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SHORT NOTES

Throwing Good Money After Bad: The Effect of Sunk Costs on the Decision to Escalate Commitment to an Ongoing Project

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The functional relationship between sunk costs and the decision to continue investment in a research and development (R&D) project was examined in an experiment with 407 undergraduate business students. Ss read an R&D scenario in which 10%, 30%, 50%, 70%, or 90% of a $10 million budget had been invested. One group of Ss indicated the likelihood of their allocating all remaining funds to finish the project. A second group indicated the likelihood of their allocating the next $1 million to continue the project. A third group indicated the likelihood that the project would be profitable. Strong, linear sunk-cost effects were observed in the first 2 groups, with no indication that incremental costs played any role in decision making. Nonsignificant results in the 3rd group suggest that the effects observed in the 1st group were not a function of higher outcome expectations among Ss with higher sunk costs.

Researchers in the field of organizational behavior have shown considerable interest in examining situations in which individuals are likely to violate the prudent advice of economists and management decision-making theorists by throwing their own and others' good money after bad. Such escalation situations create a predicament in which one must choose between continued investment or withdrawal from a course of action in which costs have already been incurred (Staw & Ross, 1987).

Sunk-cost effects have been observed in both business and personal decisions (Arkes & Blumer, 1985). Theoretical explanations for these effects have included both private and public attempts at self-justification (Staw, 1981; Teger, 1979), approach–avoidance conflicts (Rubin & Brockner, 1975), the desire to avoid wastefulness (Arkes & Blumer, 1985), and information-processing heuristics (Whyte, 1986).

In two recent experiments, Garland and Newport (in press) examined sunk-cost effects from an information-processing perspective. In these experiments, absolute sunk costs (i.e., dollars expended) and relative sunk costs (i.e., dollars expended as a proportion of some overall project budget) were manipulated orthogonally. Consistent with derivations from prospect theory (Kahneman & Tversky, 1979; Thaler, 1980), as well as a much older literature in psychophysics (Boring, 1942), sunk-cost effects on willingness to continue investing in a project were found only for the proportion of the overall project budget that had been expended. Absolute dollar expenditures had no independent effect on subjects' decisions. This result held across four different escalation situations and two different subject populations.

Despite existing evidence for sunk-cost effects, numerous questions remain about the relation between sunk costs and decisions to escalate investments in ongoing projects. The research presented in this article was designed to address three such questions.

First, previous research has generally involved a simple dichotomous manipulation of sunk costs (e.g., committing funds to begin a new project vs. committing funds to a project that has already involved a substantial investment). However, sunk costs, whether measured as a budget percentage or in raw dollars, form a naturally continuous scale. Thus, there is a need for experimental studies in which sunk costs are manipulated parametrically. This would allow for the examination of the functional relationship between sunk costs and willingness to incur additional costs to persist with a project. In the present research, sunk costs were manipulated at five levels, with 10% to 90% of a project budget previously expended.

Second, although Garland and Newport (in press) found strong evidence for sunk-cost effects, their dependent measure asked subjects to indicate the likelihood of their committing all remaining funds in the budget to the project under consideration. With this measure, the proportion of a budget expended is perfectly and inversely correlated with incremental costs (e.g., when $9 out of $10 million has been spent, there is a $1 million incremental cost associated with project completion; when only $1 out of $10 million has been spent, the incremental cost for completing the same project is $9 million). Thus, the strong effects observed by Garland and Newport may have been due to a normatively rational, prospective consideration of incremental costs rather than sunk costs.

In the present research, subjects in one condition were asked

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about their willingness to allocate the next $1 million of their budget to continue with a project, whereas those in a second condition were asked about their willingness to allocate all remaining funds in the budget. The latter group provides a direct replication of Garland and Newport (in press), with sunk costs manipulated parametrically. The former group permits an unconfounded analysis of the relation between sunk cost and willingness to make a constant future-resource allocation. Furthermore, comparison across groups, with sunk costs held constant, provides a direct assessment of the importance of incremental costs in resource-allocation decisions.

