experimental studies using executive decision makers. We conclude with a discussion of possible methods for improving the stop/no stop decision.

To preview our conclusions, we find that implementing de-escalation strategies through a decision aid framework that enhances the information environment by (1) acknowledging the existence and magnitude of market uncertainties and (2) providing opportunity costs does not greatly reduce the problem of prolonged commitment to new product failures. We attribute this result to managers' distortions of the provided information because of their use of decision heuristics. In particular, we obtain compelling evidence that suggests managers distort the provided information to make the new product introduction look more successful than it is in reality. We also find, unlike Simonson and Staw (1992), that precommitment to a self-determined stopping rule is of little value in reducing escalation bias. We attribute this finding to the manager's difficulty in defining an accurate stopping rule when making decisions in a complex environment. However, we find that getting managers to precommit to an informed stopping rule determined by an external source reduces distortion of the new information and lessens the tendency of commitment to a losing course of action. We find marginally greater success in reducing commitment to a losing course of action by using a new (independent) decision maker for the stop/no stop decision.

PROLONGED COMMITMENT TO NEW PRODUCT FAILURES

A large and well-established literature deals with the issue of prolonged commitment to a losing course of action, that is, good money chasing bad (e.g., for a brief review, see Simonson and Staw 1992). This prolonged commitment usually falls under the heading of either the fallacy of sunk costs and framing effects (e.g., Arkes and Blumer 1985; Whyte 1986) or the escalation of commitment due to self-justification (e.g., Staw 1976, 1981). Briefly, the fallacy of sunk costs refers to the tendency of managers to consider nonrelevant prior costs when making future decisions. For example, a person may frame his or her current decision relative to a prior loss (Whyte 1986). If so, and if prospect theory is in effect (Kahneman and Tversky 1979), then the person will gamble more to make up for losses relative to how he or she would behave if the decision were framed from a neutral starting position. In our case, a manager may gamble on staying the course as the only way to get a return on a prior investment (sunk cost). Similarly, desire on the part of managers to justify an initial decision yields prolonged commitment to a losing course of action even when the probability of future success is minimal.

To illustrate the phenomenon of good money chasing bad as a result of self-justification, imagine that a person previously made a go decision on a new product introduction. He or she receives some initial market feedback on this decision and must now determine if he or she will continue investing in the product or pull it from the market. Although the available market information is ambiguous, most (but not all) of the information indicates that the product introduction is not going well.

In deciding whether to continue support for the new product, recognize that if the person withdraws the earlier go decision, it may be viewed within the company as a "bad" decision (i.e., it is associated with a bad *outcome*). Thus, the person may worsen his or her position within the organization by admitting to a failed product launch. Furthermore, though exceptions exist, managers are rarely rewarded for using a good decision making *process*. Rather, managers are typically rewarded for good outcomes. Thus, the person's best shot at a reward within the organization (e.g., promotion, increased compensation, recognition) is if the new product introduction ultimately yields success. Does the person admit failure now or stick with the original decision in the hope of some (small) probability of future success? On the basis of the empirical psychological literature, we believe that most managers in this scenario will stand by their original decision in the hope of achieving future success. More formally,

> H_1: In ambiguous decision environments (e.g., the new product decision), there is a strong tendency toward continued commitment to a losing course of action (i.e., continued support for a new product failure).

Although H_1 clearly states our beliefs, it begs the question of what constitutes a new product success or failure. Different constituents may define success and failure differently (see Griffin and Page 1993). We operationalize success and failure in terms of anticipated financial performance. In particular, because of the long-term nature of most new product decisions, we use such concepts as the expected net present value of anticipated cash flows and probability of achieving a positive net present value (NPV) to measure the success or failure of a new product introduction.

REDUCING COMMITMENT TO NEW PRODUCT FAILURES

Our goal is to develop decision-making procedures that reduce managers' tendencies to prolong commitment to new product failures. Simonson and Staw (1992) suggest approaches that might reduce the need for managers to engage in self- or external justification. For example, if the manager, or the manager's organization, downplays the decision outcome when assessing the manager's underlying abilities or skills, the decision maker is less likely to maintain commitment to the original action to justify the initial decision. Conversely, if there are negative career consequences associated with admitting to failure on a new prod-

uct launch, we should find a tendency toward continued commitment to a losing course of action (Staw 1976; Tegar 1980).

These observations reveal a dilemma facing the organization. Outcomes are important for firm performance; however, outcomes are fallible measures of decision quality because they are also affected by actions outside the control of the manager and the firm. Consequently, if organizations focus solely on decision outcomes in evaluating the quality of their managers' decisions, they may induce their managers to prolong commitment to a losing course of action. Thus, one de-escalation strategy is to reduce the penalties for being associated with bad outcomes (e.g., a new product failure). This practice may, however, have the unintended side effect of reducing the manager's motivation to ensure product success.

Similarly, the organization could choose to reward managers on the basis of the quality of the decision process versus the decision outcome. Such an approach requires a complete change in the culture and structure (e.g., compensation and promotion systems) of most U.S. organizations. Such changes in organizational structure and culture take many years and go beyond the scope of this research.

Another approach to reducing escalation of commitment is to enhance the quality and structure of the decision/information environment. Previous research (Bowen 1987; Northcraft and Wolf 1984; Whyte 1986) suggests that better information or better-structured information can reduce commitment to a losing course of action. We focus on the role of decision aids and procedures in increasing the accuracy of new product withdrawal decisions.

De-escalation of Commitment Through Decision Aids and Procedures

We propose several decision approaches designed to reduce escalation of commitment. The first is designed to enrich the information environment by acknowledging underlying uncertainties and making explicit the possibility of bad outcomes that result from uncontrollable factors. For example, imagine that a decision maker uses a decision process that explicitly states there is a 30% chance of failure for a new product introduction (i.e., a 70% chance of success). Moreover, assume that the possibility of failure is attributable to factors outside the direct control of the firm (e.g., competitive response). Because the possibility of failure was initially acknowledged, management may be more likely to attribute blame for a failed outcome to uncontrollable factors and less likely to blame the failure on the decision maker. Furthermore, the organization may use the decision-making process to evaluate the manager's decision-making abilities instead of relying on fallible outcomes. Consequently, the decision maker should feel less personal accountability for bad outcomes and less need to justify previous decisions. These beliefs lead us to the following hypothesis:

H_2: Explicitly acknowledging environmental uncertainties and the associated possibility of poor outcomes prior to making the initial decision to invest in a new product will reduce the probability of future commitment to a new product failure.

