

# Looking Forward and Looking Back: Integrating Completion and Sunk-Cost Effects Within an Escalation-of-Commitment Progress Decision

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Currently, there are 2 conflicting frameworks with which to understand why decision makers might escalate their commitment to a previously chosen course of action: sunk costs and project completion. The author proposes that sunk costs and need to complete exert simultaneous pressures, both independent and interactive, on a decision maker's level of commitment. The responses of 340 participants were analyzed and supported a complementary relationship between the 2 predictors. In addition, sunk costs demonstrated a curvilinear influence on commitment and an interaction with level of completion that supported a Level of Completion  $\times$  Sunk Cost moderation model. (A marginal utility model was not supported.) Results are discussed in terms of their relevance toward offering a complementary view of 2 potential antecedents to a decision maker's propensity to escalate his or her commitment to a previously chosen course of action.

Beginning with Staw's (1976) initial article, researchers exploring the effects of sunk costs have established the fact that decision makers tend to "throw good money after bad" (Garland, 1990) and escalate their level of commitment to losing positions even on receiving negative news. (*Level of commitment* within the context of this article refers to the respondent's willingness to allocate resources and is not to be confused with an individual's commitment toward his or her organization.) That is, on the basis of the amount of time and money previously spent, decision makers could become psychologically "stuck" to an ongoing project. However, a recent line of research (D. E. Conlon & Garland, 1993; Garland & Conlon, 1998) has challenged the emphasis given to sunk costs within progress-related decision dilemmas by observing that levels of sunk costs had historically been confounded with levels of completion and when manipulated separately, sunk costs no longer affected the decision maker's level of commitment. That is, Garland and Conlon found evidence that completion effects may overwhelm any sunk-cost effects as an explanatory paradigm for the escalation of commitment.

A person waiting at a bus stop (Brockner, Shaw, & Rubin, 1979) portrays a classic illustration demonstrating the escalation-of-commitment dilemma. Maybe the person has waited 15 min for a bus ride to a destination that she or he could have walked to in about the same amount of time. A question can be asked as to what

psychological trigger might keep the person waiting an additional 5 min for the bus? Those who advocate a sunk-cost explanation would argue that the person might think, "I've already waited 15 minutes, what's 5 more?" On the other hand, those who advocate a completion explanation would argue that people would only consider waiting the extra time if they thought that by doing so, the bus would soon arrive. That is, the person would only consider the time already spent at the bus stop to the extent that it increased the likelihood that the bus would soon appear.

Escalating commitment within an organizational setting can have implications with far more gravity than whether an individual should wait an additional 5 min for a bus. Ross and Staw (1993) revealed how the Shoreham Nuclear Power Plant construction went from a proposed \$75 million project to an over \$5 billion project over 23 years without ever reaching completion. Keil, Truex, and Mixon (1995) discussed the rampant problem of cost and schedule overruns associated with information technology projects. Staw, Barsade, and Koput (1997) discussed the difficulty the banking industry has had in determining when and how to drop potentially problematic loans. Gaining a more lucid understanding of how completion and sunk-cost effects may act both independently and in concert with a decision maker's propensity to escalate his or her commitment is critical to better understanding why it is often so difficult for decision makers to extract themselves from losing situations.

On the one hand, sunk costs may tend to push decision makers forward toward appearances of not seeming to be wasteful (Arkes & Blumer, 1985). On the other hand, completion pressures may tend to pull decision makers forward toward the social desirability of finishing what was started (Staw & Ross, 1980).

Currently, we have a large body of literature supporting a sunk-cost effect (see Brockner, 1992; Staw, 1997, for reviews). We also have a growing body of literature emphasizing the importance of completion effects (D. E. Conlon & Garland, 1993; Garland & Conlon, 1998; Keil et al., 1995). We have no studies that have discovered any interactive effects between sunk costs and completion. The purpose of this article is to fill several gaps

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presently found between the two literatures. First, I argue for a complementary approach to the relative significance of sunk costs and completion on the escalation of commitment. Specifically, I demonstrate main effects for both sunk costs and completion within a single study. Historic difficulty in consistently demonstrating a sunk-cost effect is argued to be a result of either difficulty in properly manipulating relative sunk costs or the fact that sunk costs, much like marginal utility (Georges, 1974) are actually a curvilinear function. Finally, two different interaction models are theoretically justified and empirically tested.

As stated earlier, this article is bound within those decisions that can be deemed *progress* decisions. Progress decisions (Beach & Mitchell, 1990), as opposed to *adoption* decisions, require a temporal element, including a specific beginning and end date. Adoption decisions, on the other hand, involve the choice of whether to use or undertake something. The classic example of an adoption dilemma is found in Arkes and Blumer's (1985) ski trip study. Here, a person must decide which of two ski trips she or he will go on: one that costs more initially or one that is potentially more enjoyable. Similar studies (Arkes & Blumer, 1985) looked at the extent to which individuals subsequently used theater tickets that were either discounted or purchased for full value or which of two identical dinners an individual would choose to eat: price paid being the only difference, and the uneaten dinner having to be thrown away. Within these situations, completion is choice, and the choices that people make can be tied more directly to sunk costs. This study focuses on progress-related decision dilemmas where the relationship between completion and sunk costs has not been fully established (Staw & Hoang, 1995).

