

RESEARCH ARTICLE

Willingness to Continue with Software Projects: Effects of Feedback Direction and Optimism under High and Low Accountability Conditions*

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Abstract

The willingness of managers to continue with software projects can be both beneficial and troubling. Management optimism can help bring promising projects to fruition, but can also cause valuable resources to be expended on faltering projects. This study examines three factors that can affect the willingness of managers to continue with software projects: feedback direction, feedback optimism, and accountability. Feedback direction is the objective information reflecting project prospects. Feedback optimism is the subjective mode with which the objective information has been framed. Accountability is the extent to which the manager feels responsible for project outcomes. Results of a study that manipulated these three factors showed that the effects of feedback direction and feedback optimism on willingness to continue with software projects were additive (either factor alone affected willingness to continue with software projects) when accountability was high but were interactive (both factors jointly affected willingness to continue with software projects) when accountability was low. These findings have useful implications for practice and further research.

* Sirkka Jarvenpaa was the accepting senior editor for this paper; Ann Majchrzak, Rajiv Sabherwal, and Iris Vessey were blind reviewers for this paper.

Keywords: Software projects, willingness to continue, feedback direction, feedback optimism, accountability

Introduction

Managers of software projects, particularly projects involving the development of generic software packages, face keen competition and uncertain prospects for success. These managers often must make difficult decisions about whether or not to continue with their projects in an uncertain market. Sometimes, decisions to terminate projects can cause promising software projects to be abandoned too early (Ewusi-Mensah and Przasnyski 1991). Other times, decisions to continue with projects can bring about escalation tendencies (Staw 1997) that cause valuable resources to be poured into troubled software projects that ultimately fail to deliver the intended outputs (Keil et al. 1995; Newman and Sabherwal 1996).

In order to make better decisions, managers often solicit feedback on project prospects (Bowen 1987). Two important aspects of feedback are direction and optimism. *Feedback direction* is the objective information reflecting project prospects (Bowen 1987): positive feedback indicates good prospects while negative feedback reflects poor prospects for success. *Feedback optimism* is the subjective mode with which the objective information has been framed (Kahneman and Tversky 1979). Optimistic framing portrays objective information in a favorable light (e.g., capture 50% of total market share relative to competitor) while pessimistic framing depicts objective information in an unfavorable tone (e.g., fail to capture 50% of total market share relative to competitor). Both feedback direction and optimism have been found to affect human decisions. To our knowledge, prior studies have never examined both factors together in the context of software projects.

Instead of directly impacting management decisions, feedback direction and optimism may not directly affect management decisions but be moderated by *accountability*, or the extent to which the manager feels responsible for the projects' outcomes (Brockner et al. 1986; Caldwell and O'Reilly 1982). High accountability situations are likely to arise if the manager initiates the project and feels emotionally attached to it. Low accountability is likely to occur if the manager takes over the project from someone else and does not feel emotionally attached to it. Prior research has examined feedback direction and optimism in high accountability situations but not in low accountability situations (which can be particularly applicable to software projects, given high personnel turnover).

This study examines the impact of feedback direction and optimism, under conditions of high and low accountability, on a manager's willingness to continue with a software project (e.g., develop a generic software package). Specifically, it seeks to answer two research questions: (1) *how may feedback direction and optimism jointly affect willingness to continue with software projects?* And (2) *how may the effects of feedback direction and optimism be moderated by accountability?* This study contributes to the software project management literature in two important ways. First, by simultaneously varying feedback direction and optimism, it adds to our understanding of how managers make decisions when given confirmatory (optimistic framing of positive feedback or pessimistic framing of negative feedback) versus contradictory evidence (pessimistic framing of positive feedback or optimistic framing of negative feedback) on their software projects. Second, by varying accountability, it gives us some clues as to whether the

results reported for software project managers operating in high accountability situations may also be applicable to software project managers working in low accountability situations. Results from both situations are likely to be relevant to the practice of software project management.

Literature and Hypotheses

Feedback Direction

Feedback helps to reduce uncertainty and can give project managers confidence during decision-making (Remus et al. 1996; Schwenk 1986). Thus, managers often engage external consultants or experts who have no vested interests in the projects to provide credible and reliable assessments of project prospects (Liden and Mitchell 1985; Vancouver and Morrison 1995). Often in the form of market forecasts, feedback is considered positive if predicted prospects exceed original expectations and negative if the reverse is true (Bowen 1987). Such objective assessments can be particularly important for project managers who must be vigilant of competing software products that may impact the market prospects of their own software packages.

When project managers receive positive feedback, suggesting favorable prospects for success, they are likely to want to proceed with their projects so as to derive the benefits expected from completing the projects (Walsh and Henderson 1989). Therefore, positive feedback should be associated with greater willingness to continue with software projects. But few empirical studies to date have involved positive feedback, so little is known about how it influences managers' decisions.¹

Numerous empirical studies have examined the impact of negative feedback on human decisions in various contexts, including software project management (e.g., Haunschild et al. 1994; Keil et al. 1995; Staw et al. 1997). The way project managers respond to negative feedback, implying unfavorable prospects for success, is varied (Anderson and Rodin 1989; McCain 1986; Schaubroeck and Williams 1993). Negative feedback sometimes causes project managers to want to terminate the projects. This is especially true when there are substantial discrepancies from the original expectations and they are perceived to be of a long-term nature (Barton et al. 1989; Kernan and Lord 1989; McCain 1986). Such behavior can be explained by the rational cognitive model, which posits that people would choose to discontinue with courses of action if their original objectives are unlikely to be achieved. Indeed, software projects, particularly those involving the development of generic software packages, have often been terminated when project managers receive negative feedback. At other times, negative feedback causes project managers to want to complete the projects. By showing the gap between the current situation and original expectations, negative feedback may motivate people to continue in the hope of overcoming it (Anderson and Rodin, 1989; Vandewalle and Cummings 1997). By continuing with a project, people convey that they understand the problems and are now trying to overcome them (Schwenk 1986; Walsh and Henderson 1989). At the extreme, continuing with a clearly doomed project can lead to the

¹ Although Staw's (1976) early study examined both positive and negative feedback, Staw (1997) himself and others (e.g., Schoorman and Holahan 1996) have noted manipulation problems with that early study. Subsequent studies have omitted positive feedback, making it impossible to assess the impact of feedback direction on human decisions.

escalation of commitment phenomenon (Brockner 1992; Keil et al. 1995; Staw and Ross 1987).