The second approach to enriching the decision environment is to crystallize the ramifications of alternative future courses of action. Not only does this increase the salience of other options, it appropriately frames the decision as present-, versus past-, oriented. Northcraft and Neale (1986) show that withdrawal from a losing course of action can be increased by providing explicit information about the opportunity cost of the investment to the decision maker (here, the expected value of alternative uses of resources currently associated with the new product). Somewhat differently, Whyte (1986) suggests that the decision maker can reduce escalation of commitment by framing the decision in terms of future costs and benefits of different alternatives rather than by focusing on previous losses. Either mechanism suggests that withdrawal can be hastened in the event of new product failures by explicitly providing the costs and benefits of future alternatives (i.e., opportunity cost information). More formally,

H_3: Providing the future opportunity costs of continued investment in a new product will reduce the probability of commitment to a losing course of action (i.e., continued support of a new product failure).

Unfortunately, simply providing information may not be sufficient to overcome forces that bias managers in favor of a losing course of action. Instead, like other people, managers may ignore or distort this information (Taylor and Brown 1988). More generally, managers are not information-processing machines. Rather, they use a variety of heuristics and are susceptible to biases in simplifying the information environment to make decisions (Russo and Schoemaker 1989).

Given the possibility of information distortion, we offer a third decision aid feature. This decision aid restructures the decision procedure to "disallow" managers to ignore or distort relevant information. This is done through precommitment to a termination decision rule. For example, Simonson and Staw (1992) asked subjects to prespecify results that would lead them to change their original product investment support decision. They then asked the subjects to compare actual results relative to these prespecified levels before again allocating resources. They find that such a procedure leads to de-escalation in future investment commitment to a losing course of action.

We explore two different precommitment strategies. First, we offer managers the use of a stopping rule devised by an expert analyst and then ask them to commit to this rule at the time of product launch. Unlike the previously discussed decision aids, this precommitment severely restricts the manager's tendency to use nonnormative decision rules when making the stop/no stop new product decision and should thus yield more powerful results. More explicitly,

H_4: A decision aid that forces precommitment to an informed stopping rule at the time of the initial commitment will be more effective in reducing commitment to a losing course of action than acknowledging uncertainties and making explicit opportunity costs.

H_4 assumes that the stopping rule provides useful information concerning the ultimate outcome of the project. We note that constructing such a stopping rule before the fact is not always obvious. New product ventures are normally affected by a multitude of factors, and determining ultimate success may be hard to predict at the time of the stop/no stop decision. Consequently, we later elaborate on the construction of this stopping rule.

Second, we explore the effects of commitment to a self-specified stopping rule, as used in Simonson and Staw's (1992) study. At issue here is whether managers can identify an accurate stopping rule, given the complexities of the new product environment. In addition, such a rule may suffer from the "I made the rule, I can break the rule" perspective. Thus, relative to a predetermined rule, we expect a self-specified rule to be less informed and the manager more willing to renege on the predetermined rule:

H_5: Precommitment to a self-specified stopping rule will reduce escalation of commitment less than precommitment to an informed, predetermined stopping rule.

For our fourth approach to enriching the decision environment, we explore the effects of decision decoupling. Bazerman (1994, p. 82) notes that within what he labels the *unilateral escalation paradigm*, "we escalate because of *our own* previous commitments." In theory, decoupling eliminates personal escalation of commitment because the decision maker does not have to justify an initial decision. This leads Staw (1981) to suggest the possibility of changing the decision maker if his or her initial decision results in losses. In practice, Staw and Ross (1987) cite a particular bank's rule in which a new loan officer must review a loan request designed to allow continued payments on an otherwise defaulted loan to prevent the original loan officer from throwing good money after bad in an attempt to justify the initial loan decision. Thus, we offer the following hypothesis:

H_6: Sequential decision decoupling will reduce commitment to a losing course of action.

We caution that decision decoupling may not solve the problem of escalation of commitment. Several managers at the Innovation in New Product Development Conference noted that their job is to make underperforming products perform better, versus pulling the plug on failing products. In this regard, March and Shapira (1987) note an interesting tendency. They state that "managers accept risks, in part, because they do not expect that they will have to bear them" (p. 1411). In support of this insight, they cite a study by Shapira (1986) in which 48 of 50 executives said they reject the risk estimates given to them. Instead, these executives revise downward the estimated risks because they believe they can do better than expected. Similarly, Donaldson and Lorsch (1983, p. 65) state that managers believe risks can be reduced through "managerial wisdom and skill." In a broad-ranging literature review, Taylor and Brown (1988) conclude that there is pervasive optimism bias among people, along with an exaggerated sense of control over events. Kahneman and Lovallo (1994) refer to this latter tendency among mangers as *delusions of control*. If the "decoupled" decision maker demonstrates these tendencies, decision decoupling by itself will not eliminate commitment to a losing course of action. Furthermore, if managers within an organization are competing with one another for reward and recognition, what Bazerman (1994) labels the *competitive escalation paradigm* may be operative.

IMPLEMENTING DECISION STRATEGIES

We now discuss the specifics of each of the decision aids or procedures as implemented in our research. We note that this implementation is in general cumulative (i.e., the decision aid that provides a predetermined stopping rule also highlights uncertainties and provides the opportunity cost of continued commitment to a new product). The exception to this is the decision aid featuring precommitment to a self-specified stopping rule. In this instance, the decision aid highlights uncertainties but does not provide the opportunity cost of continued commitment to a new product.

Highlighting Uncertainty and Possible Negative Outcomes

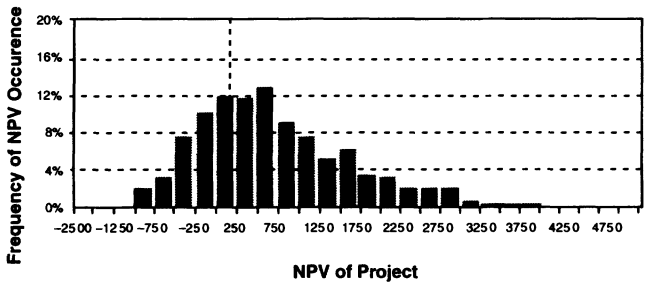
We start with the basic premise that the firm evaluates the potential value of a new product by translating all aspects of the possible outcomes in terms of their financial impact on the firm's overall performance. The standard way of making this determination is to build a multiperiod financial model of the costs and revenues associated with the new product and then calculate the NPV of the stream of the anticipated cash flows (Weston and Brigham 1978). Although the financial model varies from situation to situation, the stream of cash flows is normally predominantly affected by a reasonably small set of factors. Often, an even smaller set of these key factors is highly uncertain at the time when the firm must make the initial decision to invest in a new product venture. Moreover, there is little management can do to reduce these uncertainties if the events are not under the direct control of the firm.

