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Mitigating Escalation of Commitment: An Investigation of the Effects of Priming and
Decision-Making Setting in Capital Project Continuation Decisions

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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theory, and computer-mediated communication

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DEDICATIONS

I would like to dedicate this dissertation to my children, my husband, and my parents. Greg and Jenny, you have been both a source of support and inspiration. Throughout the Ph.D. program you have been understanding and helpful. It was your steadfast belief in me that helped me through difficult times and inspired me to do better. Greg, you have become an awesome young man. You are smart, considerate, kind, and giving. Jenny you have become a lovely young lady. You are cheerful, energetic, loving, and dedicated. You have both made me extremely proud and I know you will continue to do so.

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Mitigating Escalation of Commitment: An Investigation of the Effects of Priming and Decision Making Setting in Capital Project Continuation Decisions

Ann C. Dzurainin

ABSTRACT

This research examines escalation of commitment in capital investment decisions and the extent to which it can be mitigated using a cognitive prime. Specifically, I examine the use of a cognitive prime as a way to mitigate escalation in three decision-making settings: (1) individual, (2) face-to-face team, and (3) computer-mediated team. Continued investment in failing projects is costly for firms. The use of a cognitive prime to reduce escalation would provide a low cost way to mitigate escalation. In this study, participants are primed to think about sunk costs. The expectation is that priming individuals to think about sunk costs will increase the accessibility of sunk cost knowledge and reduce the likelihood of continued investment in the failing project. Further, based on Persuasive Arguments Theory, it is expected that the prime will reduce escalation in teams communicating in a computer-mediated setting more than in any other decision setting. The results of the experiment support the prediction that priming will reduce escalation and did so in all decision making settings. Further, the results indicate that, in the computer-mediated setting, primed teams had the least amount of

escalation behavior coupled with the largest difference in escalation compared to teams that were not primed.

1.0 INTRODUCTION

In this study, I examine the use of a cognitive prime as a way to mitigate escalation of commitment behavior in three decision-making settings: (1) individual, (2) face-to-face team, and (3) computer-mediated team. Escalation of commitment (Staw, 1976) is the tendency of individuals to continue to invest in a failing course of action because of effort, money, and time already invested. Escalation of commitment occurs in a number of managerial accounting contexts. Cheng et al. (2003) and Beeler (1998), for example, provide evidence of escalation of commitment in capital budgeting and resource allocation decisions. Kadous and Sedor (2004) examine project-continuation decisions and whether third-party consultants reduce escalation behavior. Other accounting studies have found that escalation behavior is positively related to the search for retrospective information (Beeler and Hunton, 1996), the incentive to shirk, and privately held information (Harrell and Harrison, 1994).

Capital investment decisions are a critical determinant of organizational success (Brigham and Houston, 1999; Hansen and Mowen, 2000; Brealey et al., 2001). These decisions typically involve substantial expenditures on long-term strategic investments. After the initial investment decision, managers evaluate investment performance and decide whether to continue investing in or terminate projects. Although economic theory predicts that managers will continue to invest only when the net present value (NPV) of

continued investment is positive, managers frequently commit additional resources to failing projects (Waldman, 1989; Whyte, 1991; Ross and Staw, 1993; Drummond, 1998). A survey of 579 information systems auditors found that escalated projects exceeded budget targets by 156 percent as compared to 18 percent for non-escalated projects. In addition, escalated projects exceeded schedule targets by 133 percent as compared to 22 percent for non-escalated projects (Keil et al., 2000). Escalation behavior is thus quite costly to firms, and more than 30 years of escalation behavior research in psychology, business, economics, and public policy contexts has shown that the phenomenon is extremely robust (Brockner, 1992; Staw, 1997).

Investment continuation decisions are often be made by cross-functional teams, which include accounting, finance, marketing, and operations department personnel (Brigham and Houston, 1999). The investment continuation decision team typically includes accountants and will certainly use information provided by the management accounting system (e.g., cost analyses, net present value (NPV) calculations, internal rate of return (IRR) calculations) (IMA 1999 Practice Analysis). Therefore, it is important to understand the escalation behavior of teams as well the effect that management accounting information may have on escalation behavior. Further, as organizations become more geographically dispersed, face-to-face (FTF) meetings become more difficult to arrange. The increasing availability of computer-mediated communication technology (CMC) enables organizations to use CMC in addition to or in place of FTF meetings. Meetings via CMC can provide significant savings in terms of resources and

time for organizations (Li, 2007). Research has shown, however, that decision-making performance often differs between CMC and FTF groups (Bates et al., 2002).

Prior literature has shown that decision makers often fail to ignore sunk costs when making an investment continuation decision. In this study, I investigate whether the use of a cognitive prime can mitigate escalation of commitment. Specifically, I hypothesize that priming participants to think about sunk costs will attenuate their tendency to escalate because the prime will increase the accessibility of sunk cost knowledge. Further, based on Persuasive Arguments Theory (Vinokur and Burnstein, 1974), it is expected that the prime will reduce escalation in teams communicating in a computer-mediated setting more than any other decision setting.

To examine the effectiveness of a cognitive prime in an capital project continuation decision under each of three different decision settings I conducted a 2 X 3 between-subjects experiment in which participants were either primed or not primed and assigned to either individual, CMC team, or FTF team decision-making settings. I find that priming reduces escalation behavior and did so in all decision-making settings. Primed CMC teams had the least amount of escalation behavior coupled with the largest decrease in escalation from its not primed team decision settings.

The results of this study add to both escalation research and practice. First, it extends prior escalation and construct accessibility research by demonstrating the use of a prime in an escalation decision making setting. Second, it extends the research comparing the escalation behavior of teams and individuals by showing that in a CMC decision setting priming is critical for mitigating escalation. Firms using team CMC decision

settings can significantly reduce escalation behavior by introducing a cognitive prime in the discussion process. Finally, the supplemental analyses of the team discussions provide insight into the decision processes of teams in an escalation dilemma.

The dissertation continues as follows. Chapter two provides a review of the relevant literature and the hypotheses development. Chapter 3 describes the method, research design, and results of the pilot study. Chapter 4 provides the statistical analysis and results of the main study, and Chapter 5 concludes with a discussion of the results and future research.

2.0 LITERATURE REVIEW AND HYPOTHESES

2.1 Introduction

This section provides a discussion of the literature pertaining to this study. There are four research questions of interest. First, will a cognitive prime reduce escalation in individuals' decision-making? Second, will teams escalate more than individuals? Third, will the communication mode affect the escalation behavior of teams? Fourth, will priming and team communication mode interact such that the effect of priming varies by decision-making setting?

The escalation literature and cognitive accessibility literature provide the hypotheses development background for the first research question. Escalation literature and a model of escalation behavior are reviewed. The cognitive accessibility literature is then reviewed to provide support for the proposed effect of priming.

The second research question addresses the behavior of teams relative to individuals in an escalation dilemma. Research in group escalation behavior as well as group decision-making is reviewed to develop a hypothesis regarding team and individual escalation behavior.

The literature regarding CMC and FTF team communication is reviewed to address the third research question. The key determinants of differences in team performance relevant to this study are discussed. Included in this review is a more recent study

examining escalation of commitment and communication mode. Hypotheses are then presented.

The last research question addresses the potential interaction of priming and communication mode. This question has not been studied in prior literature, however, literature in Persuasive Arguments Theory and group polarization provide support for predictions.

2.2 Escalation of Commitment

2.2.1 Background

‘Escalation of commitment’ is a term used to describe a situation where one or more decision makers commit additional resources to an investment project even though the NPV of such investment is negative. To illustrate the phenomenon consider the following example from Arkes and Blumer (1985: 129).

Scenario one

As the president of an airline company, you have invested 10 million dollars of the company’s money into a research project. The purpose was to build a plane that would not be detected by conventional radar, in other words, a radar-blank plane. When the project was 90 percent completed, another firm begins marketing a plane that cannot be detected by radar. Also, it is apparent that their plane is much faster and far more economical than the plane your company is building. The question is: should you invest the last 10 percent of the research funds to finish your radar-blank plane?

Scenario two

As president of an airline company, you have received a suggestion from one of your employees. The suggestion is to use the last 1 million dollars of your research funds to develop a plane that would not be detected by conventional radar, in other words, a radar-blank plane. However, another firm has just begun marketing a plane that cannot be detected by radar. Also, it is apparent that their plane is much faster

and far more economical than the plane your company could build. The question is: should you invest the last million dollars of your research funds to build the radar-blank plan proposed by your employee?

The difference between scenario one and scenario two is that in the first scenario you have already invested time and money in the development of the radar-blank plane. Other than that, the project is clearly failing in both scenarios. Yet, when participants answered these questions, 41 out of 48 chose to continue investing in scenario 1 whereas only 10 out of 60 chose to invest in scenario two. Although the normative answer would be to ignore the sunk costs in scenario 1, an overwhelming majority of participants decided to continue.

The vast majority of the escalation research has focused on the identification of causes of the behavior. The two causes with the most empirical support are self-justification and the sunk cost effect. Stemming from cognitive dissonance theory (Festinger, 1957), self-justification posits that individuals will be unable to change from a previous course of action because they are unwilling to admit that the prior decision was wrong. In order to maintain a positive self-image, they must ignore or discount any information contrary to their original decision. In an escalation situation, this behavior manifests as the decision to invest more resources into an already failing project. Empirical evidence supportive of the self-justification explanation of escalation of commitment has shown that as the need to justify increases, so does the likelihood of escalation behavior (Bazerman, et al., 1984; Davis and Bobko, 1986; Conlon and Parks, 1987).

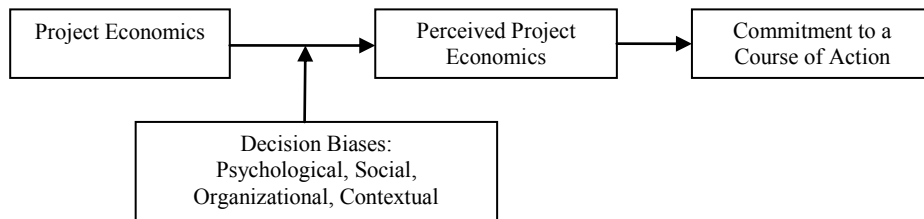
Another cause identified in many studies is the *sunk cost effect* (Arkes and Blumer, 1985; Garland, 1990; Heath, 1995; Tan and Yates, 1995). Research has shown that the decision to continue investment increases as the amount of time and money previously invested increases (Arkes and Blumer, 1985; Conlon and Garland, 1993; Keil et al., 1995; Mann, 1996; Moon, 2001). Decision makers tend to consider these “sunk” costs in the investment continuation decision even though such costs are irrelevant to the decision. It appears that individuals are unable to ignore the sunk costs incurred even though to do so would be the rational economic decision. Further, when the decision is made by a group of individuals, group decision-making biases can affect the decision outcome (Beeler, 1998; Moon et al., 2001; Moon et al., 2003).