It is possible that prior research has focused on negative feedback (and ignored positive feedback) for two reasons. First, human decisions under negative feedback defy the fundamental tenet of economic rationality. Second, people are often keener to seek explanations for negative rather than positive results (Conlon and Parks 1987). Nevertheless, because prior empirical studies have not examined positive and negative feedback simultaneously, it is not known whether positive feedback would indeed bring about greater willingness to continue with software projects than negative feedback (which has varied effects).

Feedback Optimism

Providers of feedback often frame it in tones through their choice of words or selective emphasis of points (Frisch 1993). They may frame feedback intentionally (e.g., due to prejudices or biases) or unintentionally (e.g., due to moods or optimism levels), and the same piece of (objective) feedback may be framed either optimistically or pessimistically. For example, when presenting the market forecast that a generic software package can capture 50% of the total market share, the report may emphasize the 50% of total market share captured by the software package (optimistic framing) or the 50% of total market share lost to competing software packages (pessimistic framing). When project managers receive feedback from external consultants about their software projects, it is likely to reflect the optimism or pessimism of the consultants themselves, and like feedback direction, feedback optimism may affect human decisions (Frisch 1993; McFarland and Miller 1994).

Literature in the cognitive perspective arena describes how framing may affect human decisions (Davis and Bobko 1986; Dunegan 1993). People tend to evaluate key attributes of the feedback and how these have been framed. People have been reported to favor feedback (key attributes) framed optimistically compared to feedback (key attributes) framed pessimistically (Dunegan 1993; Schoorman et al. 1994).

As mentioned previously, positive or negative feedback may undergo optimistic or pessimistic framing. For market forecasts on generic software packages, positive and negative feedback can come in the form of bigger and smaller than expected market share, respectively. When presenting such forecasts, providers of optimistically framed positive feedback would highlight the bigger than expected market share that the software packages can capture, whereas providers of pessimistically framed positive feedback would focus on the smaller than expected remaining market share that the software packages cannot capture. Likewise, optimistically framed negative feedback would focus on the smaller than expected market share that the software packages can capture while pessimistically framed negative feedback would emphasize the bigger than expected remaining market share that the software packages cannot capture (see Figure 1).

		Optimistic framing (market share captured)	Pessimistic framing (market share not captured)
Positive feedback	(bigger than expected market share)	Emphasize the bigger than expected market share captured	Emphasize the smaller than expected market share not captured
Negative feedback	(smaller than expected market share)	Emphasize the smaller than expected market share captured	Emphasize the bigger than expected market share not captured

Figure 1. Feedback Direction and Optimism

Logically, pessimistic framing may alleviate the impact of positive feedback, whereas optimistic framing may ameliorate the impact of negative feedback. However, this contention has not been empirically examined. Researchers have never studied how feedback optimism in relation to positive feedback² affects human decisions. Given that feedback direction and optimism have never been simultaneously investigated, it is not clear how project managers would make decisions when given confirmatory (optimistic framing of positive feedback or pessimistic framing of negative feedback) versus contradictory evidence (pessimistic framing of positive feedback or optimistic framing of negative feedback) on their software projects. Yet, project managers often have to make decisions under such circumstances.

Accountability

How accountable project managers are for their software projects varies in practice. Self-inference theory suggests that people tend to feel accountable for projects if the outcomes reflect their personal traits or capabilities (Brockner et al. 1986; Sandelands et al. 1988). This is especially true in situations where they played a key role in initiating the projects (Schoorman and Holahan 1996). Self-justification theory posits that such people often want to vindicate themselves for their decisions to initiate the projects and they typically do so by trying to make sure the project outcomes are good (Bobocel and Meyer 1994; Caldwell and O'Reilly 1982). Hence, project managers who have initiated their software projects are likely to have a higher level of accountability than project managers who took over their projects from their predecessors or colleagues. Both types of project managers are common in the context of software projects.

The level of accountability may affect the way project managers process feedback about their software projects (Sandelands et al. 1988). Keil (1995) observes that managers who are highly accountable for software projects tend to develop emotional attachments to the projects so much so that they pay very careful attention to project information. Therefore, when level of accountability is high, project managers tend to be sensitive to information received about their software projects and may be particularly susceptible to the effects of feedback direction and optimism.

² Empirical studies (e.g., Bazerman 1984; Northcraft and Neale 1986; Whyte 1986) have neglected positive feedback and concentrated on optimistic versus pessimistic framing of negative feedback.

Prior research on feedback direction (see Section 2.1) has mainly been carried out in high accountability situations. As discussed earlier, positive feedback should generally cause people to be more willing to continue with their software projects because the prospects for success are good. But negative feedback may elicit varied responses, depending on circumstances, with some people being more willing and others being less willing to continue. Given the likely common responses for positive feedback and the varied responses for negative feedback, positive feedback should result in a greater willingness of people to continue with their software projects compared to negative feedback.

Hypothesis 1: When accountability is high, people given positive feedback will be more willing to continue with a software project than people given negative feedback.

Researchers have also carried out studies on feedback optimism primarily (see Section 2.2) in high accountability situations. Again, as discussed above, the attribute framing literature suggests that people tend to respond more favorably to optimistically framed feedback than to pessimistically framed feedback. Therefore, feedback optimism can cause people to be more willing to continue with their software projects. Empirical results across a variety of situations (e.g., Davis and Bobko 1986; Dunegan 1993) have supported the predictions of the literature.