## Theory and Hypotheses

### *Sunk Costs*

Studies have consistently demonstrated that decision makers often consider past expenditures when making current-utility-based decisions (Staw, 1997). Arkes and Blumer (1985) equated the psychology behind this behavior as an attempt by the decision maker not to appear wasteful and conducted a series of experiments that captured the impact of sunk costs on a person's subsequent decision making. Here, the actual amount of time and money spent is argued to positively affect commitment levels similarly to high levels of responsibility manipulated in earlier studies (Staw, 1976). However, although the effects of previous expenses have been clearly demonstrated in adoption dilemmas,<sup>1</sup> Staw and Hoang (1995) have noted that sunk costs have not demonstrated a consistent link to escalating commitment within progress decisions. For example, Staw and Fox (1977) found that commitment levels could actually decrease with subsequent decisions, although sunk costs would implicitly increase. Garland, Sandefur, and Rogers (1990), in field and lab studies involving the decision whether to continue drilling for oil after initial setbacks, similarly found a reluctance among the participants to keep drilling, the results of which the authors noted were in direct conflict with a sunk-cost notion of escalation of commitment. McCain (1986) argued that sunk-cost effects on escalating behavior occur early in the process and then dissipate. Heath (1995) went one step further and argued that in many instances decision makers actually de-escalate their commitment with increased sunk costs on the basis of the decision

maker's ability to mentally account for the sunk costs in relation to an initial mental expense budget.

There are two reasons that potentially valid sunk-cost effects may have been unobserved in many of the studies above. First, the lack of a sunk-cost effect could have been due to issues concerning the efficacy of the sunk-cost manipulation. Second, the sunk-cost effect itself may actually be curvilinear (similar to a marginal utility curve) in nature. Each of these issues is addressed.

In a recent review of the field of escalation of commitment, Staw (1997) offered the first potential reason for the lack of a consistent sunk-cost effect within progress decisions: "I worry that the use of abbreviated scenarios will produce weakened rather than exaggerated escalation effects. Without some contextual richness to ground the phenomena, it may be difficult to simulate the behavioral forces operating in real escalation situations" (p. 211). Telling someone that he or she has spent a million dollars is a weaker manipulation than observing that same person actually invest that million out of her or his pocket. Of course, abbreviated scenarios would most certainly produce weakened completion effects as well. Telling someone that he or she is almost complete is a weaker manipulation than that person's expending the time and expense to reach that point. The concern that I have with sunk costs as opposed to completion effects is with the validity of the relative (Garland & Newport, 1991) nature of the numeric sunk-cost manipulations used in abbreviated scenarios.

Garland and Conlon (1998) have structured the method of their experiments very closely to their previous program of research (D. E. Conlon & Garland, 1993; Garland, 1990; Garland & Newport, 1991). This body of literature based its findings on an alteration and manipulation of the Arkes and Blumer (1985) blank radar plane scenario by manipulating and measuring both levels of sunk-cost and completion effects separately. The level-of-completion manipulation appears to be straightforward and construct valid. Whether in a field or lab setting, a participant that is informed a project is either 10% or 90% complete has few alternative interpretations.

However, are manipulations of high and low levels of sunk costs as clear? The authors manipulate sunk costs in the same manner as they do completion. The participants are told that they have previously invested either \$1 million or \$9 million out of an initial budget of \$10 million. Will, or do, the participants interpret these as either high or low sunk costs in the same manner as they would level of completion? Staw's (1997) concern for a lack of contextual richness may apply to attempts to manipulate levels of sunk costs much more so than attempts to manipulate level of completion. The notion that the previous expenditure is a percentage of an initial budget could be interpreted in two different ways. Do

<sup>1</sup> For example, in the Arkes and Blumer (1985) ski trip study, 44 out of 86 participants chose to go on the more valuable versus the more enjoyable ski trip. In another study, a person decided which of two already purchased and prepared (identical) TV dinners to eat. One dinner cost \$3, and the other dinner cost \$5. Sunk costs could be assumed as the reason that only 2 participants chose to eat the \$3 dinner versus 21 participants' choosing the \$5 dinner (66 participants had no preference). In addition, Staw and Hoang (1995) demonstrated that after controlling for on-court performance, National Basketball Association coaches tended to play their higher drafted players more minutes than they did their lower drafted players.

participants look at \$1 million invested out of a budget of \$10 million and think "I've only spent 10% of the budget," thereby eliciting low perceived sunk costs? Alternatively, do participants view \$1 million as a lot of money? To the extent that the participants interpreted a million dollars invested as a lot of money, it is asserted that the aforementioned authors were in fact comparing only high sunk costs with either high or low completion figures rather than high and low sunk costs with high and low completion, thereby masking the true impact of sunk costs due to a potential restriction in range (i.e., see D. E. Conlon & Garland, 1993, Study 2). Therefore, to the extent that sunk-cost manipulation itself is more contextually clear (within either laboratory manipulations or real-life situations), it is asserted that concurrent with the level of completion, there is indeed a sunk-cost effect, so that,

*Hypothesis 1a.* As the level of sunk costs increases, a decision maker will be significantly more willing to invest further into a progress-related project.

The difficulty in determining what is and is not a high level of sunk cost brings to the fore a second concern. In addition to instrument concerns offered by Staw (1997), I argue that conflicting findings within the milieu of escalation of commitment may be due to the assumption of a linear sunk-cost function. McCain (1986) has mentioned that sunk costs appear to be more important early in a person's decision process after she or he has received negative news and less so afterward. Staw and Ross (1987) have alluded to the possibility that temporally, the project and psychological pressures to continue investment become subordinated to other pressures (social or structural). This suggests that sunk costs, a type of project determinant, are less salient at later stages of a project.