Finally, there has been little consideration in earlier research of how previous investment in a project might influence or distort a decision maker's subjective probability of a return on that investment. In one of their experiments, Arkes and Blumer (1985) found that subjects in a sunk-cost situation made higher estimates of project success. However, according to Arkes (personal communication, July 10, 1990), this finding has not been consistently replicated in subsequent experimental studies.

To allow for the separation of sunk-cost effects on estimates of project success from their effects on decisions to continue with a project, I introduced a third dependent-variable condition into this experiment. In this condition, subjects provided estimates of project success, but they did not make any investment or withdrawal decision.

Method

Subjects

Subjects in this experiment were 407 undergraduate business students enrolled in introductory management and behavioral-science courses at a large state university in the southwestern United States.

Procedure

A single decision scenario based on an original scenario developed by Arkes and Blumer (1985) and modified by Garland and Newport (in press) was used. Five versions of the scenario were developed to represent five different levels of sunk cost. The scenario was as follows:

> You are the President of Aero-Flite Corporation, an airplane manufacturer. You have spent ____ million dollars of the 10 million dollars budgeted for a research project to develop a radar scrambling device that would render a plane undetectable by conventional radar (in effect a radar-blank plane). The project is ____ % complete. Another firm has begun marketing a similar device that takes up much less space and is much easier to operate than Aero-Flite's.

The five different scenarios specified that $1, $3, $5, $7, or $9 million had been spent and that the project was 10%, 30%, 50%, 70%, or 90% complete.

In addition to variation in sunk costs, three dependent-measure conditions were created to accompany each scenario. One group of subjects was asked the following question: "How likely is it that, if faced with this situation, you personally would decide to use the last ____ million dollars to complete this project?" This dependent measure was a replication of that used by Garland and Newport (in press) and, as indicated earlier, creates an incremental cost that is inversely proportional to sunk costs. A second group of subjects was asked: "How likely is it that, if faced with this situation, you personally would authorize the next million dollars to continue with the project?" With this dependent measure, incremental costs are constant across sunk costs. A third group of subjects was asked: "How likely is it that if you decided to complete this project using the last ____ million dollars of your budget, your company would realize a profit?"

Subjects in all groups circled a single point along a 100-point subjective probability scale. The endpoints of the scale were marked *definitely would not authorize the expenditure* (1) and *definitely would authorize the expenditure* (100) or *definitely would not be profitable* (1) and *definitely would be profitable* (100), as appropriate; the midpoint was marked *even chance.*

In summary, five levels of sunk cost were crossed with three dependent measures, creating 15 different experimental protocols. Protocols were randomly distributed to subjects during class time, along with instructions indicating that this was a study of business decision making. Subjects were asked to read the scenario carefully and to try to respond to the question asked as if they really faced the situation described. Sample sizes across condition ranged from 24 to 31.

Results

The data generated in this research posed a number of different possibilities for analysis. Although it would be perfectly acceptable to separate the data into three separate experimental studies (one for each dependent-variable condition), this would not take advantage of the fact that all 407 subjects were randomly assigned from the same population to both independent-variable (sunk cost) and dependent-variable (probability of authorizing all remaining money, probability of authorizing the next $1 million, or probability of profit) conditions. This, coupled with the fact that the same 100-point subjective probability scale was used for each measure, suggested that the data be analyzed first with a 5 (sunk costs) × 3 (dependent measure) between-subjects analysis of variance (ANOVA). It was decided in advance that this initial overall analysis would be followed with separate ANOVAs and tests for trend on each dependent measure.

Overall Analysis

A graph of average responses to each of the dependent measures at each level of sunk costs is presented in Figure 1. The results of the overall ANOVA are presented in Table 1.

As indicated in Table 1, there was a significant main effect of dependent measure on subjects' responses to the subjective probability scale. Averaging responses to each dependent measure over all levels of sunk cost revealed that subjects who were asked to indicate the likelihood that the project would be profitable responded with less certainty ($M = 35.53$, $SD = 20.23$) than did subjects asked to indicate the likelihood that they would authorize the next $1 million ($M = 52.00$, $SD = 29.03$) or all the remaining money in their budgets ($M = 51.95$, $SD = 29.36$). Surprisingly, the means on these latter two dependent measures were almost identical, even though the incremental investment was a constant $1 million for the former measure and averaged $5 million for the latter measure.