Hypothesis 2: When accountability is high, people given optimistically framed feedback will be more willing to continue with a software project than people given pessimistically framed feedback.

Prior empirical research has neglected low accountability situations, which occur when people inherit projects from others and do not have much emotional attachment to them (Kirby and Davis 1998; Schoorman and Holahan 1996). In the context of software projects, it is common for project managers to take over projects from predecessors or colleagues for a variety of reasons (e.g., personnel turnover and internal transfers). When accountability is low, project managers tend to pay less attention to project information and so should be less affected by feedback direction and optimism. Under such circumstances, they are likely to require strong mental stimuli to jolt them to act on projects (Levin et al. 1998). Optimistically framed positive feedback may provide a stronger stimulus than other forms of feedback to cause managers to be more willing to continue with their software projects. This observation would hold if feedback direction significantly affects human decisions to continue with software projects under conditions of optimistic framing but not under conditions of pessimistic framing (within a low accountability situation).

Hypothesis 3a: When accountability is low, people given optimistically framed positive feedback will be more willing to continue with a software project than people given optimistically framed negative feedback.

Hypothesis 3b: When accountability is low, people given pessimistically framed positive feedback and people given pessimistically framed negative feedback will be equally willing to continue with a software project.

The above observation would also hold if feedback optimism significantly affects human decisions to continue with software projects under conditions of positive feedback but not under conditions of negative feedback (within a low accountability situation).

Hypothesis 4a: When accountability is low, people given optimistically framed positive feedback will be more willing to continue with a software project than people given pessimistically framed positive feedback.

Hypothesis 4b: When accountability is low, people given optimistically framed negative feedback and people given pessimistically framed negative feedback will be equally willing to continue with a software project.

Methodology

The laboratory experiment used in this study had a 2x2x2 factorial design, manipulating feedback direction (positive versus negative), feedback optimism (optimistic framing versus pessimistic framing), and accountability (high versus low). All manipulations were checked based on responses of subjects to several questions at the end of the experiment (see Section 4.1). The experimental materials are presented in the Appendix.

Operationalization of Feedback Direction

For software projects involving the development of in-house systems, internal feedback often guides management decisions (e.g., information on the software development process). However, for software projects involving the development of generic packages for sale (i.e., the context of this study), external feedback (e.g., market forecasts) tends to impact the success of projects more than internal feedback. Therefore, these project managers tend to pay more attention to external than to internal feedback (Vancouver and Morrison 1995). Consequently, in line with previous studies (e.g., Conlon and Garland 1993; Schaubroeck and Williams 1993), feedback direction is manipulated using market forecasts.

In the case scenario given to subjects, they were told that CONFIG (their own software product) was projected, by an external consultant, to be able to capture 50% of the total market demand at the beginning of the development effort. The remaining 50% of the total market demand would be captured by CHAMPFIG (a competing software product). A midpoint of 50% was used to prevent subjects from forming preconceived biases for or against the viability of CONFIG with respect to CHAMPFIG. We then provided feedback to subjects in the form of a new market forecast midway through the development effort for CONFIG. In line with Bowen (1987), who considered feedback as positive if original expectations are exceeded and negative if otherwise, we operationalized positive feedback using a better than initially projected new market forecast for CONFIG. Under this treatment, we told subjects that the same external consultant issued a new market forecast suggesting that CONFIG would be able to capture 75% of the total market demand (upper quartile). We operationalized negative feedback by telling subjects that the same external consultant issued a new market forecast suggesting that CONFIG would be able to capture 25% of the total market demand (lower quartile).

Operationalization of Feedback Optimism

Following prior studies, we manipulated feedback optimism through the emphasis and choice of words (that reflected the subjective level of optimism) when presenting the feedback (the new market forecast) to subjects (Kahneman and Tversky 1979; Levin et

al. 1998). When framing optimistically, we emphasized the percentage of total market demand CONFIG would *capture*, and when framing pessimistically, we emphasized the percentage of total market demand CONFIG would *fail to capture*, in the new market forecast by the same consultant. In both cases, the predicted market share for CONFIG was the same at 75%. Likewise, optimistically framed negative feedback would emphasize that CONFIG would capture 25% of the total market demand while pessimistically framed negative feedback would emphasize that CONFIG would fail to capture 75% of the total market demand. Again in both cases, the predicted market share for CONFIG was the same at 25%.

Figure 2 summarizes the manipulation for the various combinations of feedback direction and optimism. Such manipulations are realistic because, in practice, good news is sometimes framed pessimistically and bad news is sometimes framed optimistically, either intentionally or unintentionally, when presented to managers (Frisch 1993).

		Optimistic framing (emphasized <i>capture</i>)	Pessimistic framing (emphasized <i>fail to capture</i>)
Positive feedback	(predicted market share was 75%)	CONFIG would capture 75% of total market demand	CONFIG would fail to capture 25% of total market demand
Negative feedback	(predicted market share was 25%)	CONFIG would capture 25% of total market demand	CONFIG would fail to capture 75% of total market demand

Figure 2. Manipulation for Feedback Direction and Optimism

Operationalization of Accountability

As in prior studies, we manipulated accountability by direct assignment of subjects to a role (Bobocel and Meyer 1994; Kirby and Davis, 1998).³ For the high accountability treatment, subjects played the role of a director who had championed the CONFIG software project. They were responsible for persuading top management to initiate the project and therefore were likely to be more accountable for project outcome. They were currently managing the project. For the low accountability treatment, subjects played the role of a director who had not championed the CONFIG software project, but whose predecessor was responsible for persuading top management to initiate the project. They were asked to take over the project after it had started because their predecessor left the company. Since they did not initiate the project, they were likely to be less accountable for project outcome. They were currently managing the project.