Many firms capture these underlying uncertainties and the associated range of possible outcomes by using "what if" analysis. Thus, they might construct scenarios that represent worst, best, and most likely occurrences. Recently, firms such as Merck (Nichols 1994) and DuPont (Krumm and Rolle 1992) have acknowledged their uncertainties about these key factors in terms of an entire distribution of values for these uncertainties. Simulation is then used to generate a large number of "what if" scenarios, thereby yielding a distribution of possible outcomes (i.e., NPVs) that are based on the joint distribution of the underlying uncertainties. Such a procedure is formally referred to as *risk analysis* (Hertz 1979) and is readily implemented using publicly available software such as @Risk or Crystal Ball.

To make this decision process clearer, assume (as we do in our experiment) that the success of a new product venture rests on four key uncertain variables. These variables are industry growth rate, initial market acceptance of the new venture, timing of a future innovative competitive offering, and effectiveness of a future innovative competitive offering. Management quantifies its beliefs about the possible outcomes of each of these key uncertainties (in terms of distributions) and their interrelationships. These beliefs are used as inputs to a financial model that yields cash flow projections. (Often this can be done within the context of a spreadsheet.) Specifically, a risk simulation is performed on the basis of N (where N is normally 500 to 1000) individual draws from each of the uncertainties. These draws result in a distribution of NPV values, as is shown in Figure 1. From this distribution of outcomes, we can determine both the expected NPV and the probability that the project yields a negative NPV (i.e., a product failure). In the particular example used in our research, there is a 30% chance that the project will fail (i.e., NPV < 0) and an expected NPV of approximately $670,000.[2]

[2]Although in theory we should calculate the NPV using a discount rate reflecting the systematic risk for each period, we use a single discount rate in calculating NPV. For a variety of reasons, our approach is standard practice in capital budgeting (Brealey and Myers 1991). The discount rate used reflects the average rate of return for other projects within the firm. Thus, a positive NPV would indicate a better than average rate of return compared to other firm projects.

Figure 1
NET PRESENT VALUE DISTRIBUTION



Simulation Results	
Expected (Mean) Result	$668,995
Maximum Result	$4,373,696
Minimum Result	($1,267,021)
Chance of a Positive Result	70.8%
Chance of a Negative Result	29.2%
Number of trials = 500.	

Figure 2
REGRESSION RESULTS: DRIVERS OF NPV

The Quality Valve Company

Expected NPV of Continuing the Project Years 3–10: *(NPV in 000s)*

Variable	*Value*		*Coefficient*	=	*Effect on 10-year NPV*
1. Constant					(5,164.00)
2. Market Growth Rate		% *	61	=	
3. Market Share (end of Year 2)		% *	112	=	
4. NPV at end of Year 2 (000s)		*	-2.47	=	
Estimate of NPV years 3–10 (A) = 1. + 2. + 3. + 4.					

Highlighting the Opportunity Costs of Continued Investment

The preceding discussion concerns a decision aid that enriches the information environment associated with the initial go/no go decision. What then can be done to enhance the information environment of the stop/no stop decision? One approach is to conduct a new risk analysis after observing the initial product introduction decision and treat all prior expenses as sunk. The new expected NPV amount can then be compared to the opportunity of using the firm's assets elsewhere. This approach makes explicit the opportunity costs of not terminating, which thus appropriately frames the stop/no stop decision. Nevertheless, it is also based on the current mental model of the manager and could therefore suffer from the manager's tendency toward self-justification. Specifically, the manager may subconsciously bias his or her estimates of future outcomes used in the risk analysis to make the future outlook of the new product venture look better.

Another approach, which circumvents this self-justification bias, entails determining a priori the key drivers of ultimate product success that are observable at the time of the stop/no stop decision. In our example, we could record the values from any given "what if" scenario for factors for which the information becomes available at the time of the decision (e.g., initial market share of the new offering, current market growth, profitability of the project to date). We can then ask how these observable factors relate to the ultimate outcome of the new product venture for that scenario. The mechanism for determining this relationship is to use the N risk simulations as representative of all possible NPV outcomes and then regress these projected NPV outcomes against the "observable" uncertainties. In this setting *observable* indicates the input values of the uncertainties associated with the outcomes of the individual "what if" scenarios. The obtained regression coefficients then can be used, in conjunction with actual realized values for these key determinants after introduction, to forecast the anticipated new NPV outcome (as determined at the time of the stop/no stop decision).

Figure 3
NPV COMPARISON: CONTINUING VERSUS CASHING OUT

The Quality Valve Company

Expected NPV of Continuing the Project Years 3–10: *(NPV in 000s)*

Variable	*Value*		*Coefficient*	=	*Effect on 10-year NPV*
1. Constant					(5,164.00)
2. Market Growth Rate	6.00	% *	61	=	366.00
3. Market Share (end of Year 2)	21.50	% *	112	=	2,408.00
4. NPV at end of Year 2 (000s)	(1,250)	*	-2.47	=	3,087.50
Estimate of NPV years 3–10 (A) = 1. + 2. + 3. + 4.					697.50

Expected NPV of Cashing Out Project at End of Year 2:

NPV of equipment disposal (book value)	1,237.00
NPV of cashout in Year 2 (B)	1,237.00
Gain/(Loss) From Cashout (B) – (A)	539.50

In our experiment, we provide decision makers this decision aid for their use two years after launch. This aid identifies the key indicators of the ultimate NPV and provides an estimate of NPV for years 3 to 10 (where the project was forecasted to have a ten-year life). The format of this information, as it is shown to subjects, is given in Figure 2.[3]

In addition to a forecast of future earnings, we also need to know the expected benefit of using the resources elsewhere. Thus, we calculate the expected NPV associated with the cashing out of the product. Comparison of these two NPVs indicates the opportunity cost of continuing with the product and frames the decision on the basis of future possibilities rather than on previous outcomes. The actual comparison used in our research is shown in Figure 3. This figure indicates that the estimated NPV associated with withdrawing the product is $539,500 greater than the estimated NPV associated with continuing with the product.

[3]The R^2 of this regression model, as it is reported to subjects, is .70.

Goal Setting and Precommitment

The previous decision aids do little to address the problem that decision makers can choose to ignore or distort enhanced information. Thus, a third feature incorporated into our proposed decision aid is precommitment to a stopping rule at the time of the new product go decision. For example, this rule could be "if the expected NPV for going forward with the product based on the a priori derived forecast model is less than the expected NPV associated with cashing out, then stop." Such precommitment might be argued against, because it may (1) run counter to Bayesian thinking and (2) reduce the decision maker's flexibility and use of intuition in future decisions. With respect to the first point, we control for this issue by not providing any new information on the still uncertain factors (e.g., when competition will enter, the quality of their offer). However, because of the importance of this issue, we discuss it subsequently. With respect to the second point, we note it is exactly this flexibility and use of intuition that may produce escalation of commitment.

The previous discussion assumes the use of an a priori rule based on a forecasting model. What if managers set their own stopping rule by prespecifying values for observable factors that they think would dictate ultimate failure? Because of the complexity of the decision and because the partial indicators (such as short-term profits or market share) may interact in nonobvious ways, we suspect that managers will have difficulty in constructing good rules.[4] Moreover, partial indicators provide no information about the opportunity cost of the investment. Thus, though managerially generated decision rules may be more intuitive, they may be less informative.