Pope (1995) has offered that in reaching a more precise decision framework (in terms of the negative utility of gambling and risk aversion), it is important to correctly incorporate the diminishing marginal utility of money. For example, Kemp, Lea, and Fussell (1995) found that the marginal utility of consumer goods was more closely tied to price than frequency of consumption. Worley, Bowen, and Lawler (1992) found support for this type of relationship in the size of a bonus in relation to current salary level. They found that the attractiveness of a bonus did indeed increase as its size increased in proportion to salary but that this increase was curvilinear in nature. Therefore, the decreasing rate of a bonus's impact resembled, and supported, the principle of diminishing returns. If the impact of bonuses diminishes with increased amounts of the bonus, then it would seem logical that the reverse of this finding is also true, so that the impact of money spent also decreases with increased amounts spent. Or, in the Shoreham Nuclear Power Plant (Ross & Staw, 1993) example used earlier, did the fourth \$1 billion invested into the plant have the same psychological impact as the first \$1 billion invested? It is asserted that the impact of sunk costs do act similarly to the marginal utility of money, so that,

*Hypothesis 1b.* The sunk-cost effect on a participant's propensity to continue investment into a project will be curvilinear in nature and shaped similarly to a marginal utility model.

The proposed positive relationship between sunk costs and continuing investment needs further explanation in the light of the

discussion involving the Staw and Fox (1977), Garland et al. (1990), and McCain (1986) studies, where it was asserted that sunk costs were actually negatively related to continuing investment. The difference between the three articles mentioned above and the proposed relationship in this article is that the articles that found a negative relationship between subsequent levels of sunk costs and commitment were confounded with the number of decisions made (Bateman, 1986). For example, in the Garland et al. study, the decision to continue with the next drilling project was deliberated with the knowledge that the previous attempts were completed and had failed. Therefore, in addition to the level of sunk costs, for the decision maker to decide to initiate drilling for the fourth time on a leased property, she or he would have to do this in the face of the knowledge that she or he had failed three previous times. This article bounds itself within a single decision concerning a project that does not conflict with the findings of de-escalation of commitment found within a series of decisions.

### Completion

From children staring at a half-finished dinner plate to the expectations and subsequent attributions given to leaders by their subordinates (Staw & Ross, 1980), the social desirability to "finish what you have started" has historically been treated as a powerful driver of behavior. Lewin (1926) wrote of the creation of tension that independently applied pressure toward completion on the acceptance of a task. Cialdini, Cacioppo, Bassett, and Miller (1978) researched this pressure under the guise of falling for the "low-ball" effect. Here, the initial decision to perform a specific behavior acted to increase the perseverance of a decision maker even as the costs of that initial decision rose, much like a car salesperson increasing the price of a car after the potential buyer has already agreed on a lower price. Zeigarnik (1927) found not only that was there a need to finish tasks but also that unfinished tasks were remembered significantly better than finished tasks.

In a series of five experiments, Garland and Conlon (1998; see also Conlon & Garland, 1993) correctly suggested that many previous escalation-of-commitment studies (Arkes & Blumer, 1985; Garland, 1990; Garland & Newport, 1991) had confounded sunk costs with completion. Specifically, an experiment in Arkes and Blumer's (1985) article was alleged to have been completely confounded with a desire to complete the project. In the blank radar plane study, a participant played the role of a vice president of a company that had invested \$9 million into a research project that was 90% complete. In the light of hearing that a rival company had begun to market a superior plane, the participant was then asked whether he or she would invest the remaining 10% of research funds. A careful reading of this scenario revealed that there were two possible bases for justifying further resource allocation in the face of negative information. The assumed predictor sunk costs (\$9 million already spent) was joined by a possible completion effect (90% complete). Across five studies where both completion and sunk costs were manipulated separately, Garland and Conlon (1998) found strong support for a completion effect, no support for a sunk-cost effect, and no interactions between the predictors.

Although the experiment in this article is structured similarly to the D. E. Conlon and Garland (1993) study, this article will enlarge the boundaries in which the previous robust evidence of comple-

tion effects were demonstrated in three distinct ways. First, as was previously discussed, it was hypothesized that a more robust sunk-cost manipulation may reveal a previously hidden sunk-cost effect. It is conceivable that the increased strength of sunk-cost effects comes at the expense of completion effects (D. E. Conlon & Garland, 1993).

A second, and more important, potential boundary condition that must be tested is whether the completion effect found first by D. E. Conlon and Garland (1993) is merely an artifact of, or the result of a spurious relationship with, perceived likelihood of success. The closer the decision maker feels that the project is to being complete, the better chance the decision maker may feel that the project has to succeed. In fact, Heath (1995) has correctly pointed out that until one controls for the decision maker's perception of the likelihood of success, one cannot determine the rationality of, or cull, true sunk-cost (or, in this case, completion) effects. If that is true, then completion effects may disappear after controlling for perceptions of success. This would indicate that the effect of level of completion on level of commitment found in previous studies (D. E. Conlon & Garland, 1993) was the artifact of a spurious relationship with perception of success (this would be viewed as rational decision making). The experiment in this study tests these two potential boundary conditions and bases its hypothesis on the findings of Lewin (1926), Zeigarnik (1927), and D. E. Conlon and Garland that a completion effect tied closely to irrational, or biased, decision making exists, so that even within situations demonstrating a sunk-cost effect and after controlling for perceptions of success;

*Hypothesis 2.* As the level of completion increases, a decision maker will be significantly more willing to invest further into a progress-related project.

The third boundary condition that is tested concerning project-completion effects on the decision maker is theoretical justifications for and empirical tests of the inclusion of potential interactions between completion and sunk cost.