2.2.2 Escalation Model

Although a theoretical model of escalation does not exist, Staw (1997) proposed an aggregate model of escalation behavior. The goal of the model is to make the study of escalation more comprehensible by reducing the variables studied in the existing research into an understandable classification scheme. The variables from prior research are categorized into four determinants of escalation behavior. These four determinants are identified as potential drivers of decision-making biases and are categorized as: psychological, social, organizational, and contextual (Staw, 1997). Psychological determinants address individual characteristics such as risk propensity, self-esteem and personality traits of the decision maker. Social determinants examples would include whether the decision is made by an individual or a group or if the decision makers' behavior is observable. Organizational determinants are variables related to the

organization such as political structure. Contextual determinants are variables related to the specific task such as the time or length of the project. These determinants can operate individually or in combination to bias decision makers' perception of the project economics. If it is possible to mitigate these biases, escalation of commitment in failing projects can be reduced. A summary of the model is depicted in Figure 1.

FIGURE 1: Escalation Model



This study investigates the effect of two determinants where the project economics are negative. Specifically, I examine whether the sunk cost effect (psychological determinant) can be mitigated at both an individual and group decision-making level (social determinant) using a sunk cost prime.

2.3 Construct Accessibility

A potential explanation for escalation could simply be that individuals and teams making the decision did not understand the irrelevance of sunk costs. Prior studies, however, have shown that even when individuals know they should ignore sunk costs, they still fail to do so. Arkes and Blumer (1985) tested this proposition in an experiment using two groups of students. One group of students had never had an economics course and the other group had at least one economics course. Further, the group that had the

economics course had been explicitly taught the concepts of sunk costs. Arkes and Blumer found no differences between the groups. Both groups failed to ignore sunk costs in the decision. Tan and Yates (1995) also examined the effect of instruction on sunk cost principles and found that there was no difference between the group that had instruction and the group that did not. Again, both groups escalated commitment to a failing project. Larrick, Nisbett, and Morgan (1993) found that the level of sunk cost knowledge was related to the number of economics courses taken, but they found mixed results for the effect of sunk cost knowledge on cost-benefit decisions. Sunk cost knowledge in this context refers to the individual's understanding that costs already incurred should not be included as relevant costs in the decision to continue or abandon a project. Further, knowledge of sunk costs in these studies was assumed based on demographic data provided by participants. In other words, there was no training in the aforementioned studies and no pretests of sunk cost knowledge.

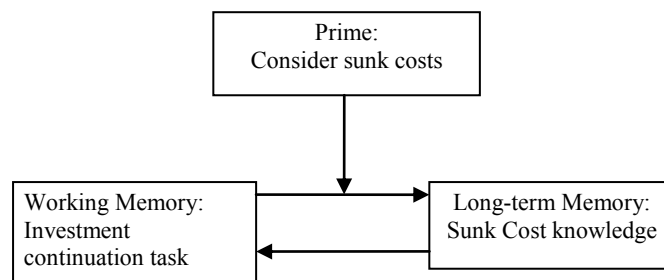
The question remains as to why individuals consider sunk costs relevant even when they know they are not. One possibility is that they fail to access their knowledge about sunk costs when they make their decision. There is a great deal of research in psychology on knowledge activation that examines the way individuals' access and apply knowledge (see Higgins 1996, for a review). Basically, there are two variables that influence the likelihood that stored knowledge will be activated: *accessibility* of the knowledge prior to stimulus presentation and the *fit* between the stimulus and the stored knowledge. Bruner (1957) used the term accessibility to refer to the ease with which an individual could apply a mental representation (knowledge) to a new input. Fit is defined as the strength of

the relationship between the stored knowledge and the presented stimulus. Gilbert et al. (1998) provide a probability model based on Bruner's seminal work. They define "...the probability of using a given representation R to interpret information I as:

$$p(\text{apply}(R, I)) = f(\text{fit}(R, I) * \text{accessibility}(R))$$
 (pg 408).

In the project continuation decision scenario, R represents knowledge of relevant and irrelevant costs to consider in the decision process. I represents the information (stimulus) given to evaluate. Accessibility of knowledge of relevant and irrelevant costs can be increased by priming the individual to think about these costs. Priming has been shown to be extremely robust in influencing construct accessibility (Higgins 1989, 1996). The priming activates the stored knowledge, which temporarily increases the accessibility of the knowledge (Higgins, 1996). As the prime increases accessibility of the sunk cost knowledge, the probability of accessing the knowledge increases.¹

FIGURE 2: Construct Accessibility Model



¹ It is important to note that accessibility and salience are not synonymous in this context. In construct accessibility, salience refers to the salient features of the stimulus. It is possible that the prime could be very prominent to the decision maker, yet they still fail to access the required knowledge from memory.

In summary, a prime will increase the accessibility of the knowledge of how to treat sunk costs. This increased accessibility of sunk cost knowledge will in turn increase the likelihood that the decision maker will ignore sunk costs and therefore be less likely to continue investment in a failing project. This leads to my first hypothesis:

H1: Individuals primed to consider sunk costs will be less likely to invest in failing projects than individuals not primed.

It is important to note that increasing the salience of sunk costs via the prime will improve the decision only if individuals access the knowledge of how to treat sunk costs. In fact, the nature of the sunk cost effect is such that individuals are aware of the sunk costs and continue to invest because of those costs, on the erroneous belief that those costs would be “wasted” if the project were not continued. Therefore, if the decision makers are primed to think about sunk costs they should actually be more likely to continue investing unless they access the knowledge that sunk costs are irrelevant.

2.4 Escalation Behavior in Decision-Making Teams.

As discussed earlier, not all escalation decisions are made by one individual. In many situations a group or team of individuals will be responsible for the project continuation decision (IMA, 1999). The results of studies of group decision making behavior in escalation situations have been mixed. Studies have shown that, compared to groups, individuals exhibit less (Whyte, 1993; Schmidt et al, 2001), the same (Bazerman et al., 1984) or more (Moon et al., 2003; Moon et al., 2001; Beeler, 1998) escalation

behavior. Comparison of results across the studies is difficult since the studies have employed different independent variables and different measures of escalation behavior.

Bazerman et al. (1984) was the first study to examine group decision-making escalation behavior. The study supported the authors' contention that escalation tendencies that exist at the individual level will carry forward into the group decision setting. The author found no differences between individual decision-making and group decision-making in the escalation dilemma, i.e., both individuals and groups escalated.

In contrast to the Bazerman et al. (1984) study, Whyte (1993) found that groups escalated more than individuals. Specifically, Whyte (1993) found that if the predominant individual tendency was for escalation then the group response was even stronger escalation. This response was strongest in group decisions where personal responsibility for sunk costs had been assigned to the group members.

Schmidt et al. (2001) is one of the few studies that addresses both group decision-making and the use of computer-mediated communication in an escalation setting. They examine whether individual managers or a team of managers make more effective (escalate less) new product development (NPD) continuation decisions. They also consider the effects of decision-making setting on team-based NPD decisions. The key findings are that, compared to individuals, decision-making teams are significantly less likely to recommend funding the failing NPD project, and virtual teams using computer-mediated communication were the least likely to recommend funding the failing NPD project. A limitation of this study, however, is that the computer-mediated teams met over the course of a week whereas the individuals and face-to-face teams made their

decision in a single session. This raises the question as to whether it was the communication medium that made a difference or the amount of time used to make the decision. My study will address this limitation.

Moon et al. (2003) conducted two experiments comparing individual and group decision making in escalation situations and found that private consideration by group members prior to meeting as a group (as in the Whyte, 1993 study) made groups more likely to escalate investment than individuals. Groups that only considered the dilemma as a group were more likely to abandon projects than individuals. In addition, groups that consider the dilemma privately before meeting with the group tend to escalate their commitment in an incremental fashion. In other words, they continued to invest in small increments over a series of decisions about the project. Although this study provided insight as to how to mitigate escalation behavior, employing the suggested process may not be possible in practice. It is unlikely that decision making teams have no prior information about the project decisions prior to meeting to discuss alternatives.

2.4.1 Group Decision Making Bias

As identified in the aggregate model of escalation, social determinants can affect escalation behavior. Group interaction would fall in this category. There is a substantial body of research demonstrating that group decision making differs from individual decision making (Wheelan, 2005) and that the differences can be positive or negative (Kerr and Tindale, 2004).

Different reasons have been proposed as to why groups perform differently than individuals in escalation situations. Self-justification theory posits that individuals

escalate commitment to failing projects as a way to justify their previous decision to invest. In a group setting, it is likely that individuals will consider the responsibility to be diffused and therefore are more likely to abandon a failing project. Prior research has shown that when individuals do not feel personally responsible for the initial decision they are less likely to continue investment in a failing project (Staw, 1976; Fox and Staw, 1979; Arkes and Blumer, 1985; Schoorman, 1988).

Another potential benefit of a group setting is the opportunity to share knowledge that other group members may not have. In addition to collective knowledge of the group, the likelihood that at least one team member will remember relevant information needed for the task is increased and helps to enhance decision making performance (Hunton, 2001) In the context of this study, group deliberations could increase the likelihood that the irrelevancy of sunk costs would be discussed, since only one team member needs to raise the issue.

Although it would seem that the benefits of group interaction would help to reduce escalation behavior, it is also possible that some of the disadvantages of group decision-making could degrade the decision process. Group polarization is one potential drawback that has been extensively examined in the psychology literature (see Myers and Lamm, 1976 for a review). Polarization is a bias in group decision making and has been shown to affect group decision outcomes (Jex, 2002). Group polarization is defined as an increase in the extremity of the average group position (Myers and Lamm, 1976). In other words, groups tend to move to an extreme position (in either direction) relative to the average position the individual group members had prior to group discussion. With the

exception of Whyte (1993), the phenomenon has not been considered in prior escalation literature. There is no reason to believe that it would not occur.² In the escalation literature we have seen that individuals already lean toward escalation, therefore, in a group situation, the polarization phenomenon could exacerbate that tendency.

The use of Persuasive Arguments Theory (PAT) as an explanation for group polarization has been empirically supported (Isenberg, 1986, Sia et al., 2002). PAT posits that people will change their opinion as they are exposed to arguments from others. PAT research has shown that shifts in group decisions (polarizing or de-polarizing) can be manipulated by the preponderance of pro and con arguments (Isenberg, 1986). How persuasive the argument is depends on the validity and novelty of the argument (Vinokur and Burnstein, 1978). An argument is considered valid if people perceive it to be correct and accurate. A valid argument is one that contains facts in support of the collective position or reinforces a previously mentioned argument. According to El-Shinnawy and Vinze (1998) there are four argument attributes for valid arguments: truth, fit, follow, and contribute. An argument would fit the ‘truth’ attribute if it is supported by the parameters defined by the problem. A ‘fit’ argument would be a statement that fits views previously expressed by the participant or the statement fits the current discussion thread.