Decision Decoupling

Decision decoupling decouples the stop/no stop decision maker from the initial commitment (go/no go) decision maker. In addition, the new decision maker is given a clear-cut comparison of the future value of alternative courses of action. In combination, this information/decision structure addresses both self-justification and framing sources of escalation bias.

EXPERIMENTAL PROCEDURES

Subjects

Subjects in our research consisted of 209 full-time senior-level managers drawn from executive programs at Duke University and an additional 20 capital budgeting experts. On average, the 209 managers report having approximately 14 years of management experience. Fourteen percent of the managers indicate not having a U.S. nationality. On average, the largest amount committed by managers to a single project when acting as the primary decision maker equaled $48.5 million. If we remove outliers of $250, $500, $700, $1,500, and $2,500 million this number drops to $17.4 million. We take these measures as strong indicators of high-level managerial responsibility and as our subjects being representative of the population of managers making product withdrawal decisions to which we want to generalize.

As part of their executive programs, and prior to participation in our study, all 209 subjects received extensive instruction in capital budgeting decisions and about the use of risk analysis in decision making. They also learned about potential heuristics and biases in decision making (e.g., framing effects). This leads to a potential demand effect that extends across all conditions. Specifically, we might posit the existence of a self-diagnosticity effect (Brockner and Rubin 1985) if people believe their decision reflects their true ability. In our setting, the "good" decision is to withdraw the product. Therefore, the obtained results could be biased in favor of the product withdrawal decision. However, because this potential demand effect holds across all conditions and because our interest centers on differences between conditions, it does not damage the interpretability of our results.

Design

Testing our six hypotheses requires a simple 1×6 between subjects design. In addition, we add two control conditions, which results in an overall 1×8 design. Of these conditions, two were initially oversampled (Conditions 2 and 3) relative to the other conditions.[5] This occurred because we wanted to vary the problem setting to ensure that our findings generalized. Specifically, in these two conditions we test two problem settings that vary the industry, company, product, and scale of the key uncertainty numbers. The overall financial implications were held fixed across both settings. We found no differences in response across these two versions and therefore pooled results across the two settings. In the interest of parsimony, we describe only one experimental setting.

Experimental Task

Subjects were asked to work on the Quality Valve Company Case. The case described a new product launch and continued investment decision for an improved valve that was targeted at the large truck emissions control market. The case described a brief history of the market, the company, and the primary competitor, Great Lakes Valve Company.

Subjects in the first five conditions were put in the position of making the recommendation to launch or not launch the proposed product. These subjects were instructed that if they launched the product and it succeeded they would likely be on the fast track to a senior management position. If they chose not to launch the product, they were told it would not hurt their careers, but they would lose this potential opportunity to be on the fast track. This reward structure was intended to simulate a typical organization's reward structure and establish the justification bias (Staw 1976) toward the escalation of commitment that we were trying to induce in all subjects.

Next, subjects were given a financial analysis of the proposed new product venture. The depth and content of this analysis varied across the five conditions. However, all subjects received an identical, strongly positive, NPV forecast

[4]As is shown in Figure 2, our calculated decision rule is not simple. A more negative second-year NPV is associated with more positive ultimate success. This is due to the nonobvious fact that larger initial sales require larger investments and thus more negative first- and second-year cash flows.

[5]Ultimately, Conditions 1 and 5 were undersampled relative to the other conditions. We did this because no respondents were choosing to withdraw the product in these conditions. Otherwise, subjects were randomly assigned across the conditions.

to induce an initial launch decision in all conditions.[6] Following the presentation of the financial information, subjects in the first five conditions were asked to make a go/no go decision and then were asked to justify their chosen option. By asking for justification of the decision we note the possibility of reinforcing a decision process accountability effect, which could reduce escalation bias (Tetlock 1985). Nevertheless, as Simonson and Staw (1992) note, the bias will decrease only if subjects believe they will be held accountable for the decision process rather than the decision outcome. Because such an effect, if it exists, holds across all conditions it does not influence our analysis and we discuss it no further.

If subjects initially chose not to launch the product, they were told they were finished with the task. If they chose to launch, the case continued with information about the product's performance after two years of being on the market. Again, the content and depth of the financial information varied with the experimental condition. Subjects in all conditions received identical information about the realized values for the four key uncertainties (market share, market growth, competitor response, and NPV of cash flows through year 2). This information was presented in a balanced fashion so that even though the project was not doing as well as expected financially, there were some positive indicator outcomes. For example, though the realized market share was significantly less than anticipated, the realized market growth rate was greater than anticipated and competitive reaction was not immediate.[7] Similarly, subjects were told that an uncorrectable production problem explained the lower than expected market share, but they also were told that the sales force and research and development groups were happy about the product introduction.

After evaluating the market feedback, subjects were asked whether they wanted to continue or withdraw the product. They again were asked to indicate a rationale for their chosen decision. Finally, the task concluded with questions about the subjects' background and experience. In the conditions in which two decisions were made, the total time of the task was approximately 30 minutes.

We next detail the specific financial information given to subjects in each of the eight experimental conditions. This information pertained to either the initial launch or subsequent stop/no stop decision. We also specify the types of commitments each subject was asked to make by condition.

1. Base/No Decision Aid Condition

Subjects in the Base/No Decision Aid cell received traditional scenario information when making the launch decision. Specifically, they were given pessimistic, optimistic, and most likely estimates for each of the key inputs to the NPV forecast (i.e., market growth rate, initial market share, and competitor reaction). Subjects also were given a most likely estimate of the NPV associated with a go decision. If subjects decided to launch, they were given the basic market feedback information detailed (i.e., the realized market share, market growth, lack of competitive response, and NPV of cash flows through year 2).

2. Risk Analysis Condition

The Risk Analysis Condition corresponds to the decision aid treatment discussed in the section Highlighting Uncertainty and Possible Negative Outcomes. Subjects were given information about the quartiles of the distributions for the underlying key uncertainties. For example, subjects were told that there is a 0% chance that the initial market share will exceed 50%, a 25% chance that the initial market share will exceed 40%, a 50% chance that the initial market share will exceed 35%, a 75% chance that the initial market share will exceed 27.5%, and a 100% chance that the initial market share will exceed 10%. In addition to this distributional information about the key uncertainties, subjects were given the simulation results of the risk analysis (i.e., the distribution of the 500 simulated NPV outcomes). Specifically, they were given the information that appears in Figure 1. After receiving this information, subjects made their initial go/no go recommendation. Following this decision subjects received the same "actual results" as in the Base Condition (1).