### *Interactive Effects*

To date, there has been neither theoretical justification for nor findings of an interaction between completion and sunk costs within escalation dilemmas. D. E. Conlon and Garland (1993) first addressed the relationship between the two predictors in their demonstration of the confound between sunk-cost and entrapment measures. They viewed the two predictors as "theoretically different concepts that contributed separately to continuing investment behavior" (D. E. Conlon & Garland, 1993, p. 403). As an example, they offered two scenarios: one in which a huge amount of time and energy had been invested and the project was 50% complete, compared with one in which a much smaller amount had been invested but the project was near completion. Their contribution rested on discovering which bit of information the participants would use as a frame (Bazerman, 1984; Frisch, 1993) in making further allocation decisions, not on any interaction of the two. In fact, in none of their five studies that separately manipulated sunk costs and completion did D. E. Conlon and Garland find any interaction (see also Keil et al., 1995). On the basis of the two hypotheses concerning sunk costs above (that a more contextually rich description of sunk costs will reveal a sunk-cost effect and that

the sunk-cost effect itself is curvilinear), it is argued that an interaction between completion and a curvilinear sunk-cost effect does indeed exist. However, there are two potential models of the interaction: a marginal utility model and a moderation model. Theoretical justification for each is accompanied by explanatory hypotheses.

### *Marginal Utility Model*

Heath (1995) indirectly has alluded to the potential of a Completion  $\times$  Sunk Cost interaction by looking at the role of mental accounting in de-escalating commitment. Heath has found evidence that a mental expense budget serves to mitigate the effects of previous expenditures, so that people will escalate only when there is no budget or it is difficult to track. In much the same way, this article asserts that within progress decisions, completion becomes a second factor that decision makers must weigh, so that sunk costs are weighed in their relation to how close those previous costs have brought the project to completion. Brockner et al. (1979) may have lent support to this line of argument when they proposed that a person's initial motives for investing in the project might possibly shift toward alternative motives as increasing amounts of resources were allocated. D. E. Conlon and Garland (1993) quote Brockner et al. as viewing this change as "due in part to the presumed increased proximity of the goal" (p. 194), which may be nothing more than completing whatever project has been started (D. E. Conlon & Garland, 1993; Lewin, 1926; Zeigarnik, 1927).

I have made the argument that both completion and sunk costs exert a main effect on a person's level of commitment. However, as a result of the fact that the effect of sunk costs on the decision maker is proposed to act much like a marginal utility curve, it follows that as a project reaches its latter stages, completion effects should increase in their relative importance to sunk costs. The impact of sunk costs is not hypothesized to decrease in importance, but their impact in relation to completion will decrease in the latter stages of completion, so that,

*Hypothesis 3a.* Sunk costs will be more strongly related to commitment than completion under low-completion conditions but less strongly related to commitment than completion under high-completion conditions.

This model is demonstrated by Figure 1.

### *Moderation Model*

The marginal utility model of a potential interaction between sunk costs and completion is intuitively rational. Much like prospect theory (Kahneman & Tversky, 1979; Whyte, 1993), where the decision maker is thought to be risk averse in a winning situation and risk seeking in a losing situation, the marginal utility model fits with existing microeconomic theory's understanding of the dynamics of marginal utility (Kemp et al., 1995) or psychology's view of mental budgeting (Heath, 1995).

In contrast, the moderation model is underpinned by the entrapment literature (Brockner, Rubin, & Lang, 1981; Teger, 1980). Brockner et al. (1981) have offered two requirements for an entrapment situation to occur: (a) The decision maker must have made a substantial previous investment or have incurred sunk

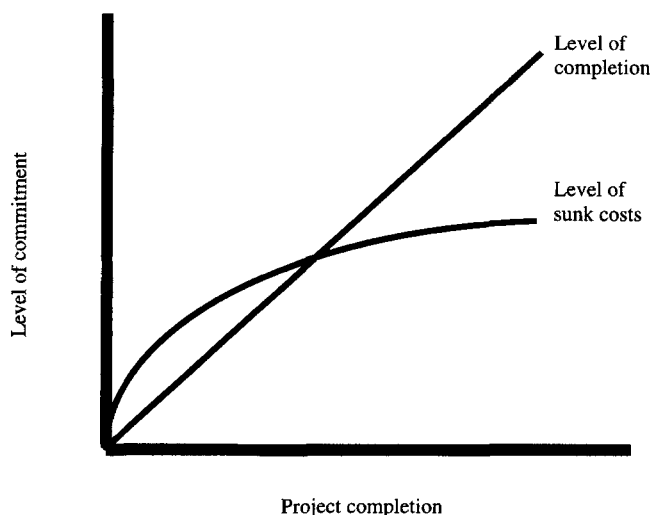


Figure 1. Proposed marginal utility model, demonstrating the interactive effects of both sunk costs and level of completion on subsequent level of commitment.

costs, and (b) the decision maker must be psychologically compelled to invest further even if the likelihood of goal attainment is low. Staw (1976) supported a moderation model in that only in the high-responsibility condition did the participants exhibit sunk-cost effects. Without that psychological trigger (responsibility), sunk costs did not affect the decision maker's level of commitment. In both low or high levels of completion, the first requirement for an entrapment situation can be met. The moderation model rests its hypothesis on the belief that the second requirement, that of psychological pressure, is not met in low-completion conditions.