Arguments that ‘follow’ are those statements that follow from accepted facts or follows previously expressed views. An argument would ‘contribute’ if it supports, represents, or

² Whyte (1993) examined individuals and groups’ escalation behavior and inferred that group polarization may lead to groups escalating more than individuals. My study differs from Whyte (1993) in two ways. First, I am examining how the behavior occurs in the group discussion process using protocol analysis. Second, I am examining whether and to what extent priming can mitigate the behavior in both CMC and FTF communicating groups.

is used in some form in one of the options for the final decision. A novel argument is one that people view as new and interesting. There are two attributes identified as novel arguments. The first is referred to as ‘new way’ and it is a statement that indicates a new form of organizing the information. The other attribute of a novel argument is a ‘new idea’. This type of statement would provide information not previously used to conduct the discussion.

Per PAT, as more valid and novel arguments in the direction of the collective position are presented, individuals will change their position toward the collective decision. Given that individuals are already prone to escalate investment in a failing project, teams making a project continuation decision for a failing project will escalate to a greater degree. The tendency of individuals to escalate will increase the likelihood of persuasive arguments in favor of escalation during team discussion. Per PAT, the increased number of persuasive arguments in the direction of escalation will increase the likelihood of escalation in team settings. This leads to my second hypothesis.

H2: Absent priming, teams will exhibit a higher likelihood to invest in failing projects than individuals.

2.5 Team Decision-Making Setting

As discussed in the introduction, the use of virtual teams is not uncommon in organizations. A survey by the Gartner Group in 2000 estimated that by the year 2004, more than 60 percent of professional employees will work in virtual teams (Kanawattanachai and Yoo, 2002). More than 20 years of research has yielded thousands of studies of virtual teams. Several literature reviews have been published providing some organization to the research in this area (Fjermestad and Hiltz, 1998; Bates et al.,

2002; Martins et al., 2004; Fjermestad, 2004; Raines, 2005). Based on these literature reviews and meta-analyses, there are several outcome measures and moderators in common among the studies. Common dependent variables studied include decision quality, time to decision, and user satisfaction. Common moderators studied are anonymous vs. nonanonymous group discussions, open-ended vs. timed discussions, group size, and task type.

The research relevant to my study is studies of decision quality and the potential moderators. Baltes et al. (2002) conducted a meta-analysis of research comparing face-to-face communication with computer-mediated communication. They found that if task time is open-ended, CMC groups are as effective as FTF groups. Similarly, they found no effect for group size. Anonymity did have an effect on decision quality indicating that non-anonymous CMC groups performed less effectively than FTF groups. Finally, they found that task type is a significant moderator of decision quality. Below I will discuss the implications of these findings for my study.

Teams in both the CMC treatments and FTF treatments had sufficient time to complete the task. The amount of time given to the teams was based on findings from the pilot study performed to test the task. Based on the actual time it took for the teams to perform the task, the final study included some time parameters, but those parameters were well within the open-ended time frame for each treatment. Task time, therefore, is not hypothesized to have an affect the decision quality outcome in this experiment.

Group size has been shown in prior studies to be a significant moderator of decision quality as the size of the group increases (Davis et al, 1997). The group size in

this experiment would be considered small (3 – 4 members), and is not hypothesized to have a significant impact on the decision quality outcome.

Task type and anonymity are, however, an important aspect of the hypothesis development for the comparison of CMC and FTF teams' decision quality. Both moderators are discussed in further detail below.

2.5.1 Anonymity

A feature of CMC is the ability to have anonymous interaction between team members. Research examining this feature of CMC has found that anonymity reduces conformance pressure due to lower social presence (Nunamaker et al., 1991, Valacich et al., 1994). In addition, members are less inhibited in the expression of their ideas (El-Shinnawy and Vinze, 1998) and more likely to evaluate the contributions of group members based on merit rather than the status of the person presenting the information (Jessup et al., 1990; Zigurs et al., 1988)

The impact of social presence in CMC was advanced by Short et al. (1976). They defined social presence as the “degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships” (p.65). Since that time there has been a large amount of research examining social presence. Early research focused on measuring the level of social presence in various media. Subsequent research focused on the effect of social presence on performance. In the performance studies, social presence was defined as the degree to which people establish personal connections with each other in a communication setting (Short et al., 1976, Sia et al., 2002). Personal connection is established through communication cues shared with one another.

Communication cues can be classified into three types; verbal, visual, and textual (McGrath, 1984). Verbal cues such as tone of voice, loudness of voice, and rate of speech are all ways to convey information. Visual cues refer to information conveyed through facial expressions and body language. Textual cues refer to information that is written, printed, typed or displayed graphically. Overall, the research has shown that dispersed CMC has lower social presence than FTF communication. The implication of the research is that lower social presence helps to encourage more equal participation among group members and affords more inhibited team members the opportunity to contribute. In an escalation decision-making dilemma, a team member may be uncomfortable taking a stance against continuing the project if the group is leaning toward escalation. In a CMC environment, the reduced social presence can help to reduce that anxiety.

2.5.2 Task type

Task type has been found to be a significant moderator of decision quality performance in CMC and FTF teams (DeSanctis and Gallupe, 1987; Murthy and Kerr, 2003; Baltes, et al., 2002; Martins et al., 2004). As such, task type is an important consideration in the development of the hypotheses in this study. Prior research has found that CMC teams outperform FTF teams in brainstorming and idea-generation due to the parallel communication capabilities of CMC. Parallel communication refers to the ability of the media to allow for simultaneous conversations. In face-to-face communication only one person can talk at a time, which can lead to production blocking in the group decision process. Production blocking occurs when group members either

do not have the opportunity to contribute to the discussion or have difficulty forming new ideas because they are listening to other group members. CMC allows for simultaneous input during the group decision-making process. Members can post their contributions to the discussion without being interrupted and can review what other members have posted at their own pace. Research has shown that realization of this benefit is very task-type specific (Fjermestad and Hiltz, 1998). For example, for tasks that involve idea generation (i.e. brainstorming), CMC groups outperform FTF groups (Bamber et al., 1996; Gallupe et al 1992; Murthy and Kerr, 2004). However, for tasks that require disseminating information and arriving at a shared understanding, FTF teams have been shown to perform better than CMC teams (Straus and McGrath, 1994; Murthy and Kerr, 2003).

Since task type is such an important moderator of performance in CMC and FTF teams, it is important to identify what type of task a project continuation decision would be. A commonly used schema for task identification is the McGrath Task Circumplex (1984). In this typology, there are eight task types in four quadrants. The categories are: generate, choose, execute, and negotiate. Examples of generate tasks would be creativity tasks (e.g. Brainstorming) and planning tasks. Quadrant II tasks (choose) includes intellectual tasks and decision-making tasks. Intellectual tasks involve solving problems where there is a correct answer. Decision-making tasks involve deciding on issues with no right answer. Negotiate tasks fall in quadrant III and involve resolving conflicts of viewpoint or interest. The final quadrant tasks are labeled execute tasks involve psychomotor tasks and competitive tasks. The project continuation dilemma in this experiment

would fall within quadrant II, intellectual tasks. The project is clearly failing and the correct answer would be to discontinue investing.

In the Fjermestad (2004) meta-analysis, 115 studies using intellectual tasks were examined. Fjermestad found that 56.4 percent of the studies found that FTF outperformed CMC, 16.4 percent found CMC to be more effective, and 27.4 percent found no effect. Similarly, Baltes et al. (2002) found that CMC groups performed more poorly on intellectual tasks (significant effect size of $d = -.50$).

2.5.3 Prior research

Prior research of CMC and FTF performance indicate that in a project continuation decision, FTF teams outperform CMC teams. Schmidt et al. (2001) provide one of the few studies that address a project continuation decision and the use of computer-mediated communication in an escalation setting. They examine whether individual managers or a team of managers make more effective new product development (NPD) continuation decisions. They also consider the effects of decision-making setting on team-based NPD decisions. The key findings are that, compared to individuals, decision making teams are significantly less likely to (1) recommend funding the failing NPD project, and (2) virtual teams using computer-mediated communication were the least likely to recommend funding the failing NPD project, followed by face-to-face teams and then individuals. The Schmidt et al. (2001) study has two limitations. First, their group decision measure is a combination of individual group member responses rather than a single consensus for each group. It is not possible to determine if the responses were the group consensus or

the individuals' perception of the group consensus.³ Second, the study employed asynchronous communication in the virtual setting but synchronous communication in the face-to-face setting. This design therefore makes it impossible to determine if the performance of the virtual team was superior because of the communication technology or because team members had more time to consider the problem and respond to group members. This difference raises internal validity concerns and limits the interpretation of the results. My study will address the limitations of Schmidt et al. (2001) by measuring group consensus directly and by using only synchronous computer-mediated communication.

It would seem that the positive influence of anonymity in the CMC setting and the results of the Schmidt et al. (2001) should lead to the prediction of CMC teams outperforming FTF teams. The effect of task type, however, predicts the opposite result. A project continuation task is an intellectual task and prior research has shown that FTF teams perform better than CMC teams for this type of task. Further, the results of Schmidt et al (2001) could have been driven by the fact that the CMC teams had more time to reach a decision than the FTF teams. Given that the escalation decision task is an intellectual task the following hypothesis is proposed. .

H3: Absent priming, FTF teams' likelihood to invest in failing projects will be lower than CMC teams.

³ In addition, there is a statistical validity concern if there was a violation of the independent observations assumption.

2.6 Team Decision-Making Setting and Priming

Hypothesis one addresses the effect of priming on individuals. Hypothesis two addresses escalation behavior in a team decision-making setting compared to individuals, absent priming. H3 addresses the effect of communication mode in a team decision making setting, absent priming. What is unknown is whether the decision-making setting and priming would combine to produce superior results. Priming is hypothesized to improve decision-making in both individuals and teams due to the increase in construct accessibility sunk cost knowledge. Teams are predicted to perform worse than individuals due to the influence of Persuasive Arguments Theory combined with the tendency for escalation (group polarization). Communication mode is not predicted to mitigate the negative effects of group polarization in the team setting (absent priming). If priming decreases escalation in teams does it do so to the same extent regardless of communication mode? There is no existing research that examines both priming and team decision-making setting in an escalation dilemma. Relying on common information sampling bias and Persuasive Arguments Theory, a hypothesis predicting the interaction effect of priming and decision-making setting will be proposed.