3. Opportunity Cost Condition

The Opportunity Cost Condition corresponds to the decision aid treatment discussed in the section Highlighting the Opportunity Costs of Continued Investment. Subjects received all information described in the Risk Analysis Condition (2) in addition to the opportunity cost information. After receiving all the Risk Analysis Condition information, and before the initial launch decision, subjects were informed of a method for calculating the opportunity costs of the investment. The regression approach was described, and the actual coefficients and fit of this regression were presented. Finally, subjects were given an example of how to use this approach with the obtained regression coefficients.

After making the initial launch decision, subjects received the same "actual results" as in the other conditions. However, these results were supplemented by an analyst's report that plugs the actual year 2 results into the regression equation to generate the expected NPV of continuing the product. This expected NPV was then compared to expected NPV of cashing out the product. The comparison seen by subjects, shown in Figure 3, suggests it is best to pull the product off the market.

4. Precommitment to a Predetermined Rule Condition

The Precommitment to a Predetermined Rule Condition corresponds to one of the decision aid treatments described in the section Goal Setting and Precommitment. This condition is identical to the Opportunity Cost Condition (3) in all but one respect: Subjects were told that management normally asks for a stopping rule. Thus, after the method for calculating opportunity costs is described, and before the initial launch decision, subjects were given three choices. First, they could agree to abide by the opportunity cost stopping rule provided (i.e., stop if the NPV associated with cashing out exceeds that associated with continued commitment to the product). Second, they could precommit to their

[6]The actual expected value of the NPV distribution does not equal the NPV associated with the mean of each of the underlying uncertainties, because the uncertainties are not independent and the payoffs are nonlinear. However, we kept the expected NPV constant to keep financial implications fixed across conditions.

[7]With respect to competitive reaction, subjects were told, "Great Lakes, however, did not lower its price and in no way seemed to retaliate. No new information was obtained with respect to possible R&D activity or probability of introducing a new valve."

own stopping rule, which they were asked to specify. Third, they could choose not to commit to any stopping rule.

5. Precommitment to a Self-Specified Rule Condition

The Precommitment to a Self-Specified Rule Condition corresponds to the second decision aid treatment described in the section Goal Setting and Precommitment. This condition is identical to the Risk Analysis Condition (2) in all but one respect: Again, subjects were told management normally asks for a stopping rule. Thus, after presentation of the risk analysis, and before the initial launch decision, subjects were given two choices. First, they could commit to a stopping rule of their own choosing, which they then specified. Second, they could choose not to commit to a stopping rule.

6. Decision Decoupling Condition

The Decision Decoupling Condition differs from the previous five conditions in that subjects were not asked to make the initial launch decision. Instead, they were asked only to make the stop/no stop decision. Specifically, this condition corresponds to the procedure described in the section Decision Decoupling. Subjects were asked to assume that a go decision was previously made by another employee of the company. They were then asked by the company to serve as an independent evaluator in making a stop/no stop decision on the basis of the year 2 information provided in the previous conditions. Thus, the individual manager's company was made responsible for the earlier decision, but not the individual manager. Other than eliminating participation in the initial launch decision, this experimental condition was most similar to the Opportunity Cost Condition (3). The manager was given the same NPV calculations for continued investment and cashing out as in the Opportunity Cost Condition. The manager was also given the history of the project (i.e., the initial expected performance for all the key market uncertainties, as well as the same information given in other conditions about the outcomes of the initial launch decision).

7. Control Condition

The Control Condition also differs from the first five conditions in that subjects did not make the initial launch decision. The purpose of this condition is to ensure that results from the other conditions are due to commitment to a losing course of action. In other words, once factors that induce commitment to a losing course of action are removed, do managers choose to cash out the failing project? If not, we cannot ignore the possibility that continued investment in the product implies that managers see this as the correct course of action (in contrast to a continued commitment to a losing course of action). Thus, in this condition no information was given about the history of the project. The only information subjects received was the financial analysis of the expected NPV associated with the options of continued investment and cashing out and a description of how these calculations were made. In this way, the year 2 information was identical to that provided subjects in the Opportunity Cost Condition (3).

8. Academic Experts Condition

Once again, subjects in the Academic Experts Condition were not asked to make the initial launch decision. This condition is identical to the Control Condition (7) in all ways except that the subjects differed. Instead of senior-level managers, the subjects were normative experts in capital budgeting decisions. Specifically, the subjects consisted of Duke University business school faculty and doctoral students in the areas of finance, accounting, and economics. The purpose of this control condition was to verify that product withdrawal was the normatively correct decision.

Measures

The dependent measure of most interest in our analysis is the stop/no stop decision. Note that because of the sequential nature of the task, we only obtain this measure in Conditions 1 through 5 if the subject makes an initial go decision. In addition, we analyze the open-ended retrospective justification measures obtained from subjects after each decision. These measures provide detail about what information subjects' said they used, how they interpreted the information, and what new information they created.

RESULTS

In Table 1, we summarize the results from our study. We start by noting that, where relevant, most subjects (90%) made an initial recommendation to launch the product.[8] The small number of subjects choosing not to launch the product gave either a direct ("I'm risk averse") or implicit ("The probability of success is too low") reference to risk-averse behavior.

Next, we turn our attention to results in the Academic Experts Condition (8). In this condition, we asked capital budgeting experts to choose the correct course of action. As can be seen in Table 1, *all* subjects in this condition opted to pull the product. Given this result, we subsequently refer to continued support of the new product as prolonged commitment to a losing course of action (i.e., we assume the experts are normatively correct).

Subjects in all other conditions are practicing managers. We discuss these conditions in ascending order. In the Base/No Decision Aid Condition (1), we did nothing to reduce commitment to a losing course of action. *None* of the subjects in this condition chose to withdraw the product. Thus, consistent with H_1, we find that an ambiguous decision environment prolongs commitment to a losing course of action. Looking at the retrospective justifications for their continued commitment, we find that subjects focus on the positive information (e.g., industry growth, lack of competitive entry, best technology, sales force likes selling the product) and reinterpret negative information in a positive light (i.e., market share position is good and product and process problems can be fixed).

We find the results for the Risk Analysis Condition (2) of great interest. Only 1 of 36 subjects in this condition chose to withdraw the product after making an initial commitment. This proportion is not significantly different from the behavior exhibited by subjects in the Base/No Decision Aid Condition (1). Thus, contrary to H_2, explicitly acknowledg-

[8]Condition 4 yields a significantly higher go rate for the initial decision than Conditions 1 and 3. There were no other significant differences across conditions with respect to this decision. If anything, we conjecture that a higher initial go rate would lead to a lower withdrawal rate at the second decision (i.e., as a group these people may be more prone to risk taking. Despite this, the withdrawal rate in Condition 4 is significantly higher than in Conditions 1 and 3, as is hypothesized.