Under low-completion conditions, the notion that a decision maker will feel entrapped is equivocal. Attempts not to appear wasteful (Arkes & Blumer, 1985) are offset by the realization that higher expenditures contrasted with low completion may be associated with budget problems (Heath, 1995) or with being behind schedule. This, according to Heath may actually pressure the decision maker to de-escalate his or her commitment to the extent that a mental accounting of the completion-sunk-cost discrepancy is known. Anecdotally, completion within progress decisions is often associated with things being built. Dowie (1981) has discussed how nuclear energy projects are allowed to continue in the face of public protest and obscene cost overruns. He has noted that "by the time they get around to demonstrating and challenging the license, we'll have a million tons of steel and concrete in the ground, and no one in their right mind will stop us" (Dowie, 1981, p. 23). Under low levels of completion related to progress decisions, these visible structural (Staw & Ross, 1987), or institutional, pressures may not yet exist.

High-completion conditions, to the contrary, may offer situations in which the psychological pressures to continue are strongest. Here, the decision maker may feel entrapped, and sunk costs exert their impact. Northcraft and Wolf (1984) have described real situations related to progress dilemmas, two of which involve construction projects. Within these situations, "things" are being built, and both psychological and real contracts are entered into. The impact of visibility (E. Conlon & Wolf, 1980) and the social

desirability to stay the course (Staw & Ross, 1980) will provide the psychological impetus for justifying past expenditures. Therefore, sunk-cost effects are thought to exert pressures under high-completion conditions, so that,

*Hypothesis 3b.* Sunk costs will not be related to commitment under low-completion conditions, but sunk costs will be related to commitment under high-completion conditions.

This model is demonstrated by Figure 2.

## Method

### Participants and Design

Three hundred fifty-four undergraduate students enrolled in a capstone management course at a large midwestern university participated in this study as an opportunity to gain extra credit toward their final grade. Participants were randomly assigned to one of eight treatment conditions in a  $2 \times 4$  design where completion (2) and sunk costs (4) were manipulated as independent variables. The experiment was conducted during class time in a controlled environment. Although participation was strictly voluntary, the students were encouraged to conscientiously complete the questionnaire. Research assistants were trained to look for any questionnaires that were either turned in prematurely (completed significantly earlier than other students with a noticeable lack of effort) or completed incorrectly (p. 2 not completed). Fourteen questionnaires were not used on the basis of failure in either of the two above criteria, although inclusion of these questionnaires did not affect the results in any way.

### Decision Task

Students were asked to carefully read, evaluate, and answer questions related to a short scenario. The answers to the questions provided were to be answered as if the scenario were actually true. A sample of one of the scenarios appears below, followed by a discussion of the manipulations. The instrument was an adaptation of the blank radar plane scenario that first appeared in Arkes and Blumer (1985) and has subsequently been used

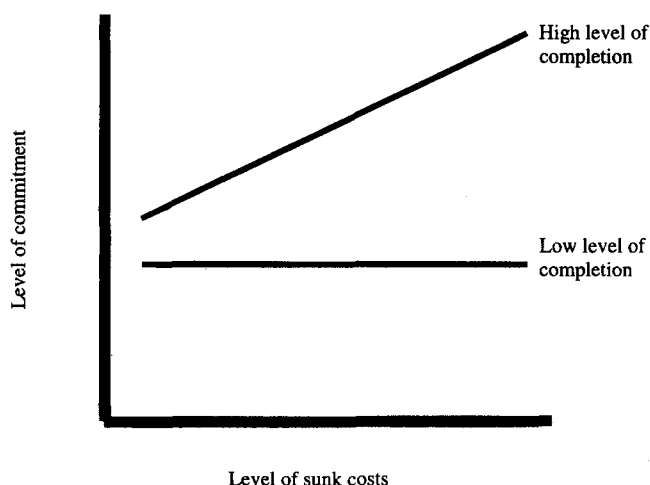


Figure 2. Proposed moderation model, demonstrating the interactive effects of both sunk costs and level of completion on subsequent level of commitment.

in a number of published sunk-cost studies (D. E. Conlon & Garland, 1993; Garland, 1990; Garland & Conlon, 1998). Each participant received the following scenario, with one of the variations:

You are the Vice President of Operations for a mid-sized high-tech manufacturing firm. You have spent 1 (0, 5, or 9) million dollars and 6 (0, 18, or 32) months towards a research project to develop a radar-scrambling device that would render a ship undetectable by conventional radar, in effect, a radar-blank ship. So far, you have invested a small (moderate or large) amount of funds, and time, compared with the 10 million dollars and 3 years normally budgeted for these types of projects.

The engineering department has informed you that the project is 10 (90)% complete.

You have just discovered that another firm has already begun marketing a similar product that takes up less space and is much easier to operate than your design. The decision you face now is to either abandon the project or authorize the next 1 million from the budget to continue this radar scrambling research project.

On the basis of the scenario, the students were asked to determine (on a scale of 0 to 100) the extent to which they would continue investing in the aforementioned project.

### Measures

#### Control Variable

Heath (1995) noted that before one could discuss the rationality or irrationality (Bowen, 1987) of escalation of commitment dilemmas, she or he must first control for perceptions of success. Therefore, controlling for a person's perception of likelihood of success would provide a more clean measure of the escalation of commitment derived strictly from either of the two measures of interest. On the basis of the information provided within the previous scenario, the participants were asked to indicate their belief of the likelihood of the project's success on a scale from 0 to 100.