³ Although some studies operationalized accountability by allowing (or not allowing) subjects to choose the projects, this study did not adopt such an approach because the effects of accountability and choice could be confounded (Bobocel and Meyer 1994; Schoorman and Holahan 1996).

Task and Procedure

To begin, subjects received the case scenario, which was adapted from Keil et al. (1995) and Whyte (1991). They played the role of a director of a computer software company, who was managing the CONFIG software project (developing a generic database system with advanced artificial intelligence capabilities for sale in the market). At the beginning of the CONFIG project, a study by an external consultant concluded that CONFIG would capture 50% of the total market demand while the remaining 50% would be captured by CHAMPFIG (a competing software product which has the same capabilities as CONFIG). Depending on their accountability treatment, subjects were either responsible or not responsible for persuading top management to initiate the CONFIG project.

Midway through the CONFIG project (after spending 50% of the budget and completing 50% of the project), the scenario described that the director engaged the same external consultant to conduct a new market forecast. The scenario stated the 50% midpoint for sunk cost and completion level because too high a level could bring about escalation of commitment tendencies, whereas too low a level could lead to indifference toward competition (Conlon and Garland 1993; Keil et al. 1995). Depending on their treatment for feedback direction, the consultant gave the subjects either positive feedback (increased market share) or negative feedback (reduced market share). Depending on their treatment for feedback optimism, the consultant gave the feedback using either an optimistic emphasis (focusing on percentage of market demand CONFIG could capture) or a pessimistic emphasis (focusing on percentage of market demand CONFIG could not capture). Although this simple feedback from the consultant might be considered to be too little project information, it reflects many real-life scenarios where project managers suffer from a lack of information due to a variety of reasons (e.g., unavailability of information about competing products, insufficient resources to engage better consultants, or inadequate time to gather more information).

After evaluating the feedback from the consultant, subjects had to state their willingness to continue with the CONFIG software project in terms of a probability (0% meaning definitely not continue and 100% meaning definitely continue) (Keil et al. 1995). This variable was the dependent variable of the study. Before they departed, subjects provided their background information for control checks, completed a questionnaire that elicited responses for manipulation checks, and took part in a debriefing session.

Subjects

A total of 134 senior undergraduates enrolled in an information systems course at a large university voluntarily completed this study. On average, they were 21.6 years old. About 58% were males and 42% were females. Subjects were randomly assigned to one of the eight treatment conditions to control for the impact of their background on the results. The success of this random assignment had been checked (see Section 4.1).

Analyses and Results

All statistical tests were carried out at a 5% level of significance. Results at a 10% level of marginal significance were also acknowledged.

Manipulation and Control Checks

We assessed the manipulation of feedback direction, feedback optimism, and accountability using the combined scores for two questions. All questions were anchored on a 7-point scale ranging from “strongly disagree” (1) to “strongly agree” (7). The questions we used to check the manipulation of feedback direction were “The consultant’s report is good news for the CONFIG project,” and “The consultant’s market share assessment shows that the CONFIG project has good prospects.” Consistent with the experimental manipulation, subjects under the positive feedback treatment agreed to these questions to a significantly greater extent than subjects under the negative feedback treatment ($t = 3.19, p < 0.01$).⁴ Questions assessing the manipulation of feedback optimism were “The consultant adopts an optimistic attitude when preparing the report,” and “The consultant takes a positive perspective when presenting the findings.” Again, consistent with the experimental manipulation, subjects under the optimistic framing treatment agreed to these questions to a significantly greater extent than subjects under the pessimistic framing treatment ($t = 2.77, p < 0.01$).⁵ Questions checking the manipulation of accountability were “I am accountable for the success of the CONFIG project,” and “The outcome of the CONFIG project is important to me.” Consistent with the experimental manipulation, subjects under the high accountability treatment agreed to these questions to a significantly greater extent than subjects under the low accountability treatment ($t = 3.27, p < 0.01$). In summary, the manipulation of the three independent variables appeared to be successful.

ANOVA tests showed that subjects in the various treatments did not differ significantly in terms of age and work experience. Mann-Whitney tests revealed that the gender ratio of the subjects did not differ significantly across the various treatments. Controls over subject background, enforced through randomization, appeared to be effective.

Hypotheses Tests

Table 1 summarizes descriptive statistics for the dependent variable. Table 2 reports the results of an ANOVA test involving the three independent variables (feedback direction, feedback optimism, and accountability) and the dependent variable. Since the dependent variable could not satisfy homogeneity and normality requirements simultaneously, we confirmed all significant results with Mann-Whitney tests and post-hoc t-tests. We found main effects for feedback direction ($F = 6.73, p < 0.02$), feedback optimism ($F = 4.41, p < 0.04$), and accountability ($F = 4.07, p < 0.05$). In addition, there was an interaction between feedback direction and feedback optimism ($F = 5.90, p < 0.02$), as well as a three-way interaction involving all independent variables ($F = 5.96, p < 0.02$). The interpretation of the three-way interaction should take precedence (Keppel 1991). To test the hypotheses, we used simple effect analyses (Keppel 1991), which decomposed the data along accountability.

⁴ Subjects under the pessimistically framed positive feedback treatment also agreed to these questions to a greater extent than subjects under the optimistically framed negative feedback treatment ($t = 1.84, p < 0.07$). Feedback direction did not appear to confound with feedback optimism.

⁵ Subjects under the optimistically framed negative feedback treatment also agreed to these questions to a greater extent than subjects under the pessimistically framed positive feedback treatment ($t = 1.89, p < 0.07$). Again, feedback direction did not appear to confound with feedback optimism.