Table 1
SUMMARY OF EXPERIMENTAL RESULTS

		Initial Decision		Year 2 Decision			Significance Tests[a]							
CONDITION	N	GO	NO GO	STOP	NO STOP	PERCENTAGE STOP	1	2	3	4	5	6	7	8
1. Base/No Decision Aid	15	13	2	0	13	0	X		.05	.01		.01	.01	.01
2. Risk Analysis Decision Aid	43	39	4	1	38	3		X	.01	.01		.01	.01	.01
3. Opportunity Cost Decision Aid	34	28	6	6	22	21	.05	.01	X	.05	.05	.01	.01	.01
4. Precommitment to a Pre-Determined Rule Decision Aid	31	30	1	13	17	43	.01	.01	.05	X	.01	.20	.05	.01
5. Precommitment to a Self-Specified Rule Decision Aid	14	13	1	0	13	0			.05	.01	X	.01	.01	.01
6. Decision Decoupling	31	NA	NA	17	14	55	.01	.01	.01	.20	.01	X	.20	.01
7. Control Condition	41	NA	NA	27	14	66	.01	.01	.01	.05	.01	.20	X	.01
8. Academic Experts Condition	20	NA	NA	20	0	100	.01	.01	.01	.01	.01	.01	.01	X

[a]Interpret as this condition is significantly different from the listed condition

ing uncertainty and making the probability of failure known at the time of initial launch does not reduce escalation of commitment. A risk analysis decision aid, by itself, does not appear to overcome the effects of an ambiguous information environment.

Because only one subject chose to withdraw the product in the Risk Analysis Condition, we might reasonably ask whether the information provided was sufficient to make a withdrawal decision. As was noted previously, information was presented in a balanced fashion, with both positive and negative feedback. One negative factor was the obtained market share. The realized market share, 24%, was stated to be less than the "expected 35%." Subjects in this condition were given information, at the time of the launch decision, that there was less than a 25% chance of realizing a market share below 27.5%. Therefore, the 24% market share realization represents a negative surprise. Because the overall chance of failure was approximately 30%, a simple market share stopping rule would have been to withdraw the product if the realized market share was in the lowest 30% of the anticipated range. Thus, the managers had enough information to sense that the launch was failing. Furthermore, the negative market share feedback was coupled with an underlying reason for low market share (i.e., an uncorrectable technology problem).

As with the base condition, the justification data reveal why this negative information had almost no impact on the stop/no stop decision. Simply put, managers ignored or reinterpreted negative information to put it in a more positive light. Only one subject acknowledged that market share performance was worse than expected, and he or she then proceeded to justify why the lower market share was acceptable. Eight subjects were pleased with the market share performance even though it was much lower than expected. Also, despite being told of an uncorrectable technology problem, 22 of the subjects indicated continued commitment to the product because they were pleased with the current offering or were optimistic about possible technology improvements. Twenty subjects justified their decisions by citing "positive" financial factors.

The results obtained in the Opportunity Cost Condition (3) show that after committing to an initial launch, 6 of the 28 subjects chose to withdraw the product. Relative to Conditions 1 and 2, providing information about opportunity costs significantly reduces commitment to a losing course of action. Thus, we find statistical support for H_3. However, even with the reduction in ambiguity of the information environment, it is important to note that only 21% of the subjects chose to withdraw the product despite financial data indicating this was the best course of action.

Again, the justification data reveal why particular decisions were made. For the six subjects that withdrew the product, five reported that the product was not profitable relative to the opportunity cost of the capital and the remaining subject saw cashing out as a way to break even on the project despite poor product performance. In addition, both production problems and subpar market share were cited twice.

The twenty-two subjects that chose to continue the product offered a variety of reasons to support this decision. Four offered classic justification reasons for continued commitment (two stated that pulling the product is equal to admitting failure, one stated that success is still possible if the product stays on the market, and one stated that personal success depends on product success). Eleven indicated they could improve the production technology. Four reinterpreted the obtained market share to be acceptable, whereas eleven inappropriately reinterpreted financial data to justify their decisions. Some of these statements were factually false (e.g., the expected NPV associated with cashing out exceeds the expected NPV associated with continued commitment).

The Precommitment to a Predetermined Rule Condition (4) results indicate support for H_4. Thirteen of 30 subjects withdrew support after an initial commitment decision. This proportion is significantly higher than Conditions 1, 2, and 3. We note that of these 30 subjects, 17 chose precommitment to "our" stopping rule, 8 chose their own rule, and 5 would not precommit to a stopping rule. Of the 17 committing to "our" rule, 9 withdrew the product (53%). Thus, 8 subjects violated the precommitment agreement. Three of the 8 subjects using self-specified rules withdrew the prod-

uct, and 1 of the 5 subjects that refused precommitment withdrew the product.

Justification data indicate that 11 of 13 subjects that chose withdrawal cited poor financial performance and/or their precommitment rule. Of the 17 subjects that maintained commitment, 3 cited potential for product improvement, 1 cited upside potential, and 12 cited positive financial performance.

Results in the Precommitment to a Self-Specified Rule Condition (5) show that *no* subjects in this condition chose product withdrawal. This withdrawal rate is significantly lower than that of the Precommitment to a Predetermined Rule Condition (4) and the Opportunity Cost Condition (3). Thus, we find support for H_5 (i.e., that a self-specified stopping rule will reduce escalation bias less than an accurate, predetermined stopping rule).

Two of 13 subjects in this cell refused precommitment to a stopping rule. Of interest is the behavior of the 11 subjects that specified stopping rules. Of these, 5 violated their own rules (i.e., "I make the rules, I can break the rules"). Three rules were so ambiguous that, effectively, they failed to constitute a stopping rule. Finally, 3 subjects lived by their rules, which led to continued support for the product introduction. Because the NPV associated with cash out exceeds the NPV associated with continued support, this last outcome reinforces the difficulty of developing an accurate stopping rule.

The Decision Decoupling Condition (6) provides insight into the value of changing decision makers. Seventeen of the 31 subjects in this condition chose to withdraw the product when put in the position of making the stop/no stop decision after another manager had made the initial commitment decision. This withdrawal rate is significantly higher than that in Conditions 1, 2, 3, 4 (marginally), and 5. Thus, we find support for H_5 (i.e., decision decoupling will reduce escalation commitment). However, also of interest is that just over 50% of the subjects chose product withdrawal. Although this approach potentially eliminates both personal justifications and framing effects that may lead to continued commitment to a losing course of action, it does not fully eliminate escalation bias.

Similar to many subjects in the other conditions, subjects in the Decision Decoupling Condition who continued marketing the product felt the financial outlook for the product looked positive. Nine of the 14 subjects that left the product on the market cited financial reasons, which again reflects distortion of information to conform with the decision the decision maker wanted to make. In addition, 2 subjects cited the upside potential for gains. These justification data may suggest optimism and control bias.