For level of completion, the extent to which a significant relationship existed between level of completion and level of commitment after perception of success was controlled for would demonstrate the importance of level of completion beyond a potential confound with perception of success. As stated earlier, findings within previous studies (D. E. Conlon & Garland, 1993; Garland & Conlon, 1998) of a completion effect might have been the result of a spurious relationship with perception of success. Therefore, it was essential to control for perception of success (which might be purely rational) before asserting a direct completion effect (which was more closely tied with classical biased decision-making theory).

#### Independent Variables

**Completion.** Completion effects were manipulated by stating within the scenario that the project was either 10% or 90% complete.

**Sunk costs.** There were four manipulations of the current levels of sunk costs. First, the amount of money already invested would equal almost none or \$1, \$5, or \$9 million. The amount of time already invested was almost none or 6, 18, or 32 months. Finally, the sum of the amount of time and money spent was compared with a similar project's budget as being either almost none or a small, moderate, or large amount of money. The scenario used in this study included additional elements to the sunk-cost manipulation that were absent in previous studies using a similarly worded scenario. First, a time-invested element was added to the sunk-cost manipulation. Second, the participant was directly informed as to the appropriate level of spending that had already been invested. For example, in the \$1 million invested condition, the participant was informed that the amount invested thus far was low compared with similar projects. Note also that in deference to the production of the stealth bomber, the subject of the scenario was changed to a radar-blank ship. In sum, the sunk-cost manipulation used in this study is not more extreme than in previous studies but is more descriptive or more specific to the intended manipulation (Staw, 1997).

#### Dependent Variable

After reading the scenario, participants indicated the percentage probability from 0 to 100% (0 = *absolutely no*, 50 = *don't know*, 100 = *absolutely yes*) that they would authorize the expenditure of the next \$1 million to continue the project.

### Results

#### Manipulation Checks and Descriptive Statistics

A manipulation check was conducted for both sunk cost and completion. After the participants answered the questions pertaining to the study, they turned to a second page. Here, they were asked to answer several more questions without turning to the previous page. For sunk costs, the participants were asked to answer on a scale of 0 to 100 the extent to which they felt that they had already invested a lot of time and money on the project. The mean difference between the \$0 ( $M = 32.94$ ), \$1 ( $M = 41.29$ ), \$5 ( $M = 63.86$ ), and \$9 ( $M = 80.73$ ) million sunk-cost levels was significant and in the proper direction,  $F(3, 336) = 83.46$ ,  $p < .001$ . For level of completion, the participants were asked to answer on a scale of 0 to 100 the extent to which they felt that the project was near completion. The mean difference between the 10% ( $M = 22.99$ ) and 90% ( $M = 79.19$ ) conditions was significant,  $F(1, 338) = 735.16$ ,  $p < .001$ , and in the proper direction.

The means, standard deviations, and zero-order correlations of all variables are reported in Table 1. An interesting relationship that has not been previously discussed within the escalation literature is the lack of significance between perception of success and

Table 1  
Means, Standard Deviations, and Zero-Order Intercorrelations

Variable	<i>M</i>	<i>SD</i>	1	2	3	4
1. Level of completion	50.68	40.03	—			
2. Level of sunk costs	41.16	31.72	.048	—		
3. Likelihood of success	50.02	25.57	.276**	.083	—	
4. Level of commitment	56.12	31.00	.297**	.149**	.604**	—

Note.  $N = 340$ . Likelihood of success is a control variable.

\*\*  $p < .01$ .

sunk cost (perception of success–sunk cost  $r = .08$ ,  $p > .05$ ) concomitant with a significant correlation between perception of success and level of completion ( $r = .28$ ,  $p < .01$ ).

### Tests of Hypotheses

Hierarchical regression was used to test for potential interaction effects between level of sunk costs and level of completion when predicting level of commitment (see Table 2 for results). Step 1 regressed the proposed control variable likelihood of success advocated by Heath (1995). Results suggested a significant relationship between the perceived probability of success and subsequent commitment levels,  $t(1, 338) = 13.93$ ,  $p < .01$ ,  $\Delta R^2 = .36$ .

After controlling for perceived likelihood of success, Step 2 regressed both level of completion and level of sunk costs on subsequent level of commitment. Hypothesis 1a offered that sunk cost would significantly affect the decision maker's level of commitment on the basis of a more enriched scenario. Table 2 demonstrates that using the adjusted scenario, the level of sunk cost was significantly related to level of commitment,  $t(1, 338) = 2.26$ ,  $p < .05$ ,  $\Delta R^2 = .01$ ; thus, Hypothesis 1a was supported.

However, Hypothesis 1b proposed that the sunk-cost relationship to level of commitment was actually curvilinear in nature. After partialing out any linear sunk-cost effects, this hypothesis was tested in Step 3. In keeping with this hypothesis, the squared sunk-cost term was indeed significantly correlated with level of commitment,  $t(4, 335) = 1.99$ ,  $p < .05$ ,  $\Delta R^2 = .01$ . However, the shape of the sunk-cost curve was not similar to a proposed marginal utility model. The level of commitment associated with the first three sunk-cost conditions were not statistically different from each other,  $F(1, 255) = 0.22$ ,  $ns$ ,  $p = .01$ , when the highest sunk-cost condition was removed. Further, the level of commitment associated with the highest sunk-cost condition ( $n = 83$ ,  $M = 66.54$ ) was significantly greater than that of the other three conditions ( $n = 257$ ,  $M = 55.0$ ),  $F(1, 338) = 8.79$ ,  $p < .01$ . A marginal utility-shaped curve would show the greatest difference between either the \$0 and \$1 million, or the \$1 million and \$5 million, sunk-cost levels and less difference between the \$5 million and \$9 million sunk-cost levels. Therefore, although level of sunk costs demonstrated a curvilinear component, the shape of the

curve was different than was hypothesized. Therefore, Hypothesis 1b was not supported.