There was also a strong main effect of sunk costs on subjects' responses. Responses on all dependent measures increased monotonically with sunk costs, as illustrated in Figure 1. However, reported willingness to authorize additional funds, both the next $1 million and all the remaining money in the budget,

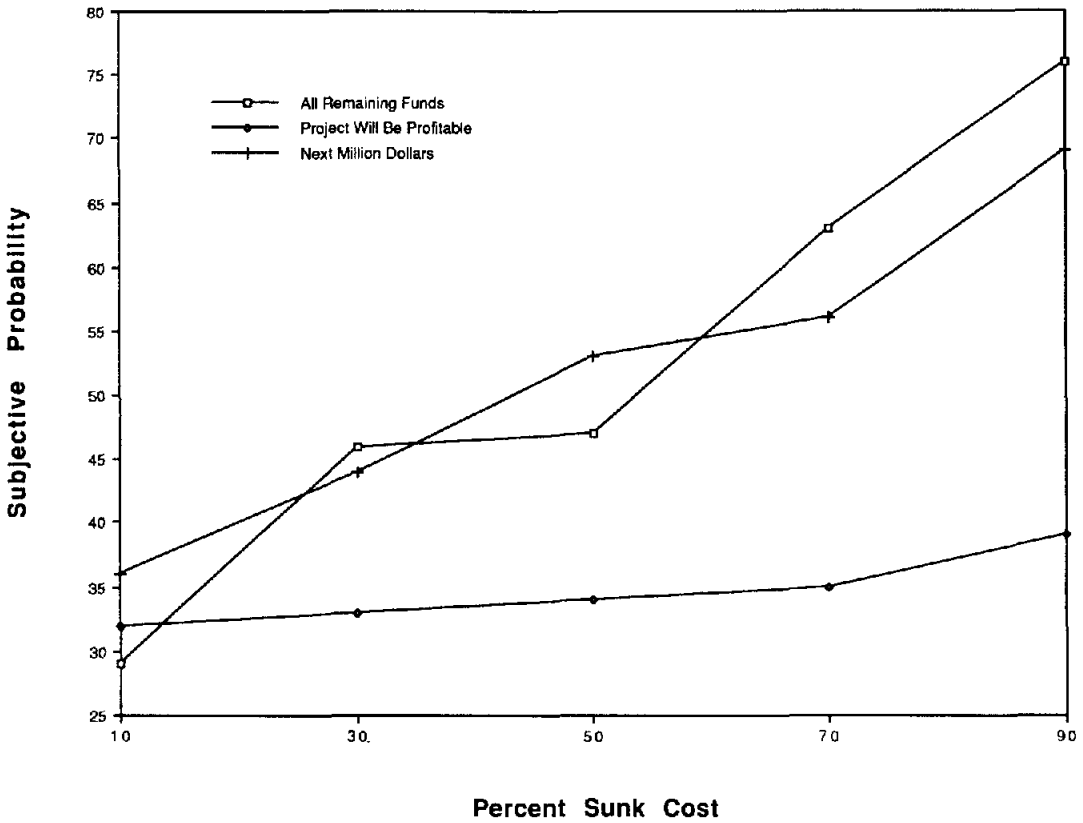

Figure 1. Relationship between sunk costs and each of the three dependent measures.

appears to have increased more sharply with sunk costs than perceived likelihood that the project would be profitable.

In support of these observations, there was a significant interaction effect between sunk costs and dependent measure on subjects' responses (see Table 1). It is evident from inspection of Figure 1 that this interaction was a function of the difference in slope between the likelihood-of-profit measure and both additional-investment measures. The existence of this significant interaction effect made it especially useful to follow the a priori decision to conduct separate analyses on each dependent measure. These analyses are presented in the following sections.

Probability of Authorizing All Remaining Budget Funds

An ANOVA of subjects' reported likelihood of authorizing all remaining funds in their budget revealed a strong and significant effect of sunk cost, $F(4, 122) = 12.20$, $p < .0001$. As sunk costs increased, there was a corresponding increase in the reported likelihood of authorizing all remaining funds to complete the project (see Figure 1). A polynomial analysis of these data revealed only a highly significant linear trend, $F(1, 122) = 47.26$, $p < .0001$, with no significant deviation from linear trend, $F(3, 122) = .74$, $p > .50$.