Subjects in the Control Condition (7) were not given historical information that could induce bias toward continued commitment due to either justification or framing. Because of our belief that product withdrawal is the normatively correct decision, we should observe 100% withdrawal. Deviations from this would represent differing beliefs in our subject population about the correct course of action. In this regard, 27 of the 41 subjects (66%) discontinued the product. This result suggests that, when free from escalation biases induced by our experimental conditions, one-third of the subject (managers) population still believes that continued investment is appropriate. We found this result surprising, because all subjects were trained in concepts such as opportunity cost and capital budgeting. Therefore, we examined whether there were different levels of expertise in making resource allocation decisions that correlated with the stop/no stop decision. In particular, we examined the relationship between size of previous dollar decisions (as a proxy for expertise) and the stop/no stop decision. We found no correlation between these two variables even after controlling for experimental conditions and rescaling the size of dollar commitment variable in a variety of ways.

Consequently, comparisons with 66%, and not 100%, represent the relevant contrast in our study for assessing the effect of biases on commitment to a losing course of action. Despite this lower comparison figure, the control condition produces a significantly higher withdrawal rate than all the experimental conditions in which managers are subject to biasing factors.[9] Thus, we conclude that none of our proposed solutions fully eliminates the problem of continued commitment to new product failures.

DISCUSSION AND CONCLUSIONS

We begin with the premises that at least some new product failures are inevitable and that people tend to remain committed to a losing course of action. We then raise the issue of how best to deal with new product failures, noting that firms can save large amounts of money by appropriately managing product failures. Product failures that linger are money sinks, draining managerial and financial resources that could be more appropriately used in other areas (e.g., in support of other new product development activities). In the following discussion, we draw attention to five conclusions with respect to managing new product failures.

On the basis of data collected from senior-level managers, our research provides considerable evidence that managers often remain committed to a losing course of action in the context of new product introductions. Assuming generalizability from our research setting, we offer our first major conclusion:

C_1: Escalation of commitment is a major problem in managing new product introductions and should not be ignored.

This conclusion begs the question of why managers continue to commit to product failures. In particular, is it because decision makers are poorly trained or somehow inept at their jobs? As do Staw and Ross (1987), we reject this conclusion. Rather, we believe that these decision makers possess a tendency toward optimism and display a rational response to organizational pressures. Still, these "rational" decisions are irrational from the perspective of the organization (i.e., they produce prolonged commitment to a losing course of action).

Thus, we believe it is important for organizations to understand and correct for underlying tendencies toward escalation of commitment in the new product arena. In this regard, our study not only tests several decision procedures, it also provides justification data that yield insights into how commitment to a losing course of action can persist. Perhaps most important, we obtain these results from a sample of managers who have substantial experience in making large-scale monetary decisions.

We found some of our results surprising in light of extant literature. For example, structuring the stop/no stop problem through a decision aid that highlighted uncontrollable uncertainties and the possibility of negative outcomes did not

[9]The Control Condition withdrawal rate is only marginally significantly higher than that in the Decision Decoupling Condition.

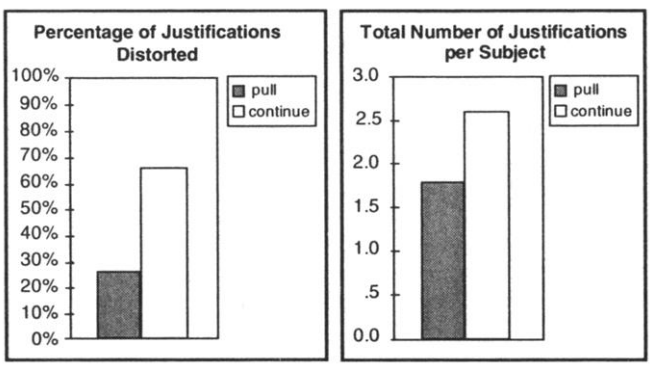
reduce the tendency toward commitment to a losing course of action whatsoever. Also, we found that "giving the answer" (i.e., providing the NPV comparison between continuing and withdrawing the product) did little to de-escalate commitment to a losing course of action. Specifically, almost 80% of the subjects in this condition remained committed to the new product in the face of compelling evidence in favor of product withdrawal. Similarly, asking managers to set and commit to a stopping rule did not work, because no managers chose to withdraw in this condition. These results lead to our second major conclusion:

C_2: Existing solutions to reduce escalation of commitment do not necessarily work when the decision environment is complex, as is typically the case for most new product introductions.

Examination of our justification data across all conditions of our experiment reveals how commitment could persist. Our subjects do not operate as normative information processing machines. Rather, we find strong evidence for the presence of the biases suggested by Taylor and Brown (1988), who conclude that people try to make data fit previously held theories. In our setting, the initial information provided to subjects was highly positive about the new product introduction. This induces a "theory" that the new product will succeed. Because of either attempts to confirm this "theory" or excessive optimism, our justification data yield patterns consistent with Taylor and Brown's thesis. In Figure 4, we summarize the justification data across all conditions, using managers as subjects (i.e., Conditions 1–7). In discussing these patterns, recall that subjects were given both positive and negative information about actual initial performance of the product launch.

First, Taylor and Brown suggest that if information is consistent with prior beliefs it is much more likely to be recalled. As is shown in Figure 4, if a subject decided to continue commitment to the new product, he or she provided, on average, 2.6 different types of positive reasons. In contrast, those who withdrew the product almost always cited poor financial performance and provided, on average, 1.8 different types of reasons. We attribute this discrepancy in number of justifications given to a quantity versus quality trade-off. Specifically, subjects choosing continued commitment appear to be countering the high-quality (according to our academic experts) negative information by manufacturing a higher quantity of reasons supporting continued commitment.

Figure 4
JUSTIFICATION DATA: SUBJECTS THAT PULLED VERSUS SUBJECTS THAT CONTINUED



Second, Taylor and Brown suggest that in attempting to fit data to previously held theories, people will interpret neutral information as positive and will either ignore or distort negative information. With respect to neutral information becoming positive, we observe 66 instances of this occurring among subjects that chose continued commitment.[10] This represents 19% of the total number of different types of justifications given for continued commitment to the product.

The justification data also are compelling with respect to interpreting negative information as positive. Among subjects choosing continued commitment, we observed 152 instances in which negative information (e.g., obtained market share) was interpreted positively and only 3 instances in which negative information was perceived accurately. These negative-to-positive distortions constituted almost half (44%) of the total justifications given for continued commitment.

As is shown in Figure 4, the combined neutral-to-positive and negative-to-positive interpretations represent 63% of the total justifications given for continued commitment. Thus, most of the manufactured reasons justifying continued support for the new product represent distortions. In contrast, Figure 4 indicates that among subjects choosing withdrawal, only 24% of the total justifications given for product withdrawal were distorted negatively (i.e., positive or neutral information that was given a negative interpretation). This level of distortion is significantly lower than that for subjects choosing continued commitment and leads to our third major conclusion:

C_3: Enriching or improving the information environment does not substantially reduce commitment to a losing course of action. Instead, managers may distort the provided information to justify continued commitment to the initial course of action.