Accountability	Feedback direction	Feedback optimism	Willingness to continue		Cell size
			Mean	Std. dev.	
High	Positive	Optimistic	79.33	12.8	15
		Pessimistic	69.41	17.84	17
	Negative	Optimistic	70	20.31	17
		Pessimistic	60	21.79	17
Low	Positive	Optimistic	78.24	18.11	17
		Pessimistic	55.88	28.08	17
	Negative	Optimistic	51.76	17.76	17
		Pessimistic	64.12	23.73	17

	DF	SS	F	p
Feedback direction (FD)	1	2858.4	6.73	0.011*
Feedback optimism (FO)	1	1871.32	4.41	0.038*
Accountability (AC)	1	1727.06	4.07	0.046*
FD x FO	1	2506.23	5.90	0.017*
FD x AC	1	0.54	0.00	0.972
FO x AC	1	205.75	0.49	0.488
FD x FO x AC	1	2528.99	5.96	0.016*

* $p < 0.05$

Under the high accountability treatment, both feedback direction ($F = 4.15$, $p < 0.05$) and feedback optimism ($F = 4.69$, $p < 0.04$) had main effects (see Table 3). We confirmed the result for feedback direction by a Mann-Whitney test ($\chi^2 = 3.57$, $p < 0.05$) and a post-hoc t-test ($t = 1.93$, $p < 0.06$). Subjects given positive feedback were significantly more willing to continue with the project than subjects given negative feedback. Hypothesis 1 was supported. We also confirmed the result for feedback optimism by a Mann-Whitney test ($\chi^2 = 4.72$, $p < 0.03$) and a post-hoc t-test ($t = 2.07$, $p < 0.05$). Subjects given optimistically framed feedback were significantly more willing to continue with the project than subjects given pessimistically framed feedback. Hypothesis 2 was supported.

	DF	SS	F	p
Feedback direction (FD)	1	1445.19	4.15	0.046*
Feedback optimism (FO)	1	1632.28	4.69	0.034*
FD x FO	1	0.03	0.00	0.993

* $p < 0.05$

Under the low accountability treatment, there was an interaction between feedback direction and feedback optimism ($F = 10.27$, $p < 0.01$) (see Table 4). We carried out two additional sets of analyses. First, we decomposed the data along feedback optimism.

Under the condition of optimistic framing, feedback direction had a main effect ($t = 4.30$, $p < 0.01$), confirmed by a Mann-Whitney test ($\chi^2 = 12.63$, $p < 0.01$) and a post-hoc t-test ($t = 4.30$, $p < 0.01$). Positive feedback yielded higher willingness to continue with the project than negative feedback (see Table 1). Under the condition of pessimistic framing, feedback direction had no effect ($t = 0.92$, $p = 0.36$). Positive and negative feedback yielded comparable willingness to continue with the project (see Table 1). Hypotheses 3a and 3b were supported.

Table 4. Results of ANOVA Test (Low Accountability Treatment)				
	DF	SS	F	p
Feedback direction (FD)	1	1413.24	2.83	0.097
Feedback optimism (FO)	1	425	0.85	0.359
FD x FO	1	5119.12	10.27	0.002*

* $p < 0.05$

Second, the data was decomposed along feedback direction. Under the condition of positive feedback, feedback optimism had a main effect ($t = 2.76$, $p < 0.01$), confirmed by a Mann-Whitney test ($\chi^2 = 6.27$, $p < 0.02$) and a post-hoc t-test ($t = 2.76$, $p < 0.01$). Optimistic framing yielded higher willingness to continue with the project compared to pessimistic framing (see Table 1). Under the condition of negative feedback, feedback optimism had a marginal main effect ($t = 1.72$, $p < 0.10$), confirmed by a Mann-Whitney test ($\chi^2 = 2.68$, $p < 0.10$) and a post-hoc t-test ($t = 1.72$, $p < 0.10$). Pessimistic framing produced higher willingness to continue with the project compared to optimistic framing (see Table 1). Hypothesis 4a was supported but Hypothesis 4b was not supported. Collectively, these two sets of analyses revealed that, when accountability was low, subjects were more willing to continue with the project when they were provided with optimistically framed positive feedback (this result was predicted) and, to a smaller extent, pessimistically framed negative feedback (this result was unexpected).

Discussion and Implications

Figure 3 summarizes the experimental findings, which answer the two research questions.

Under conditions of high accountability, feedback direction and optimism appear to independently affect willingness to continue with software projects. But under conditions of low accountability, feedback direction and optimism seem to jointly affect willingness to continue with software projects.