Table 1
Analysis of Variance of the Effect of Sunk Costs Across Three Dependent Measures

Variable	*SS*	*df*	*MS*	*F*	*p*
Dependent measure (DM)	24,274	2	12,137	20.13	.0001
Sunk cost (SC)	39,287	4	9,822	16.29	.0001
DM × SC	11,526	8	1,441	2.39	.016
Error	236,357	392	603	—	—

Probability of Authorizing the Next $1 Million

An ANOVA of subjects' reported likelihood of authorizing the next $1 million to continue with the project revealed a strong and significant effect of sunk cost, $F(4, 145) = 6.67$, $p < .0001$. Furthermore, the pattern of results for this measure (see Figure 1) closely parallels that for the measure of willingness to authorize all remaining budget funds. A polynomial analysis on these data revealed only a highly significant linear trend, $F(1, 145) = 26.17$, $p < .0001$, with no significant deviation from linear trend, $F(3, 145) = .21$, $p > .80$.

Perceived Probability of Profit

Despite the apparent relationship in Figure 1 between sunk costs and subjects' perceptions of the likelihood that the project would be profitable, an ANOVA of this dependent measure did not reveal any statistically reliable effect, $F(4, 125) = .82$, $p > .50$.

Discussion

Subjects' willingness to authorize additional resources for a threatened research and development project was both positively and linearly related to the proportion of the budget that had already been expended. Furthermore, the relationship that was found between sunk costs and willingness to continue investment in the project could not be explained either by differences in incremental costs or by differences in estimates of the likelihood that project completion would result in a profit. Thus, incremental costs and benefits, two prospective variables that might be expected to influence rational decision making, appeared to be unrelated to the pattern of results in this study. Of course, had subjects been asked to estimate project success before allocating resources, the former decision might have affected the latter decision.

What is particularly surprising about these results is that incremental costs, on the average, had absolutely no effect on subjects' willingness to make further investments in the project. This result, which is as contrary to normative decision models as the finding that sunk costs have any impact on investment decisions, is certainly worthy of future investigation.

Although the results of the present research seem clear enough, there are still a host of questions that remain to be considered about the effect of sunk costs on decision making in escalation situations. For example, although in most studies of escalation and entrapment behavior (Staw & Ross, 1987; Brockner, Shaw, & Rubin, 1979) negative feedback has been considered a given, the role played by negative feedback in generating sunk-cost effects has not yet been clearly delineated (Staw & Fox, 1977; Staw & Ross, 1978). In a recent study, Kernan and Lord (1989) found that the combination of an explicit performance goal and highly negative feedback resulted in deescalation. Kernan and Lord used control theory (Campion & Lord, 1982) to explain their results, suggesting that large discrepancies between goals and feedback can result in lower performance expectations.

Interestingly, the possible influence of sunk costs on decisions to withdraw from or persist with projects in the face of positive feedback has been ignored. From a normative perspective, the decision to commit additional resources to a project should be a function of incremental costs or benefits and opportunity costs (Northcraft & Neale, 1986), regardless of feedback. From a prospect-theory perspective, withdrawal from any project before one has recouped previously invested resources should be perceived as a certain loss. Thus, sunk costs might indeed influence decisions to withdraw from or persist with projects in the face of positive as well as negative feedback.

Finally, Lord and Maher (1990) recently proposed that theoretical and empirical work on decision making has largely ignored the context of decision making. In this regard, Conlon and Parks (1987) noted a dearth of field research on escalation. Despite a wealth of anecdotal evidence, the same can be said for the study of sunk-cost effects. Thus, there is a need to examine sunk-cost effects when individuals are making decisions for real stakes, rather than simply role playing. There is also a need to examine how experts in a particular field, who may be far more tuned in to incremental costs, opportunity costs, and potential benefits (e.g., research and development managers in the case of the present study), might respond to variables that have been found to influence the escalation decisions of novices.

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