2.6.1 Common information sampling bias

One of the benefits of teams as compared to individuals in decision-making discussed in the development of hypothesis two was collective knowledge. Although it intuitively makes sense that the benefit of collective knowledge would improve group performance, some research has shown that unshared information is actually less likely to be used in a group decision process. The tendency for groups to discuss more of the

common information known by all group members to the exclusion of unshared information known only to one or a few group members is referred to as common information sampling bias. Originally proposed by Stasser & Titus (1985, 1987), common information sampling bias cast doubt on the belief that groups' decision making performance would be superior to individual decision making. If group members do not share their individual knowledge, the benefit of collective knowledge will not be realized. Stasser & Titus (1985) model sharing of information held by individual members as a curvilinear trend where $p(D)$ is the probability that a given item will be discussed (Stasser, et al, 1989):

$$p(D) = 1 - [1 - p(M)]^n$$

$P(M)$ is the probability of new information being introduced into the discussion and n is the number of group members. $P(M)$ is a function of the ability of members to remember information, the opportunity to do so, and their motivation to participate in the discussion. As $p(M)$ is increased, the tendency for groups to favor shared information will be reduced and as a consequence, the probability of the group discussing unshared or unique member information will be increased. Based on this model, increasing the group members' ability to remember relevant costs and the opportunity to contribute that information to the group discussion will increase the probability that the information will be shared. One way to accomplish this is via the communication mode used for team interaction. Prior research has shown that the use of computer-mediated communication can increase sharing of unique knowledge in a "hidden profile" problem solving task wherein some team members possess unique information critical to solving the problem

(Murthy & Kerr, 2004). Specifically, Murthy and Kerr (2004) showed that if the technology used is the appropriate fit for the hidden profile task then groups using CMC outperform face-to-face groups. As discussed earlier, one of the benefits of CMC is parallel communication. Parallel communication helps to reduce production blocking by allowing members to simultaneously contribute thoughts and ideas to the group conversation. It is posited that priming will improve decision-making in the project continuation decision because it will increase the accessibility of the sunk cost knowledge construct. In a team setting, priming will increase the likelihood of at least one member discussing the prime, which will be even more likely to occur for CMC teams because of the parallel communication ability afforded by the CMC technology.

2.6.2 Persuasive Arguments Theory

As discussed earlier, group polarization is a bias that affects decision making. Research examining group polarization in FTF and CMC settings has produced mixed results, with some studies finding greater polarization in CMC groups (Sia, et al. 2002; Siegel et al., 1986), others finding lower polarization in CMC groups (Karan et al. 1996) and still others finding the same amount of polarization between CMC and FTF groups (El-Shinnawy & Vinze, 1998; Weisband, 1992; Dubrovsky et al., 1991). Group polarization in the decision to continue a failing project is particularly troubling. If group members come to the group discussion already exhibiting escalation behavior, then the result of group decision making after discussion will be an even greater degree of escalation. As discussed previously, priming individuals to think about sunk costs could be one way to mitigate escalation behavior. Based on PAT, the prime would represent an

argument against escalation. Therefore, the introduction of the prime could influence more valid and novel arguments in favor of abandoning the project, resulting in lower escalation as posited in hypothesis one.

The interactive effect of prime and decision-making setting from a PAT perspective is less clear. Sia et al. (2002) examined SCT and PAT as reasons for differences between CMC and FTF team decisions. They found that the removal of visual cues and/ or the provision of anonymity through CMC may help to lower social presence. The Sia et al. (2002) study was not able to specify which of the two effects was responsible for the results. The results indicate that visual cues and/or anonymity leads to the contribution of more novel arguments and the tendency of people to try and outdo each other in the direction of the collective decision. In other words, the use of CMC was associated with increased group polarization as compared to unsupported groups and face-to-face CMC groups.

2.6.3 Priming and communication mode hypothesis

In my study, the reduced social presence in the CMC setting is predicted to have the same effect as found in Sia et al. (2002). The reduction of the verbal and visual communication cues will lead to a greater tendency for individuals to try and outdo each other in the direction of the collective group decision. Since the collective decision will very likely lean toward escalation, the CMC group will be expected to have higher escalation than the FTF groups. Further, the lower social presence created in the CMC will lead to increased contribution of novel and valid arguments due to lower communication apprehension (Nunamaker et al. 1991). The lower social presence in the

CMC setting also increases the likelihood of equal participation by group members, thereby increasing the chance of novel and valid arguments being contributed. Novel and valid arguments encourage people to change their position and move toward the collective position, potentially leading to group polarization.

PAT research has shown that shifts in group decisions (polarizing or de-polarizing) can be manipulated by the preponderance of pro and con arguments (Isenberg, 1986). It is expected that the introduction of the prime will influence a depolarization in the escalation decision. Introduction of the prime should make sunk costs more salient and increase the likelihood that at least one team member will remember what sunk costs are and that they are irrelevant. Further, priming the group members to think about sunk costs will increase the discussion of arguments against continued investment. This interaction of prime and decision-making setting could combine to mitigate the increased escalation expected in teams (hypothesis two). Given that the effects of PAT are more pronounced in a CMC setting, I hypothesize that primed CMC groups will exhibit the most benefit from priming by escalating the least, followed by FTF primed teams and then not primed teams.

H4: The likelihood to invest in failing projects will be lowest for primed CMC teams relative to primed FTF teams and teams not primed.

3.0 METHOD

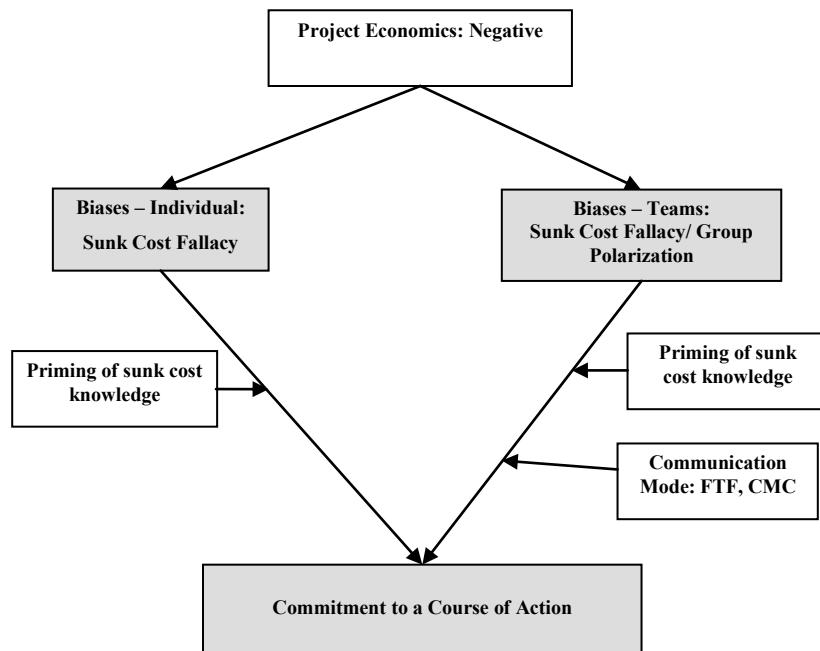
3.1 Introduction

The research hypotheses were tested using a 2 x 3 between-subjects experiment. This section details the experimental method. The research model, design, and variables are discussed first. Information about the participants follows. The chapter concludes with a discussion of the pilot study and results.

3.2 Research Model

Based on Staw (1997), Figure 3 illustrates the research model. Participants are given negative information about the project and then must decide on a course of action.

FIGURE 3: Research Model



3.3 Research Design

The experiment is a 2 X 3 between-subjects design, with *construct accessibility* (Prime, No Prime) and *decision-making setting* (individual, CMC-team, FTF-team) as independent variables. The likelihood of continuation of investment is the dependent variable. The dependent variable was measured on a scale of 0% - 100%. Figure 4 provides a summary of the research manipulations.

FIGURE 4: Independent Variable Manipulations

Individual Primed	CMC Team Primed	FTF Team Primed
Individual Not Primed	CMC Team Not Primed	FTF Team Not Primed

3.4 Independent Variables

3.4.1 Construct Accessibility

The knowledge of how to treat sunk costs in an investment continuation decision is needed in order to accurately evaluate the relevant costs. During the decision process, the decision maker must access his/her knowledge from long term memory. Similar to prior construct accessibility research, a prime is used in this experiment to increase the accessibility of sunk cost knowledge. Specifically, teams in the ‘primed’ treatment were given an additional instruction to “list sunk cost(s) if any” prior to discussing the project continuation decision.

As discussed in the construct accessibility section, a construct must be available in memory for it to be accessed. If a participant does not have knowledge of how to treat sunk costs, the construct accessibility treatment will have no effect. All participants completed a training session at the start of the experiment to assess whether they understand the concept of sunk costs. A frequency analysis of the answer to the final training question revealed that 95.7 percent of the participants answered correctly. This result confirms that participants understood the concept of sunk costs prior to beginning the experiment. The five participants that failed the training question were all in the individual treatment. They were removed from the final analysis. After completion of the training, a questionnaire about demographic information and two distracter tasks were completed.

3.4.2 Decision-making setting

The participants in the experiment have not worked together as a team prior to their team meeting in the experiment. In order to create a sense of team identity, participants were assigned to color coded teams. Use of color groups to engender a sense of group identity has been shown to be a strong manipulation in psychology literature (Turner, 1987). This manipulation is done to increase the realism of the experiment. Each team member received a color folder that identified their team color and contained experimental materials addressed to that specific color team.⁴ Participants in the CMC team condition used Microsoft Windows Live Messenger to communicate with their team

⁴ This manipulation is similar to Towry (2003).

members. Microsoft Windows Live Messenger was chosen for two reasons. First, it is a CMC tool that is widely available and easy to use with very little training. Participants in the CMC treatment were asked to indicate if they understood how to use the tool. Only two participants had never used a chat tool prior to the experiment. Second, the chat tool allowed for real-time recording of the communication logs. The logs enabled participants to review what others had written during the discussion and allows for analysis by the experimenter of team discussions.

Windows Live Messenger enables group discussions via text in a group discussion log. All communication is displayed simultaneously, in real-time, in the group discussion log. Each message is time stamped and identified by team member number.⁵ Prior to conducting the experiment, groups were established on Windows Live Messenger, consisting of 3 or 4 individual member identification numbers. The software allows team members to type on a message board. The message log history was available for participants to refer back to any messages posted during the session.