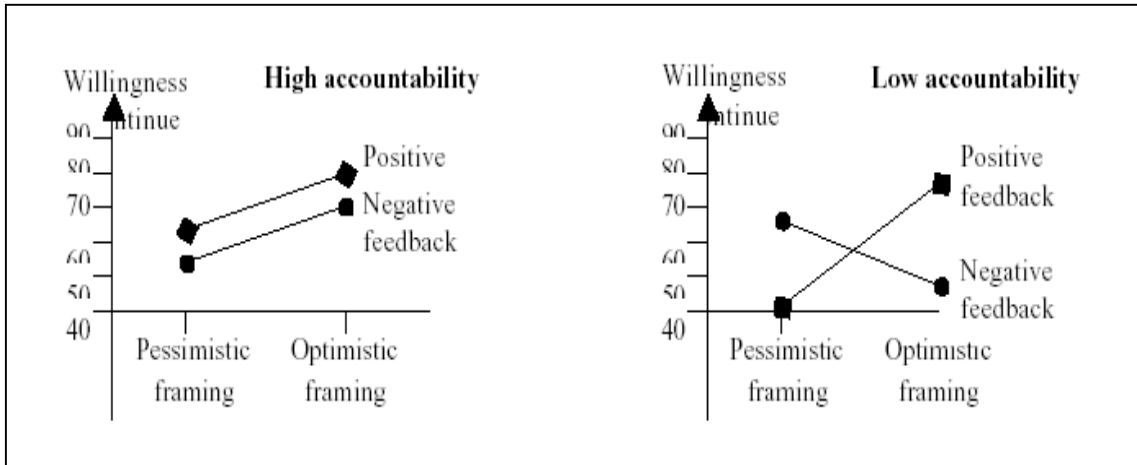


Figure 3. Graphical Summary of Results

Discussion of High Accountability Condition

Results of this study reveal that in high accountability situations, people tend to be more willing to continue with software projects (involving development of generic software packages) if they receive positive feedback and/or optimistically framed feedback. *Thus, the effects of feedback direction and optimism on willingness to continue with software projects are additive under conditions of high accountability.* Moreover, these results show that in high accountability situations, people tend to resolve contradictory evidence (pessimistic framing of positive feedback or optimistic framing of negative feedback) by raising their subjective perception of success and therefore have greater willingness to continue with software projects. But with confirmatory evidence (optimistic framing of positive feedback or pessimistic framing of negative feedback), subjective perception is less relevant.

Prior research has investigated how varying degrees of negative feedback might affect human decisions in high accountability situations (e.g., Garland et al. 1990; Haunschild et al. 1994). Results indicate that people tend to ignore objective (negative) feedback and instead base their decisions on some situational factor (e.g., the gap between the current situation and original expectations, or their eagerness to see the situation turn around). This study adds to these prior findings by showing that people in high accountability situations demonstrate more willingness to continue with software projects when exposed to positive feedback as opposed to negative feedback. Moreover, the variance in willingness to continue tends to be smaller when people are given positive feedback compared with negative feedback (see Table 1). The smaller variance in the positive feedback condition suggests that managers highly accountable for software projects may have focused on a common factor when making their decisions, and this factor is likely to be the objective (positive) feedback. The larger variance in the negative feedback condition confirms prior results and suggests that managers highly accountable for software projects may have considered a number of factors when arriving at their decisions, the objective (negative) feedback being just one.

Prior studies have also examined people who are highly accountable for projects might be affected by negative feedback that is framed differently (e.g., Davis and Bobko 1986; Schoorman et al. 1994). Empirical studies on attribute framing demonstrate that negative feedback can induce greater willingness to continue with projects if it has been framed

optimistically rather than pessimistically. Results of this study agree with the predictions from the attribute framing literature because subjects might have treated the market forecast from the consultant as an attribute (with optimistic or pessimistic framing characteristics depending on treatment). These results also add to the attribute framing literature by illustrating that the effects of framing observed for negative feedback can be extended to positive feedback. In other words, managers highly accountable for software projects are likely to have greater willingness to continue with their projects if feedback (regardless of positive or negative) has been framed optimistically rather than pessimistically.

Discussion of Low Accountability Condition

This study also reveals that in low accountability situations, people may be more willing to continue with software projects if they are provided with optimistically framed positive feedback or, to a smaller extent, pessimistically framed negative feedback. *Therefore, the effects of feedback direction and optimism on willingness to continue with software projects are interactive under conditions of low accountability.* Moreover, these results show that in low accountability situations, people tend to resolve contradictory evidence (pessimistic framing of positive feedback or optimistic framing of negative feedback) by lowering their subjective perception of success and therefore have lesser willingness to continue with software projects. But with confirmatory evidence (optimistic framing of positive feedback or pessimistic framing of negative feedback), subjective perception is, again, less relevant.

Contrary to prediction, subjects in low accountability situations not only demonstrated greater willingness to continue with software projects when given optimistically framed positive feedback but also when given pessimistically framed negative feedback. The notion of mental stimulus provides a plausible explanation for this observed interaction. When people are not highly accountable for projects, they usually need a strong stimulus to jolt them to pay attention to the projects (Levin et al. 1998). As hypothesized, optimistically framed positive feedback seemed to be a strong enough stimulus to induce subjects to be more willing to continue with software projects. But unexpectedly, pessimistically framed negative feedback also constituted a strong enough stimulus to cause subjects to behave likewise. For both these treatments, the strong stimulus might have resulted from the large percentage figure on market forecast (capture 75% of total market demand or fail to capture 75% of total market demand) presented to subjects (see Figure 2).

The greater willingness to continue with software projects that arose from optimistically framed positive feedback is a rational outcome, but the marginally greater willingness to continue with software projects that arose from pessimistically framed negative feedback is less intuitive. Insights provided by the subjects during debriefing reveal three possible explanations. First, the low accountability treatment involved a change of management for the project. People might have attributed the poor results (pessimistically framed negative feedback) to the incompetence of their predecessor in monitoring the market (Walsh and Henderson 1989). Staw et al. (1983) observed that failure tends to be blamed on external weaknesses but success tends to be attributed to internal strengths. Thus, people might demonstrate greater willingness to continue with the project in the hope that the situation would turn around. A study of practicing managers shows that many of them believed that they could turn their situations around in a variety of scenarios (Staw and Ross 1987).

Second, people are motivated by opportunities to overcome adversity, which allow them to demonstrate their abilities (Staw and Ross 1987). This is especially true if the adversity has resulted from the actions of others. In many organizations, managers who turn their situations around are more valued than those who sustain prior successes (Staw and Ross 1987). Indeed, history has credited many leaders who overcame difficulties and persisted till they succeeded (the hero effect) (Staw and Ross 1980). Hence, people might have remained undaunted in the face of adversity (pessimistically framed negative feedback) arising from the actions of their predecessor.

Third, many people are accustomed to perceive competition as something healthy. The existence of competition indicates that the project outcome is valuable (Haunschild et al. 1994; Teger 1980). Particularly when the perceived consequences of failure are not severe, the competition itself may even outweigh all other considerations when people are deciding whether to persist or withdraw. With this mental attitude, people might have chosen to continue with the project when confronted with competition (pessimistically framed negative feedback) in a situation where the perceived consequences of failure might not be severe (low accountability).