Hypothesis 2 predicted a significant positive relationship between level of completion and subsequent level of commitment. This relationship was proposed to expand the boundaries of the relationship found in previous literature by, first, demonstrating both sunk-cost and completion effects within a single study and, second, demonstrating completion effects even after controlling for perceptions of success. In keeping with our hypothesis, level of completion was significantly related to level of commitment in the presence of a significant sunk-cost effect and after controlling for perceived likelihood of success,  $t(3, 336) = 3.13$ ,  $p < .01$ ,  $\Delta R^2 = .02$ . Therefore, Hypothesis 2 was supported.

Table 2 demonstrates support,  $t(5, 334) = 2.00$ ,  $p < .05$ ,  $\Delta R^2 = .01$ , for an interaction between level of sunk costs and completion (Step 4). Recall that I proposed two different forms of an interaction (a marginal utility model and a moderation model). The form of the interaction did not support the marginal utility model. First, the findings did not demonstrate an interaction between a curvilinear function of sunk costs and completion,  $t(6, 333) = 0.52$ ,  $p > .05$ , which was proposed in the marginal utility model. In addition, the plot of the curvilinear sunk-cost function does not support the marginal utility model. Therefore, Hypothesis 3a was not supported.

Support for a moderation model of the interactive effects of level of sunk costs with level of completion was evidenced by regressing sunk costs on commitment at both low,  $n = 165$ ,  $F(1, 163) = 1.03$ ,  $p > .05$ ,  $ns$ , and high,  $n = 175$ ,  $F(1, 173) = 7.39$ ,  $p < .01$ , levels of completion. Level of sunk costs was significantly related to level of commitment in the high-completion condition only. Therefore Hypothesis 3b was supported. An interesting outcome of the moderation model was that although sunk-cost effects were present only within situations that were near completion, the shape of the sunk-cost effect had a curvilinear component (see Figure 3). The implications of this interaction model are discussed in more detail within the Discussion section. Note that all hypotheses were also tested without controlling for likelihood of success. Although the two variables of interest remained significant, level of completion:  $n = 340$ ,  $t(2, 337) = 5.64$ ,  $p < .001$ ,  $\Delta R^2 = .07$ ; level of sunk costs:  $n = 340$ ,  $t(2, 337) = 2.62$ ,  $p < .01$ ,  $\Delta R^2 = .03$ , the interactions fell below marginal levels (Sunk Cost  $\times$  Completion  $n = 340$ ,  $t(3, 336) = 1.00$ ,  $p > .05$ ).

Table 2  
Regression Results for Moderation Hypotheses

Predictor	df	t	$\Delta R^2$
Step 1			
Likelihood of success	1, 338	13.93**	.36
Step 2			
Level of sunk costs	3, 336	2.26*	.03
Level of completion		3.13**	
Step 3			
Sunk Cost $\times$ Sunk Cost	4, 335	1.99*	.01
Step 4			
Sunk Cost $\times$ Completion	5, 334	2.00*	.01
Step 5			
Sunk Cost <sup>2</sup> $\times$ Completion	6, 333	0.52	

Note.  $N = 340$ .

\*  $p < .05$ . \*\*  $p < .01$ .

### Discussion

The findings in this article offer a contribution to the existing body of literature related to commitment and the escalation of commitment in three distinct ways. To begin, this is the first article to find significant results for both sunk costs and completion effects within a single study. Historically, researchers have assumed that decision makers tend to either look retrospectively (E. Conlon & Parks, 1987) toward sunk costs or prospectively (D. E. Conlon & Garland, 1993) toward completion. This article finds evidence that decision makers actually look forward (prospectively) and look back (retrospectively).

Second, an ancillary finding related to sunk costs is evidence that there is a curvilinear component to the effect of sunk costs that, to date, has not been fully addressed. In addition, this article expands the boundaries of project-completion effects by demon-



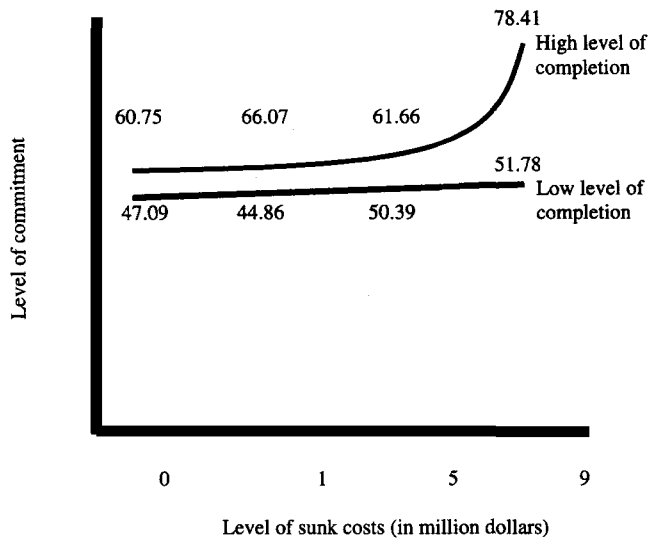


Figure 3. Moderation model demonstrating the interactive effects of both sunk costs and level of completion on subsequent level of commitment.

strating that this effect occurs concurrently with sunk-cost effects and exists after one controls for the decision maker's perceptions of success. In effect, this is the first study to demonstrate the effect of level of completion without a potential spurious relationship with perception of success.