3.5 Dependent Variable

The dependent variable of interest in the study is the likelihood that the participant will continue to invest in the project. As discussed in the procedures section above, participants are asked to rank on a scale of 0% to 100% the likelihood that they will continue with the project. This dependent variable was chosen for two reasons. Using a

⁵ Team members interacted semi-anonymously. That is, participants were able to associate comments with the participant's number however; they did not know the actual identity of the participant. This was done to keep team history consistent among the teams. If participants knew each other from other courses that may have influenced their interactions.

scale measure rather than a dichotomous measure (yes/no) allows for investigation of the degree to which participants change their decision after meeting with their group. In addition, this measure has been used in many prior escalation studies providing comfort as to the validity of the measure and maintaining comparability with prior studies

3.6 Potential Covariates

To identify other variables that may interact with the dependent variable of interest data were collected from the participants regarding the number of accounting, finance (FINANCE) and economics (ECON) courses taken, gender, and number of years of work experience. These variables have been shown in prior research to affect escalation of commitment. Additionally, the likelihood to invest decision made by participants prior to their team meeting was also tested as a potential covariate.

3.7 Planned Statistical Analysis

The four research hypotheses will be tested as follows. Hypotheses 1, 2 and 3 will be tested using an independent samples t-test. T-tests are appropriate when there are two different groups and you wish to compare the mean score between groups on a continuous variable. Hypothesis 4 will be tested using an ANOVA with planned contrasts. Planned comparisons are used when you wish to test specific hypotheses concerning the differences between different levels of the independent variables. For hypothesis 4 the comparison of interest is how CMC primed teams compare to primed FTF teams and primed individuals.

3.8 Participants

To test the research hypotheses, 221 Masters-level and upper level undergraduate business students at a large southeastern university were recruited to participate in an experiment. Students were awarded course credit for their participation in the experiment.

As discussed in the construct accessibility section, individuals must have the knowledge construct needed for the task available in order to access it from long-term memory. In this task the construct needed is knowledge of how to treat sunk costs; therefore, it is important to use participants that have been instructed in investment project analysis and the treatment of sunk costs. Students enrolled in either an MBA, MAcc program, or an undergraduate upper level accounting course are most likely to have been exposed to both concepts in their course work (economics, managerial accounting, and finance).

The use of students as subjects in escalation studies is not uncommon and has been criticized by some (Chang and Ho, 2004). To maintain internal validity of the experiment, participants must be capable of performing the task required. As already discussed, the knowledge critical for this decision setting is to understand the concept of sunk costs. Using students that would have been exposed to the concept in their course work along with the training session in the experiment will confirm that the participants are capable of performing this task.

3.9 Experimental Task

3.9.1 Training

To assure all participants possessed the relevant knowledge of sunk costs, all participants completed a training session. The session consisted of five questions about capital project investment decisions (Figure 5). Participants first saw a screen that listed definitions for relevant costs, irrelevant cost, opportunity cost, sunk cost, and net present value. The screen that followed displayed a question about one of those terms. If the participant answered the question correctly, they moved on to the next question. If they answered incorrectly, they were shown a screen with an explanation of the correct answer. After that, they moved to the next question. The last question required the participant to correctly identify relevant costs in an investment decision. Figure 5 is a summary of the training materials. The definitions were all on one screen. Each question that followed was on a separate screen. Participants advanced to the next question if they either answered it correctly, or viewed the correct answer and explanation.

FIGURE 5: Training Materials

Consider the following definitions:

Relevant Costs – Future costs that can change across alternatives

Irrelevant Cost – A cost that is the same for more than one alternative

Opportunity Cost – The benefit sacrificed or foregone when one alternative is chosen over another

Sunk Cost – A cost for which the outlay has already been made and that cannot be affected by future decisions. Sunk costs are irrelevant costs.

Net Present Value (NPV) – Represents the present value of a project's future cash flows less its purchase price. It is the economic value of a project at a point in time.

Question 1

Only relevant costs should be considered when making an investment decision. True or False?

Question 2

Sunk costs are relevant and should be counted as part of the cost of future investments. True or False?

Question 3

Opportunity costs should be considered when evaluating alternatives for decision making. True or False?

Question 4

NPV is the economic value of a project at a point in time. True or False?

Question 5

You currently own a car that is 10 years old. The price of the car was \$12,000 and it is fully paid. You are considering purchasing a new car that costs \$26,000. The relevant costs to consider in that decision are?

- a) \$12,000 + \$26,000
- b) \$12,000
- c) \$26,000

After participants completed the training they completed a demographic questionnaire and then a distracter task. The purpose of the distracter task was to clear the information just received about cost definitions from working memory. The task required the participant to list as many countries that begin with the letter “L” as possible and then to list all the countries they could think of that begin with the letter “I”. Based on the responses given to these questions, all participants took the task seriously.

3.9.2 Materials

After the training questions, demographic data collection, and distracter task participants acted as a member of a management team and make an investment continuation decision. Participants read the following scenario, adapted from Schmidt et al. (2001):

April 2, 2007:

You are a member of the RED management team for a company that produces video gaming equipment. Your company has developed a new product that is greatly anticipated by consumers. You were the original designer of the product and personally recommended that the company begin production. (or “You were a member of the original design team”)⁶ Due to long lead time your team recommended several pieces of machinery and other tooling necessary for the production of the new product to be ordered in advance. A few of the machines have already been delivered and installed. In addition, training of the production workers is nearly complete. The budget allocation for the project is \$16 million. So far, \$3.5 million has been spent on the product development. The *projected* performance information (as of April 2, 2007) is presented below:

Projected annual sales:.....\$24.5 million
Projected annual profits:.....\$5 million
Projected NPV.....\$7 million

As the designer and champion of the product a successful launch would likely result in a substantial promotion for you.
(*or “As a member of the original design team a successful launch would likely result in a substantial promotion for you”)

Participants are asked what the likelihood is that they would continue to invest in the project on a scale of 0 – 100%. After their decision, they received the following information:

⁶ One team member was told that they were the original designer. The remaining team members were told that they were part of the original design team.

PROJECT UPDATE:

October 1, 2007:

Three months before your company expects to launch the product, your competitor launched a similar product that is superior to yours. In addition, the superior product sells for less than your product and costs less to produce. **The total cost of launching your new product (production, distribution, and marketing) incurred to date totals \$12 million.** Revised total product launch costs are expected to be \$15.5 million.

Revised information (as of October 1, 2007) about the product launch is presented below:

Revised annual sales:.....\$17.5 million

Revised annual profits:.....\$1.5 million

Revised NPV.....(\$100 thousand) (negative)

Your management team is responsible for determining if the company should continue with the product launch. There is \$4 million remaining in the product launch budget.

So far, you have spent a total of \$12 million dollars preparing to launch your new product, including costs for product development, production equipment, production of units to stock distribution channels, and advanced marketing.

As the original designer of the product you will likely receive a considerable promotion and monetary bonuses if the project launch is successful.

(or “As a member of the original design team you will likely receive a considerable promotion and monetary bonus if the product launch is successful”)

The participants were asked to make another project continuation decision indicating their likelihood to continue investment.

Responsibility for the initial investment decision has been shown to increase escalation behavior. The first investment decision is used to operationalize this construct. In addition, one team member is told that they are the original designer and the remaining team members are told they are part of the original design team. Again, these manipulations are intended to increase escalation tendencies.

3.9.2 Validation of experimental materials

An important assumption of the study is that participants understand the concepts of relevant costs and sunk costs. The first stage of the experiment included explanations

of these concepts as well as the concepts of irrelevant costs and opportunity costs to mitigate hypothesis guessing. Initial trials of the experimental materials used in the pilot study indicated that when only relevant costs and sunk costs were explained, the participants accurately guessed the purpose of the experiment. Subsequent trials of the experimental materials indicated that the addition of the concepts of irrelevant and opportunity costs to the training eliminated hypothesis guessing. After reading the concept definitions, the participants completed a series of questions to assess whether they understood the definitions. A final question tested their ability to appropriately distinguish between relevant costs and sunk costs. Ninety-five percent of the participants correctly answered the final question in the training session.

3.9.3 Procedures

Participants entered a computer lab and were instructed to sit at one of the laptops and await instructions. Once all participants were present, they were instructed to access a website where they completed the sunk cost knowledge training, a demographic questionnaire, and then a distracter task. Participants were randomly assigned to either an individual decision setting session or put into groups of 3 to 4 and assigned to CMC or FTF group sessions. The group size was determined based upon how many participants were signed up for an experimental session. The goal was to stay below five members and above 3 members and try to balance the number of groups in each treatment. As discussed in the literature review, group size is a potential moderator once the groups exceed 6 members. Once assigned to a decision-making setting, participants were randomly assigned to either primed or no prime conditions.

Face-to-face teams moved to individual meeting rooms after completing the first phase of the experiment. The meeting rooms were equipped with blank paper and pens. Participants were informed that their group session would be recorded (audio) and each team member was given a name card to place in front of them during the meeting. The name cards were labeled “1”, “2”, “3” etc. rather than using the participants actual names, to maintain comparability with the CMC condition where participants interacted semi-anonymously. Teams in the primed condition had additional instructions requiring them to list sunk costs from the case. All teams were instructed to discuss the case.⁷ After 15 minutes of discussion, the research administrator gave the team the final answer sheet and instructed them to come to a group consensus investment continuation decision. After completing the task, participants turned in the group answer sheet and completed the exit questionnaire.

Participants assigned to the computer-mediated communication decision making condition remained in the computer lab. Cardboard dividers separated the participants so that they could only view their own computer screen. Phase one of the experiment was identical to the FTF team procedures. Following the final individual decision, participants were randomly assigned to ‘primed’ or ‘no-prime’ conditions in four person teams. All participants received instructions on the use of the CMC tool. Was the interaction anonymous or non-anonymous? Clarify. CMC teams in the primed condition were asked to list sunk costs from the case. Teams discussed the case materials via the Microsoft

⁷ Pilot study information indicated that the teams spent about 20 minutes on average discussing the case and coming to a consensus. A review of the pilot study discussion logs also indicated that teams hurried through the discussion to answer the final question about team consensus. Therefore, in the main study, teams were not told they needed to come to consensus until they spent 15 minutes discussing the case.

Instant Messenger group discussion board. Similar to the FTF condition, after 15 minutes of discussion teams were asked to come to a group consensus. Once they completed the final answer sheet and turned it in to the administrator, participants completed the exit questionnaire.

3.10 Pilot Study

Sixty-six undergraduate students participated in a pilot study of the experimental materials and research design. All students were enrolled in a Principles of Managerial Accounting course and received course credit for participation. Details of the pilot study are provided in Appendix C.

Based on the pilot study experiences some changes were made to the main study research design. First, it was evident from post-experimental questionnaires that the participants were guessing the hypothesis of the study. In the pilot study, the training phase involved only sunk cost training. The pilot study training materials were changed to include additional project continuation decision training. Based on the results of the exit questionnaire after the changes to the materials, none of the participants accurately identified the hypotheses. In the main study, the training phase also included additional project continuation decision training, to mitigate hypothesis guessing.