Implications for Practice

Given that this study employs artificial scenarios and student subjects, any attempts to generalize the findings to organizational settings and actual software project managers must be done with caution. Nevertheless, Staw and Ross (1987) note that the use of artificial scenarios and student subjects tends to dampen rather than amplify the results. Therefore, the actual effects of feedback direction, feedback optimism, and accountability may be even stronger in reality. By depicting a weaker picture of what may happen in practice, the results of this study have some useful implications.

Managers of software projects (especially those pertaining to development of generic software packages) can benefit from having access to accurate and complete feedback, whether positive or negative. The tendency of many software teams to report only good news up the hierarchy and to suppress bad news (Keil and Robey 1999) should be strongly discouraged because such practices impair the management decision process. While nothing much can, or indeed should, be done to alter feedback (e.g., provide partial feedback or change feedback to please management), feedback optimism and accountability may be manipulated to facilitate software project management.

The results of this study demonstrate that project managers may respond to feedback more rationally when they are highly accountable for projects. In other words, they exhibit greater willingness to continue with software projects when given positive rather than negative feedback, regardless of feedback optimism. This suggests that it may be useful to keep managers' level of accountability high (Brockner et al. 1986). Possible ways to raise the level of accountability of software project managers include providing them with strong incentives for project success, allocating projects to them based on their interests, or allowing those who initiate projects to see the projects through to completion (Keil 1995; Sandelands et al. 1988). Results of this study also reveal that, under conditions of high accountability, project managers may have greater willingness to continue with software projects when provided with optimistically rather than pessimistically framed feedback, regardless of feedback direction. Hence, if software project managers can retain high accountability, framing positive feedback optimistically

and negative feedback pessimistically should not produce unexpected consequences. Given that positive feedback indicates good prospects for success, framing positive feedback optimistically may induce managers to persist with their projects and keep them from prematurely terminating these projects (Ewusi-Mensah and Przasnyski 1991; Newman and Sabherwal 1996). Given that negative feedback indicates poor prospects for success, framing negative feedback pessimistically may discourage managers from persisting with their projects and possibly succumbing to escalation of commitment tendencies (Keil 1995; Newman and Sabherwal 1996).

In some situations, it may be extremely difficult (if not impossible) to keep the level of accountability of software project managers high. For example, the management of some software projects may have to change hands due to personnel turnover or internal transfers (Keil and Robey 1999; Staw and Ross 1987), factors that are common in the software industry. Under such conditions of low accountability, the results of this study suggest that project managers may be less rational in reacting to feedback. Specifically, pessimistically framed negative feedback may cause them to have marginally greater willingness to continue with software projects (see Figure 3). Thus, when accountability is low, feedback on software projects should be framed optimistically as far as possible (Whyte 1991). When the feedback is positive, framing such feedback optimistically may spur managers to persist with promising projects. However, when the feedback is negative, framing such feedback optimistically may reduce its salience and lower the probability that managers will demonstrate escalation of commitment tendencies. External software consultants and organizational intelligence gathering groups (important sources of feedback for software project managers) may want to bear such findings in mind when preparing reports for software project managers.

Implications for Research

Researchers can pursue some avenues of further study. First, different levels of accountability may moderate the impact of feedback direction and optimism in different ways. This study uses a high accountability scenario involving a project champion (Staw and Ross 1987). Future studies can employ different high accountability scenarios (e.g., a manager whose rewards are aligned to software project success) to see if the additive effects of feedback direction and optimism would be weaker. Similarly, various low accountability scenarios can be studied in the future to verify the interactive effects of feedback direction and optimism. Examples of such scenarios include situations where people make collective project decisions (Whyte 1993), have ready scapegoats to take the blame (Leatherwood and Conlon 1987), or have good excuses to vindicate themselves (Staw and Ross 1987).

Second, different types of positive and negative feedback may have different impact on willingness to continue with software projects. Feedback differs in terms of source (Staw and Ross 1987), equivocality (Bowen 1987), predictability (Leatherwood and Conlon 1987), causality (Staw and Ross 1987), and timing (Drummond 1995). For example, negative feedback for software projects may indicate internal sources of problems (e.g., incessant changes in software requirements or high turnover among project members) or external sources of problems (e.g., unanticipated advances in technology or launch of competitive products). Project managers may be more resilient to internal than external problems because they are in a better position to address them and control the situation (Staw and Ross 1987). Alternatively, project managers may respond more aggressively

to external competition because market share may be critical to their businesses. Future studies can examine these issues.

Third, while this study examines the framing of quantitative information about market share, future studies can assess the impact of framing qualitative information. With quantitative information, rational project managers can compare optimistically and pessimistically framed feedback for mathematical equivalence. But with qualitative information (e.g., rich text descriptions of project prospects), it is impossible to check for mathematical equivalence. The impact of qualitative information on willingness to continue with software projects may be less predictable because qualitative information may be interpreted differently by different project managers. Yet, feedback on software projects, including reports from external consultants, can often be qualitative in nature. Future research can examine whether and how qualitative information may be framed as well as the impact of such framing efforts on willingness to continue with software projects.

Limitations of This Study

First, this study employed a research experiment involving artificial scenarios and student subjects. Also, the three independent variables have been operationalized using concise rather than extended descriptions. Though this research approach results in strong internal validity, the results may lack generalizability. For tasks involving human information processing and decision making (as in this study), researchers have suggested that the use of student subjects would not invalidate the results (Ashton and Kramer 1980; Garland and Newport 1991; Staw and Ross 1987). Nevertheless, it would still be useful to validate the findings of this study in the context of real software project scenarios and actual software project managers.