Third, this is the first article to argue for, and demonstrate, an interaction effect between sunk costs and completion. Two different interaction models were theoretically justified and tested. The results support a moderation model, so that the interaction between sunk costs and completion tend to act synergistically within situations where completion and sunk costs are both high. Illustratively, the data within this study support the argument that decision makers tend to escalate their commitment when they feel entrapped (Brockner et al., 1979) within situations involving both high sunk costs and high project completion, so that these two forces tend to interact in a way that synergistically increases the likelihood of further commitment. In fact, the empirical evidence points to a potential "magic square," which is a situation that is high in both completion (90%) and sunk costs (\$9 million). This mean (78.41) was significantly higher than the other three means combined,  $F(1, 173) = 3.80, p < .05$ , within the high-completion condition, and the next highest mean, one-way contrast  $F = 2.08, p < .05$ , within the high-completion condition. There is anecdotal evidence of this interaction offered by Garland and Conlon (1998), who have observed that Ross and Staw (1993) noted that a majority of the expenditures on the Shoreham Nuclear Plant Project were allocated after the plant was thought to be 80% complete.

By rejecting the marginal utility model, this article also questions the assumptions made by McCain (1986) or historic micro-economic assumptions that sunk costs are important only early in the project and less so later. This may be true given a series of decisions, each made in the face of negative information, but for a single decision within a progress dilemma, the evidence toward a moderation model clearly indicates that sunk costs have their greatest impact as level of completion increases.

This potential magic square condition, which is both high in sunk costs and level of completion, either can be viewed as the

condition in which true entrapment occurs (Brockner et al., 1979), as alluded to by Ross and Staw (1993), or can offer avenues of future research. Other potential future studies and limitations to the present study follow.

### Limitations

The major limitation of this study was the use of student participants and a relatively simply worded scenario to model what is obviously a complex natural dilemma. I have noted some potential concerns with the sunk-cost manipulations of previous studies that attempted to explore the separate effects of both sunk costs and completion. These same studies indicated no sunk-cost or interactive effects when separated from completion; therefore, additional findings using a similarly structured experiment were a necessary first step toward pointing the literature toward a more complementary paradigm. This study successfully clarifies and advances the findings of earlier works using basically the same manipulation by adding specificity to the sunk-cost manipulation (years invested and a definitive statement of the level of sunk-costs incurred) and, maybe more importantly, controlling for perceptions of success (which enabled a more clear look into the true impact of the two variables of interest). Therefore, any limitation associated with the use of both students and simple scenarios was necessary to offer a reconceptualization of how these two phenomena, sunk-costs and need to complete, act both independently and in concert with a decision maker's proclivity to continue investing into a dubious progress-related project. That is, the purpose of this study was to find results, different from previous literature, within a controlled environment rather than address issues of generalizability.

### Future Studies

Using this framework, it would be of interest to replicate these findings using either or both field data or temporally driven experiments. One area that would be of great interest is a study that would look at the effect of time (in a natural context) on escalation of commitment separately and interactively with both financial sunk costs and completion. The majority of studies within this literature has ignored sunk costs as investments of time and has instead focused on sunk costs as dollar amount spent. In fact, the one field study that did indirectly include time as a sunk cost (Staw & Hoang, 1995) actually found that the absolute level of sunk-cost-related commitment decreased with concomitant increases in time.

This study revealed an interaction between sunk costs and completion that supported a moderation model at the expense of a marginal utility model, both of which had theoretical justification. Future work could either contradict, improve on, or replicate in a different setting the design of the current study, to support either of the proposed models.

It was noted earlier that many studies have demonstrated a de-escalation of commitment (Garland et al., 1990; McCain, 1986; Staw & Fox, 1977) founded on a series of decisions going forward in the light of negative information. However, it would be interesting to explore how the way that negative information is received affects a decision maker's subsequent level of commitment. That is, most studies have based the dilemma of whether to continue or



abandon a project on the receipt of negative news. If there was no negative or even ambiguous information concerning the progression of a project, there would be no reason for the decision maker to ponder whether to continue to invest in the project. In most studies, this negative news has been given to the participant in the form of a news flash. In natural settings, however, the negative information concerning a project is often revealed to a decision maker over time, in a manner that is more akin to a leaking faucet. That is, in the natural environment, most situations are similar to that found in technology cost overruns (Keil et al., 1995) or problem loans (Staw et al., 1997), where delays and negative reports are ongoing. In addition, in the Staw and Hoang (1995) National Basketball Association study, the propensity for teams to play higher drafted players more (thought to exhibit higher sunk costs because of increased salary and visibility associated with being a higher drafted player), even after controlling for on-court performance, was more than likely done in the face of a series of mediocre games rather than a single terrible game.

Future studies could look at the dynamics involved in the form in which information is provided and look for potential differences in the decision maker's attributions (Staw & Ross, 1978) associated with either leaking-faucet or news-flash negative information. Moreover, because progress-related decisions are often evaluated in stages (Cooper, 1990), more studies could look at the timing of negative information that might take place at certain key dates or at certain levels (Northcraft & Wolf, 1984) of either budget (sunk costs) or completion (Schmidt, 1996). These studies would explore phenomena similar to the different reactions a frog might have to being dropped into a pot of boiling water versus a frog within a pot of water that is slowly brought to a boil. Given the findings of this study, it does seem prudent that research going forward that attempts to build on the escalation-of-commitment literature within progress-related decisions include both sunk costs and completion as important drivers of a decision maker's level of commitment.

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