The pilot study also revealed that when given all the experimental materials, including the final team decision form, the participants rushed through to complete the final question possibly not giving adequate consideration to all information. In the main study, the research administrator waited until it appeared the groups had finished discussion before giving them the final instruction and answer form. It was through this

process that it was determined that the teams discussed the case particulars for about 15 minutes prior to turning to off-topic discussion. Once given the final instruction to come to a group answer, the groups took more time to discuss the decision prior to completing the answer form. The main study incorporates this same time frame, allowing 15 minutes for discussion before providing teams with the answer form.

Finally, individuals were added to the main study rather than only studying teams. Prior research has not tested priming in a project continuation decision and the results of individual versus team decision making are inconclusive. Adding individuals to the final study allows for additional contribution to the research stream, specifically the investigation of the effect of priming in an individual decision-making context.

4.0 RESULTS

4.1 Introduction

The results of the main hypotheses tests are presented in this chapter. Details regarding the participants are provided first followed by a discussion of the manipulation checks. The data analyses for the test of hypotheses including the test for statistical assumptions are provided next. The chapter ends with a discussion and presentation of additional analyses performed on the team discussions.

4.2 Participants

Participants were Masters-level and upper level undergraduate business students at a large southeastern university. Eleven of the 221 participants were eliminated from the sample due to training failure (5), manipulation check failure (4), or missing data (2). The participants eliminated were all in the individual treatments. The missing data likely the result of a computer program problem encountered in the second session.⁸ The remaining 210 participants are in either individual (46) or team (164) treatments. Forty-one percent of the participants are male. The average age of the participants is 25.5 years. The average number of years work experience is 5.57. The mean number of accounting, finance, and economics courses is 6, 1.5, and 2.3 respectively. Table one provides a

⁸The analyses were conducted with all the participants and the results were qualitatively similar.

summary of participant demographics by treatment. A Chi-square test of independence revealed no significant differences among the treatments for gender or age. An ANOVA for average number of accounting courses, finance courses, economics courses and years of work experience confirmed that there are no significant differences among the treatment groups. These results provide confidence in the random assignment of participants to treatment conditions.

TABLE 1

Participant Demographics by Experimental Setting

Experimental Setting	Gender	Age		Average Number of Courses (range)		Average Years of Work Experience (range)
<i>FTF/NP</i> (n=46)	Male = 14 Female = 32	<20 = 20 – 24 = 25 – 29 = 30- 34 = >=35 =	2 23 12 2 7	ACCT= FIN = ECON=	6.65(1-7) 1.35 (0-9) 2.15 (0-7)	5.79 (0-27)
<i>FTF/P</i> (n=38)	Male = 20 Female =18	<20 = 20 – 24 = 25 – 29 = 30- 34 = >=35 =	1 24 8 1 4	ACCT= FIN = ECON=	5.84 (1-7) 1.51 (0-8) 2.27 (0-5)	5.07 (0-28)
<i>CMC/NP</i> (n=42)	Male = 22 Female =20	<20 = 20 – 24 = 25 – 29 = 30- 34 = >=35 =	0 28 9 4 1	ACCT= FIN = ECON=	5.69 (1-7) 1.33 (0-5) 1.98 (0-4)	4.93 (0-32)
<i>CMC/P</i> (n=38)	Male = 15 Female =23	<20 = 20 – 24 = 25 – 29 = 30- 34 = >=35 =	0 22 9 3 4	ACCT= FIN = ECON=	6.38 (1-6) 1.68 (0-9) 2.9 2 (0-9)	6.43 (0-30)
<i>Individuals/NP</i> (n=23)	Male = 8 Female =15	<20 = 20 – 24 = 25 – 29 = 30 – 34 = >= 35 =	2 11 4 2 4	ACCT= FIN = ECON=	5.09 (1-8) 1.52 (0-9) 2.00 (0-4)	6.41 (0-20)
<i>Individuals/P</i> (n=23)	Male = 7 Female =16	<20 = 20 – 24 = 25 – 29 = 30- 34 = >=35 =	1 16 2 3 1	ACCT= FIN = ECON=	6.00 (1-7) 2.17 (0-9) 2.61 (0-6)	4.91 (0-27)

Variable Definitions:

<i>FTF/NP</i>	Face-to-Face, Not Primed
<i>FTF/P</i>	Face-to-Face Primed.
<i>CMC/NP</i>	Computer-mediated Communication, Not Primed
<i>CMC/P</i>	Computer-mediated Communication, Primed
<i>Individual/NP</i>	Individuals Not Primed
<i>Individual/P</i>	Individuals Primed
<i>ACCT</i>	Accounting
<i>FIN</i>	Finance
<i>ECON</i>	Economics

4.3 Manipulation Checks

4.3.1 Initial Decision

In order to determine whether the manipulations in the experiment mitigate escalation behavior, several analyses were conducted. First, the participant must make the initial decision to invest in the project. Escalation of commitment research shows that when an individual feels responsible for the initial investment they are more likely to continue investment even if the project is failing. In this study, the information provided to the participants for the initial decision is positive. The participants then make an investment decision based on this initial information. The overall mean likelihood of investing in this initial decision was 72.05 percent. All participants had the same information and to assure that there were no significant differences between the treatment groups for the initial investment decision, an ANOVA was performed. The ANOVA confirmed that there were no statistically significant differences among the treatments for the initial investment decision.

4.3.2 Decision After Bad News

Participants were given a second set of information describing the updated status of the project. The project update was 'bad news' in that it informed the participants that the project now had a negative net present value and that a competitor had launched a superior product at a lower cost. In the individual treatments, the second decision is the dependent variable of interest. In the team treatments, the group decision after bad news is the dependent variable of interest.

If commitment to the project continues, the participants will exhibit continued likelihood of investing. The mean likelihood of investing after receiving negative information was 34.45 percent. This result indicates that the participants recognized the bad news, but still continued investment in the project.

4.3.3 Responsibility Manipulation

As discussed in chapter two, personal responsibility has been shown to increase escalation. To increase escalation the participants were told that they were part of the original design team on the project. In addition, one member of each team and every individual treatment participant were told that they were the original designer of the product. Further, all participants were told that they would likely receive monetary bonuses and a promotion if the project launch is successful. These manipulations were introduced to increase escalation tendencies.

Of the 43 participants that were in the responsible condition 77 percent correctly answered the question. Interestingly, an additional 43 participants not in the personal responsibility condition answered that they were personally responsible. It appears that some participants felt personally responsible regardless of the manipulation.

4.3.4 Priming Manipulation

The priming manipulation was simply an instruction to “list sunk cost(s), if any”. There were two ways to test this manipulation. The first was to check the answer to the manipulation check question “were you specifically asked to list sunk costs.” The second was to check the experimental materials to determine if they listed sunk costs. All

experimental materials submitted by the participants in the primed treatments had sunk costs written on them. Analysis of the response to the manipulation check question on the exit questionnaire revealed that 83 percent of the participants in the primed condition correctly identified that their team was explicitly asked to list sunk costs.

4.3.5 Team Identity

The participants were told that they were part of a management team. Team identity was established by assigning a color to each team. This color was then used in all the materials the participants were given. For example, a member of the BLUE team would have a blue folder that contained all the experimental materials. Face-to-face groups met in rooms identified by the color of their team. Computer-mediated groups were identified in the instant messenger software by team color. To determine if the participants felt that they were part of a team a question in the exit questionnaire asked them to rate on a scale of 1 to 7 how well they believed their team worked together. A 1 indicated they strongly agreed that their team worked well together and a 7 indicated that they strongly disagreed. The mean response was 2.22 indicating that the participants felt fairly strongly that their teams worked well together. There were no significant differences among the treatment groups.

4.4 Data Analysis

4.4.1 Introduction

Discussion of potential covariates is discussed next followed by the analysis of statistical assumptions. Hypothesis testing is then discussed.

4.4.2 Covariates

A covariate is a variable that has a relationship with, or has the potential to be related to the dependent variable. The goal is to identify covariates that are predictable but cause unwanted sources of variability in the dependent variable. Covariates can be chosen based on theoretical grounds or prior literature. Escalation literature has identified that prior economics training can influence the decision to continue investment (Larrick et al., 1993). In addition, group decision literature has identified that team size can have an influence on team performance (Davis et al, 1997, Baltes et al., 2002). As such the number of economics classes taken by participants and team size were analyzed as potential covariates.

The potential covariates were tested for correlation with the independent and dependent variables. Covariates that are significantly correlated with the dependent variable improve the explanatory power of the model and should be included. Covariates that are significantly correlated with the independent variables reduce explanatory power and should be excluded from the model. Neither the number of economics classes taken nor the number of team members were significantly correlated with the dependent variable Pearson's correlation coefficient for economics was $-.011$ with a p-value of $.937$. Team size Pearson correlation coefficient was $-.098$ with a p-value of $.496$. As such, they were not included in the model.

4.4.3 Statistical Assumptions

There are general assumptions that apply to all parametric techniques. The first assumption is that the dependent variable is measured at the interval or ratio measure. The second is that the observations were obtained using a random sample of the population. The third assumption is that the observations are independent of another. The fourth assumption is that the observations are normally distributed. The fifth assumption is that samples are obtained from populations of equal variances (Tabachnick and Fidell, 2001).

4.4.3.1 Dependent Variable, Random Assignment, Independent Observations

The first, second and third assumptions are met in this experiment. The dependent variable in this study is the likelihood of project continuation on a scale of 0 – 100%. This type of measure meets the first assumption for parametric testing. Although this study is not a true random sample of the population, the participants are representative of the population of interest and are randomly assigned to treatment conditions in the experiment. The third assumption is also met as the observations in the experiment are independent of one another.

4.4.3.2 Normal Distribution

To check the assumption of normality of the dependent variable the skewness and kurtosis descriptive statistics were examined. The Kolmogorov-Smirnov statistical test was also evaluated.

Skewness assesses the symmetry of the distribution. A positively skewed distribution indicates that there are many observations at the small end of the scale and relatively few at the higher end. A negatively skewed distribution would indicate the opposite. A normal distribution would have skewness of zero. The dependent variable of interest in this study (Decision) exhibits a positively skewed distribution (0.644).

Kurtosis assesses how peaked the distribution is. Distributions with a positive kurtosis (leptokurtic distribution) are too peaked and those with negative kurtosis (platykurtic distribution) have a flat distribution (Tabachnick and Fidell, 2001). The dependent variable of interest in this study (Decision) has a negative kurtosis (0.653).

The Kolmogorov-Smirnov statistic supports the skewness and kurtosis results ($p < .001$). The data were screened for outliers to rule out influential observations causing the departure from normality. A box plot of the data revealed no outliers.

The tests reveal that the dependent variable violates the assumption of normality. As the parametric tests to be used in the analysis are robust to departures from normality, no adjustments were made to the dependent variable.