Second, to keep the research experiment manageable, the number of factors manipulated and studied had to be kept small (three factors in this case). In reality, a plethora of other factors also affect management decisions on whether or not to continue with software projects. Also, to enhance the internal validity, the three factors under study had to be operationalized using strong manipulations (see Sections 3.1 to 3.3) so as to induce statistical differences (if these exist). In reality, these factors may exist in other weaker modes (see Section 5.4). For example, we manipulated feedback using clear market share figures, following Whyte (1991). In reality, software project managers may receive incomplete or inaccurate feedback due to lack of resources or time, or because some information is simply unavailable. These project managers would have to work within constraints of incomplete or inaccurate feedback (weaker modes of feedback) when making their decisions.

Third, the subjects in this study played the role of project managers who were currently managing a software project. Given the experimental scenarios (see Section 3.4), they were implicitly supporting (or at least not opposing) the software project. The subjects were never asked to take the perspective of project managers who opposed the software project. Thus, when given pessimistically framed positive feedback from the consultant, the subjects might have found it difficult to comprehend why the consultant should frame the positive feedback using a pessimistic tone. Similarly, in practice, consultants may frame positive feedback using optimistic or pessimistic tones (intentionally or unintentionally). However, project managers who do not oppose the

software project may also find it difficult to relate to positive feedback that has been pessimistically framed.

Conclusion

This study depicts how accountability may moderate the impact of feedback direction and optimism on human decisions pertaining to software projects. In summary, the effects of feedback direction and optimism on willingness to continue with software projects were additive when accountability was high but were interactive when accountability was low. These results contribute to the software project management literature in two important ways. First, they generate new insights on how software project managers may make decisions in the context of confirmatory (optimistic framing of positive feedback or pessimistic framing of negative feedback) or contradictory evidence (pessimistic framing of positive feedback or optimistic framing of negative feedback). Second, these results yield some clues about how the effects of feedback direction and optimism on the decisions of software project managers may differ in high accountability conditions (which has been the domain of prior research) versus low accountability conditions (which is particularly applicable to software projects, given high personnel turnover).

As the software market becomes more global, and as organizations increasingly purchase software packages from vendors around the world, software projects (particularly those involving development of generic software packages) face tougher competition and become more challenging to manage. To help software project managers cope with these challenges, factors driving critical management decisions (which affect software project success) must be better understood (Keil et al. 2000; Newman and Sabherwal 1996). The intricate relationship among three such factors (feedback direction, feedback optimism, and accountability) has been unraveled in this study. Future studies toward this end can yield valuable knowledge on software project management.

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APPENDIX

This Appendix summarizes the experimental materials given to subjects. Depending on their accountability treatment, subjects received one of the two accountability scenarios. Also, depending on their feedback direction and feedback optimism treatments, subjects received one of the four feedback direction/feedback optimism scenarios.

CompuSys Corporation

Instructions

The case below is adapted from a genuine business scenario. Please read the case and answer *all questions* that follow based on your *personal opinions*. There are *no right or wrong answers*. When you have completed, please return the case to the administrator.

Case

You are a Director of CompuSys Corporation, a computer software company. Your company has been working on a CONFIG software project (developing a generic database system with advanced artificial intelligence capabilities for sale in the market). The CONFIG software should appeal to major computer hardware companies because it can potentially help to boost computer hardware sales by facilitating the work of sales representatives. To generate sales, sales representatives need to put together a set of computer hardware components that are compatible with each other and, when combined, will result in a complete and functioning computer system for their customers. The CONFIG software can help sales representatives with this complex task of customizing computer systems to meet customer needs. Another computer software company is also working on a CHAMPFIG software project that has the same objectives as the CONFIG project.

At the beginning of the CONFIG project, your company had engaged an external consultant to carry out a market study involving CONFIG and CHAMPFIG. The external consultant had concluded that CONFIG and CHAMPFIG would each capture 50% of the total market demand.

High accountability scenario (heading not shown in actual case)

You are the champion of the CONFIG project. You were solely responsible for persuading top management to initiate the CONFIG project. You have been asked to take charge of the CONFIG project since its inception. You are currently managing the CONFIG project.

Low accountability scenario (heading not shown in actual case)

You are not the champion of the CONFIG project. Your predecessor was solely responsible for persuading top management to initiate the CONFIG project. You have been asked to take charge the CONFIG project when your predecessor left the company. You are currently managing the CONFIG project.

Your company is now midway through the CONFIG project (50% of the budget has been spent and 50% of the project has been completed). Eager to have a clearer picture of the current market situation, your company has engaged the same external consultant to carry out a follow-up market study involving CONFIG and CHAMPFIG. The consultant has just concluded the study and reported their findings.

Positive feedback, optimistic framing scenario (heading not shown in actual case)

The consultant observes that the total market demand for such software products has remained the same as their initial assessment at the beginning of the CONFIG project. Sales representatives from computer hardware companies are still interested in using such software products to facilitate their work. Besides CONFIG and CHAMPFIG, no other comparable software products would be available in the market in the foreseeable future. Based on their current assessment, the consultant concludes that the CONFIG software would capture 75% of the total market demand.

Negative feedback, optimistic framing scenario (heading not shown in actual case)

The consultant observes that the total market demand for such software products has remained the same as their initial assessment at the beginning of the CONFIG project. Sales representatives from computer hardware companies are still interested in using such software products to facilitate their work. Besides CONFIG and CHAMPFIG, no other comparable software products would be available in the market in the foreseeable future. Based on their current assessment, the consultant concludes that the CONFIG software would capture 25% of the total market demand.

Positive feedback, pessimistic framing scenario (heading not shown in actual case)

The consultant observes that the total market demand for such software products has remained the same as their initial assessment at the beginning of the CONFIG project. Sales representatives from computer hardware companies are still interested in using such software products to facilitate their work. Besides CONFIG and CHAMPFIG, no other comparable software products would be available in the market in the foreseeable future. Based on their current assessment, the consultant concludes that the CONFIG software would fail to capture 25% of the total market demand.



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