We call attention to our newly proposed technique for using a decision aid to establish a stopping rule. As has been suggested elsewhere (e.g., Simonson and Staw 1992), we conclude that goal-setting may reduce escalation of commitment. However, without providing managers a means for establishing a stopping rule, this precommitment does not deter them from adhering to a losing course of action. In contrast, if the manager commits to the predetermined decision rule proposed herein (i.e., 17 of the 30 subjects in Condition 4), this approach performs as well as or better than all other techniques examined (9 withdrawals, or a 53% withdrawal rate) in reducing commitment to a losing course of action. This suggests that the stopping rule generated here offers promise in terms of improving the stop/no stop decision.

The results of decision decoupling also provide cause for optimism (55% withdrawal rate). Decoupling sequential decisions through the use of different decision makers led to a substantial reduction in commitment to a losing course of action. Nevertheless, we view this as a less efficient approach relative to precommitment to a stopping rule, because two managers must familiarize themselves with all the relevant information bearing on the decision.

[10]In the context of our experiment, information is neutral if no such information was provided.

In Figure 5, we summarize the relative effectiveness (as measured by withdrawal rates) of the decision procedures tested here. These results lead to our fourth major conclusion:

C_4: Decision procedures that "take out of play" old information (e.g., decision decoupling, predetermined stopping rules) are most effective at reducing escalation of commitment.

Because of the potential additional human resource costs associated with decision decoupling, we favor the use of an informed predetermined stopping rule. Despite this belief, we recognize that our particular stopping rule procedure may not lead to the most informed stopping rule. Deriving efficient stopping rules, useful at the time of product introduction, is a potentially interesting area for further research. In this regard, we return to a previous issue, that is, our stopping rule does not allow for Bayesian updating.

Although our decision rule procedure (i.e., developing the weights) only uses information that is known at the time of the initial go/no go decision, deployment of the stopping rule procedure entails use of information known (observed) at the time of the stop/no stop decision. In this way, new (factual) information is introduced into the stop/no stop decision. An alternative approach would be to conduct a new risk analysis at the time of the stop/no stop decision, thereby enabling the manager to update his or her knowledge of the uncertain future environment.

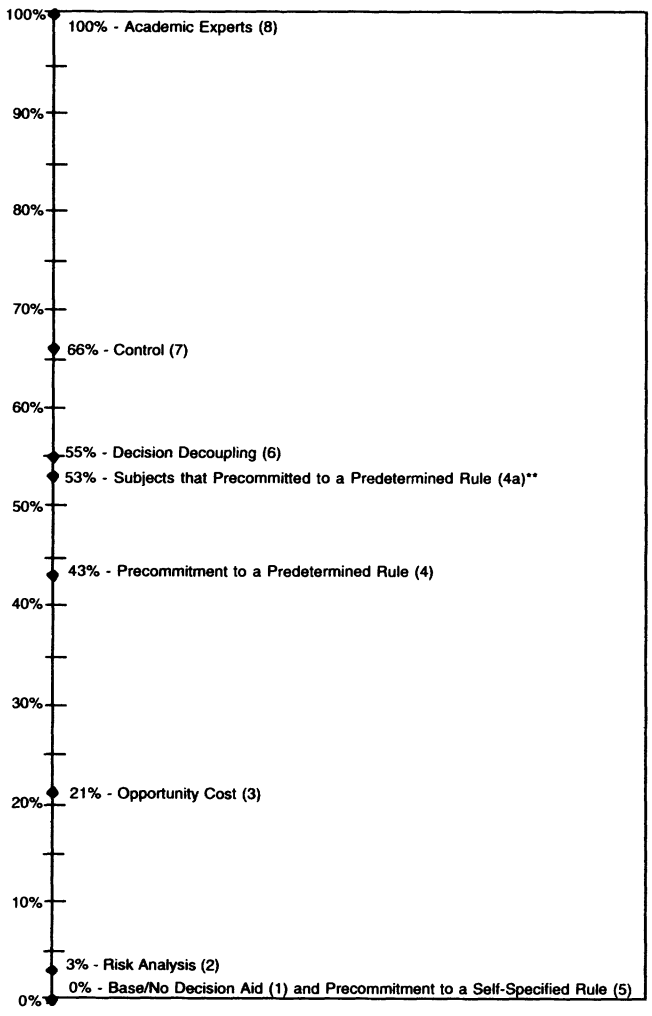
We recognize, theoretically, that this approach dominates our stopping rule procedure because it reflects the most up-to-date belief structure of the manager as well as verifiable information. In practice, however, this advantage may not hold if managers unconsciously bias their risk analysis inputs in a way that skews the analysis in favor of continued commitment. The question is, do "new" observations yield unbiased (i.e., better) information? The answer to this question is empirical, but on the basis of the large behavioral decision theory literature on judgmental biases (e.g., anchoring, overconfidence, availability) and our own justification evidence, we believe that a predetermined stopping rule leads to better stop/no stop decisions than does an update and re-evaluate approach. Because of potential gains from efficient stopping rules, this is as an empirical question worth answering.[11]

Finally, we find that fully one-third of the subjects in our control condition chose to continue commitment to the new product even though *none* of the normatively trained academic capital budgeting experts chose to continue commitment to the new product. These results have two significant managerial implications. First, there is a potential conflict between those who manage the new product launch and those who control the firm's resources (e.g., finance and accounting). Second, it raises the issue of the proper definition of success or failure of a new product launch. With respect to this latter issue, we believe that the gap between the normatively correct behavior and the observed behavior in our control condition is due less to definitional differences in what constitutes success or failure than to a tendency toward optimism on the part of managers. This conjecture is supported by the justifications given by managers in the Control Condition (7) who stayed with the project (e.g., "profitability will be greater than expected"). These justification results lead to our final conclusion:

C_5: If mangers tend to believe they can "control" uncertainties in their favor (i.e., increase the probability of future success for a new product introduction) escalation bias will persist.

We raise this issue because it suggests that none of our proposed decision aids can eliminate escalation bias fully. Thus, we conjecture that new product decision procedures are needed that account for managers' bias toward optimism and sense of control over risk.

Figure 5
PERCENTAGE OF SUBJECTS PULLING PRODUCT OFF MARKET*



*Numbers in parentheses correspond to the experimental conditions.
**Condition 4a represents the subset of subjects in Condition 4 that chose to precommit to the predetermined rule.

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[11]We remind the reader that in our situation no new information was given about the remaining key uncertainties. Thus, a new risk analysis would not have reflected new information.

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