4.4.3.3 Constant Variance

The final assumption tested was homogeneity of variance. This means that the variability of dependent variable for each of the groups is similar. A Levene's test for equality of error variances was performed. The result of the test indicates that the dependent variable exhibited constant variance across the treatment groups ($F=1.456$, $p=.212$).

4.4.4 Hypothesis Testing

4.4.4.1 Descriptive Statistics

The dependent variable is the likelihood to continue to invest in the project (DECISION). Table two provides a summary of the descriptive statistics for DECISION, organized by independent variable levels. The information in the table reveals that the lowest likelihood to invest occurred in the CMC-Team primed treatment followed by Individual primed, FTF-Team primed, FTF-Team not primed, Individual not primed, and CMC-Team not primed, respectively. Specific tests of the hypotheses are discussed next.

TABLE 2

**Descriptive Statistics: Likelihood to Continue Investment
(DECISION)
Mean percent likelihood (Standard Deviation)**

		Decision Mode			
		Individual	CMC –Team	FTF - Team	Row Means
Prime	Yes	22.17 (24.48) n = 23	15.00 (29.08) n =12	25.00 (26.92) n = 13	21.15 (26.04) n = 48
	No	38.70 (28.81) n = 23	41.54 (37.83) n =13	36.54 (28.24) n = 13	38.88 (30.67) n = 49
	Column Means	30.43 (27.73) n = 46	28.80 (35.86) n = 25	30.77 (27.67) n= 26	Overall 30.10 (29.69) n = 97
<i>CMC</i> =	Computer-Mediated Communication team decision mode				
<i>FTF</i> =	Face-to-Face Team decision mode				
<i>n</i> =	Number of observations. In the Team treatments it is the number of teams, in the individuals it is the number of individuals.				

4.4.4.1 Cognitive Prime

The first hypothesis addresses the effect of priming on individuals' decisions. Specifically, it is posited that individuals that are primed to consider sunk costs will be less likely to invest in failing projects than their not-primed counterparts. To test this hypothesis an independent T-test was performed. T-tests are appropriate when there are two groups and you wish to compare the mean score on a continuous variable. The two groups compared in this hypothesis are Primed and Not Primed. The dependent variable is likelihood to continue investment (DECISION). The Levene's test for equality of variances was not significant. The t-test for equality of means with equal variances assumed is reported below in table 3.

TABLE 3

**Independent Samples Test
DECISION and Prime**

Group Statistics: Individuals

	N*	Mean	Std. Deviation
Not Primed	23	38.6957	28.81041
Primed	23	22.1739	24.48683

Independent Samples test

	Significance (2-tailed)	Mean Difference	Std. Error Difference
Equal variances Assumed	0.042	16.52174	7.88406

*N = Number of observations

The results indicate that the Primed individuals exhibited a lower likelihood to continue investment in the project than the Not Primed individuals (22% vs. 38%). This difference is statistically significant ($t = 2.096$, $p < 0.042$). Hypothesis one is supported.

4.4.4.2 Decision-Making Setting: Teams vs. Individuals

The second hypothesis addresses the potential difference in escalation based on decision making mode. It is hypothesized that teams will exhibit a higher likelihood to invest in failing projects than individuals. This hypothesis is also tested using an independent samples t-test, the results of which are illustrated in Table 4 below.

TABLE 4

**Independent Samples Test
DECISION and Decision Setting**

Group Statistics

	N*	Mean	Std. Deviation
Team	26	39.0385	32.80303
Individual	23	38.6957	28.81041

Independent Samples test

	Significance (2-tailed)	Mean Difference	Std. Error Difference
Equal variances Assumed	0.969	.34281	8.87328

*N = Number of observations. In the Team treatments it is the number of teams, in the individuals it is the number of individuals.

The Levene's test for equality of variances was not significant therefore equal variances are assumed. The group statistics reveals that Teams had a lower likelihood to continue investment, however, this is not significantly different than the Individual mean likelihood to continue investment. Hypothesis two is not supported.

4.4.4.3 Communication Mode - Teams

Hypothesis 3 examines the effect of communication mode for teams making project continuation decisions. Specifically, it is hypothesized that, absent priming, FTF teams will have a lower likelihood to continue investing in failing projects than will CMC

teams. Similar to hypotheses one and two, this hypothesis is also tested using an independent samples t-test. The results of the test are shown in Table 5.

TABLE 5
Independent Samples Test
DECISION and Communication Mode

Group Statistics

	N*	Mean	Std. Deviation
FTF not primed	13	36.5385	28.23891
CMC not primed	13	41.5385	37.82551

Independent Samples test

	Significance (2-tailed)	Mean Difference	Std. Error Difference
Equal variances Assumed	0.706	-5.000	13.092

*N = Number of observations. In the Team treatments it is the number of teams.

The Levene's test for equality of variances was not significant therefore equal variances are assumed. The group statistics reveals that FTF teams had a lower likelihood to continue investment (36.5%); however, this is not significantly different than the CMC mean likelihood to continue investment (41.5%). Although the means are in the predicted direction without statistical significance hypothesis 3 is not supported.

4.4.4.4 Priming and Decision Making Mode

The final hypothesis predicts that priming will have the greatest effect for CMC teams compared to primed FTF teams and teams not primed. To test this hypothesis an ANCOVA was performed followed by three planned comparisons. The decision made prior to meeting with the team was tested as a potential covariate and was found to be

significant. The overall ANCOVA model is significant ($F= 5.338, p <0.001$). The main effect for Prime is significant ($p < 0.018$) however there is not a significant main effect for Mode ($p<0.800$) or the interaction of Prime and Mode ($p<0.347$). The results of the ANCOVA are shown in Table 6.

TABLE 6
Likelihood of Project Continuation ANCOVA

ANCOVA Results

Source	Sum of Squares	df	Mean Square	F-statistic	p-value^a
Corrected Model	15866.50	4	3966.62	5.338	0.001
Intercept	0.883	1	0.883	0.001	0.973
Decision prior to meeting*	10556.92	1	10556.92	14.207	0.000
Prime	4475.50	1	4475.50	0.065	0.018
Mode	48.08	1	48.08	6.023	0.800
Prime * Mode	671.95	1	671.95	0.904	0.347
Error	34181.54	46	743.08		
Total	50048.04	50			

^ap-values are two-tailed

*This represents the decision to continue made by each participant prior to team discussion.

As Prime is significant, the hypothesis was then specifically tested by the planned contrasts of the effect of priming within each mode. The comparison of CMC Primed to CMC Not primed is significant ($p <0.032$, one-tailed). The comparison of CMC Primed with FTF Primed is not significant ($p<0.191$, one-tailed), although the means are in the hypothesized direction. The comparison of CMC Primed to FTF Not Primed is significant ($p<0.037$ one-tailed). Hypothesis four is partially supported. The results of the planned contrasts are shown in Table 7.

TABLE 7
Likelihood of Project Continuation – Planned Contrasts

Planned Contrasts	Likelihood of Project Continuation			
	Means	df	t-statistic	p-value ^a
CMC/P – CMC/NP	15.00 – 41.54	1	1.954	0.063
CMC/P – FTF/P	15.00 – 25.00	1	0.893	0.381
CMC/P – FTF/NP	15.00 – 35.54	1	1.876	0.073

^ap values are two-tailed

<i>CMC/P</i> =	CMC primed
<i>CMC/NP</i> =	CMC not primed
<i>FTF/P</i> =	FTF primed
<i>FTF/NP</i> =	FTF not primed

4.5 Team Discussion Log Analysis

4.5.1 Introduction

One of the challenges to understanding the decision-making process of teams is identifying what it is about the team discussion that influences team decision-making. The vast majority of research makes inferences about decision-making based on the outcome of the team decision. While this is often the only way to evaluate team behavior, it is possible to understand the “why” of the decision process by examining the process itself. In this experiment the details of the team discussions were collected. In the CMC condition computer logs of all discussion posts were collected. The FTF team meeting discussions were digitally recorded. The collected data were then coded and analyzed to shed some light on the “black box” of the decision-making process. Based on Persuasive Arguments Theory, the team dialog was evaluated. Details of the data collection, coding and analysis follow.

4.5.2 Data

4.5.2.1 Transcription

The discussion logs from the CMC team meetings were captured using Microsoft Live Instant messenger. Each comment made during the team meeting is listed as a separate line with the date, time, and participant identification number. Microsoft Live Instant Messenger saves the discussion file as an Excel file. Figure 6 below is an example of a CMC team communication log.

FIGURE 6

CMC Team Discussion Log

TeamNo	Date	Time	From	Message
1	3/24/2008	4:25:51 PM	Ann	Welcome Team!! You may begin discussion about the case. A copy is in your folder for your reference. There are also instructions in your folder, please follow those. Continue discussion until I let you know what your next task will be.
1	3/24/2008	4:26:22 PM	Participant 8	ready
1	3/24/2008	4:26:49 PM	Participant 6	ready
1	3/24/2008	4:27:47 PM	Participant 5	Well would anyone not continue the project?? I would...
1	3/24/2008	4:28:01 PM	Participant 8	why would you?
1	3/24/2008	4:29:33 PM	Participant 5	well if you have put 12.5 million into it already you only need 3.5million to continue and the budget allocates 4 million... I felt that, that amount of time and money is just too valuable to scrap the project
1	3/24/2008	4:30:01 PM	Participant 5	why wouldn't you continue??

The FTF team meetings were recorded on a digital voice recorder. These recordings were then transcribed into a format similar to the CMC discussion logs. An example of the transcribed FTF discussion log is shown in Figure 7.

FIGURE 7

FTF Team Discussion Log

TeamNo	Date	Time	From	Message
31	3/24/2008	10:00:00	Ann	Okay, this is March 24th and this is the green team.
31	3/24/2008		12	Hello, I'm participant number 12.
31	3/24/2008		10	Hello, I'm participant number 10.
31	3/24/2008		9	Hello, I'm participant number 9.
31	3/24/2008		11	Hello, I'm participant number 11.
31	3/24/2008		12	So did you guys say anything, you know, how it asked, um, if you would pursue the project or not?
31	3/24/2008		12	What'd you guys say?
31	3/24/2008		10	Is that the first one?
31	3/24/2008		12	No, it's the second one.
31	3/24/2008		10	Oh, okay.
31	3/24/2008		10	If you had the bonus incentive?
31	3/24/2008		12	Yeah
31	3/24/2008		9	It's like...
31	3/24/2008		10	That's the second question.
31	3/24/2008		12	Yeah cause it changes you know and now revising annual sales 17.5 million, revise annual profits 2.5 million and your revised NPV's a negative 100,000
31	3/24/2008		11	I said no because I thought I remembered from cost if npv was negative you'd never do it

The FTF participants began their discussion by introducing themselves by participant number. This allowed the transcriber to match the voice of the participant comments that each participant made during the team meeting. The transcriber entered each comment made into an Excel spreadsheet.

After all the FTF team meeting discussions were transcribed the Excel spreadsheets were combined to create one file of FTF discussion logs. The CMC Excel files were also combined to create one CMC discussion log spreadsheet. These combined spreadsheets were made to appear identical and differences that may have indicated the different treatments were eliminated. Specifically, all data were adjusted to have just the participants' number and not the word participant. In addition, the time column was eliminated from the coding spreadsheet since the FTF log did not have a time stamp for each comment.

4.5.2.2 Coding

The spreadsheets were given to two independent coders for coding. Based on Persuasive Arguments Theory the coders identified the direction of the comments made by the participants as either in favor of continuation of the project or against continuing the project (Direction). PAT posits that people will change their opinion as they are exposed to arguments from others. How persuasive the argument is depends on the validity and novelty of the argument (Vinokur and Burnstein, 1978). An argument is considered valid if people perceive it to be correct and accurate. A novel argument is one that people view as new and interesting. As more valid and novel arguments in the direction of the collective position are presented, individuals will change their position toward the collective decision

A valid argument is one that contains facts in support of the collective position or reinforces a previously mentioned argument. According to El-Shinnawy and Vinze (1998) there are four attributes of valid arguments:

Valid Argument Attribute	Definition to be used for coding
Truth	Statement is supported by the parameters defined by the problem.
Fit	Statement fits views previously expressed by the participant or the statement fits the current discussion thread
Follow	Statement follows from accepted facts <i>or</i> follows previously expressed views
Contribute	Statement supports, represents, or uses in some form one of the options for the final decision

A novel argument is one that contains facts in support of the collective position and brings new insights (argument not previously mentioned). Based on t El-Shinnawy and Vinze (1998) coding scheme, there are two attributes of a novel argument:

Novel Argument Attributes	Definitions to be used for coding
New way	Statement indicates a new form of organizing the information
New idea	Statement provides information not previously used to conduct the discussion

In addition to coding arguments in favor of or against continuation, the coders also identified comments that were valid and/ or novel. Comments that did not fit any of these categories were labeled as “other” by the coders.

The coders were blind to the hypotheses. One coder was an upper-level accounting student; the other was a liberal arts graduate student. Both coders understood the project continuation task given to the participants.

4.5.2.3 Inter-rater Reliability

The coders independently coded the data set. To assess the reliability of the coding, an inter-rater reliability test was conducted. Inter-rater reliability is the degree of

agreement between the raters. A number of statistics can be used to assess inter-rater reliability, however, the Cohen's Kappa is the most commonly used statistic. After the coders completed coding all the communication logs a Cohen's Kappa coefficient was determined for each variable of interest. The Kappa for Direction was 0.860 for the 307 items coded. A Kappa coefficient of 0.61 – 0.80 is considered to be substantial agreement (Landis and Koch, 1977). Therefore, the coding for Direction is considered to be reliable. The Kappa coefficient for the Valid was 0.507, a "moderate" agreement level. The Kappa coefficient for Novel was 0.359 which would be considered weak agreement between the coders. A reconciliation was performed on a portion of the coded data (four team's discussion logs) and then the coders independently coded another four teams discussion logs. The Kappa statistics were substantially the same as the first inter-rater reliability comparison. As such, only the variable "Direction" was analyzed further.

4.5.3 Argument Direction

The interesting aspect of the direction of the arguments during the team meetings is that they are an indication of the persuasiveness of the arguments presented during discussion. If more arguments are given in the direction of abandoning the project, then according to PAT, the group decision will move in favor of abandoning the project. However, if the arguments are in favor of continuing, the group will likely continue investment in the project.

It was hypothesized that priming would reduce escalation because teams would 'recall' that sunk costs are irrelevant. The prime should therefore lead to more arguments

against and/or fewer arguments in favor of project continuation. Further, it was hypothesized that teams communicating via CMC would be more likely to introduce arguments against escalation due to lower social presence and introduce even more arguments if they were also primed. In summary, the increase in arguments against and decrease of arguments in favor of escalation will lead to a lower likelihood to continue investment in the failing project. Hypothesis one confirmed that priming is effective in reducing escalation. Hypothesis four confirmed that in CMC teams, the introduction of priming resulted in the lowest likelihood of investing compared to all other conditions (i.e., CMC primed had the lowest mean likelihood to continue investment).

If PAT is the explanation for this behavior, I would expect to see that when lower escalation decisions were made by the team, the number of arguments against are greater than the number of arguments to continue. In other words, the direction of the arguments influences decision outcome. To test this prediction a regression analysis was performed using the following model: $Decision = \beta_0 + \beta_1 Continue - \beta_2 Against + \epsilon$. As expected, the model was significant ($F=29.536$, $p<0.000$, adjusted $R^2 = 0.543$). Both Continue and Against were significant ($p<0.000$) and in the expected direction. Table 8 is summary of the regression results.

TABLE 8

Regression Results for Likelihood to Invest Decision

Variable [^]	Predicted Sign	B Coefficients	t-statistic	p-value#
Intercept		33.698	5.126	0.000
Continue	+	3.528	4.537	0.000
Against	-	-3.431	-5.237	0.000
Adjusted R-Sq		0.543		
[^] Continue = number of arguments in favor of continuing investment in the project Against = number of arguments against continuing investment in the project. #p-Values are two-tailed unless otherwise indicated.				

Once determined that the argument direction is related to the likelihood to invest decision further analysis was performed to determine if the effect was different among the groups. This was tested using an ANOVA with the dependent variable Net Arguments and independent variables Prime and Mode. Net Arguments represents the difference between the number of arguments for and against continuing. If Net Arguments is a negative number that would mean that more arguments against continuing were presented than arguments in favor of continuing. Based on the theories used to develop the hypotheses, it is expected that there will be a significant difference between the groups for both Prime and Mode. The results of the ANOVA are reported in Table 9.

TABLE 9
Net Number of Arguments in Favor of or Against Escalation

Panel A: Descriptive Statistics

		Decision Mode		
		CMC	FTF	Row Means
Prime	Yes	-6.25 (6.14) n = 12	0.00 (5.950) n = 11	-3.26 (6.72) n = 23
	No	-1.62 (7.55) n = 13	2.15 (4.60) n = 13	0.27 (6.42) n = 26
	Column Means	-3.84 (7.16) n = 25	1.17 (5.26) n = 24	-1.39 (6.73) n = 49
<i>CMC</i> =		Computer-Mediated Communication team decision mode		
<i>FTF</i> =		Face-to-Face Team decision mode		
<i>n</i> =		Number of observations. In the Team treatments it is the number of teams, in the individuals it is the number of individuals.		

Panel B: ANOVA Results

Source	Sum of Squares	df	Mean Square	F-statistic	p-value ^a
Corrected Model	468.613	3	156.204	4.123	0.011
Intercept	99.429	1	99.429	2.624	0.112
Prime	140.460	1	140.460	8.075	0.007
Mode	305.969	1	305.969	3.707	0.061
Prime * Mode	18.758	1	18.758	0.495	0.485
Error	1705.019	45	1705.019		
Total	2173.633	49			

^ap-values are two-tailed

The descriptive statistics in Panel A reveal that the CMC teams had a negative net argument mean indicating that the number of arguments against continuing was greater than the number of arguments in favor. CMC primed teams had the highest negative mean followed by CMC not primed, FTF primed, and FTF not primed respectively.

Panel B contains the results of the ANOVA and as expected the model is significant (F=

4.123, $p < 0.011$). Both Prime and Mode are significant with one-tailed p-values for Prime of 0.004 and 0.030, respectively. The interaction of Prime and Mode is not significant.

It appears from the analysis of the team meeting logs that in line with Persuasive Arguments Theory both Prime and Mode affect the number of arguments made for and against continuing the project. It appears, however, that the affect is not additive. The analysis of net arguments would lead to the prediction that the teams with the lowest project continuation likelihood would be CMC primed teams followed by CMC not primed, FTF primed, and then FTF not primed. The hypothesis testing revealed a different order. Table 10 provides a summary of the Decision and Net Arguments by treatment.

Table 10
Net Argument and Decision Means

		Decision Mode	
		CMC	FTF
Prime	Yes	-6.25 15.00%	0.00 25.00%
	No	-1.62 41.54%	2.15 36.54%
<i>CMC</i> =		Computer-Mediated Communication team decision mode	
<i>FTF</i> =		Face-to-Face Team decision mode	

Examining Table 10 reveals that CMC not primed teams had the second lowest net arguments but the highest escalation.

4.6 Choice Shift

4.6.1 Introduction

To shed some further light on the decision-making process a post hoc analysis of choice shift was completed. PAT research has shown that shifts in group decisions (polarizing or de-polarizing) can be manipulated by the preponderance of pro and con arguments (Isenberg, 1986). It is expected that the introduction of the prime will influence a depolarization in the escalation decision. The preceding analysis confirmed that priming and mode influenced the preponderance of arguments against escalation; however, the final decisions made by the teams did not fully reflect the de-polarization anticipated. The following analysis examines the shift in decision prior to team discussion to the final team decision,

4.6.2 Analysis

The choice-shift was determined by the difference between the average of the team members' decision prior to team discussion and the team consensus decision. A positive shift indicates that the team moved in favor of continuing the project. A negative shift indicates that the team moved toward the decision against continuing the project. Table 11 contains the descriptive statistics for the choice-shift.

Table 11

**Choice-Shift Descriptive Statistics
Mean (Std. Deviation)**

		Decision Mode	
		CMC	FTF
Prime	Yes	-16.18 (28.16) n=12	-11.67 (21.30) n=11
	No	9.74 (29.88) n=13	3.96 (23.55) n=12
<i>CMC</i> =		Computer-Mediated Communication team decision mode	
<i>FTF</i> =		Face-to-Face Team decision mode	
<i>n</i> =		Number of teams	

In line with the Decision results, the choice shift means confirm that CMC primed had the largest shift away from escalation followed by FTF primed, FTF not primed, and CMC not primed, respectively. Table 12 contains the results of the ANOVA used to identify if the differences between the groups is significant.

Table 12

Choice-Shift

ANOVA Results

Source	Sum of Squares	df	Mean Square	F-statistic	p-value ^a
Corrected Model	5743.994	3	1914.665	2.842	0.048
Intercept	624.277	1	624.277	0.927	0.341
Prime	5386.161	1	5386.161	7.996	0.007
Mode	5.043	1	5.043	0.007	0.931
Prime * Mode	330.944	1	330.944	0.491	0.487
Error	30987.444	46	673.640		
Total	36731.438	49			

^ap-values are two-tailed

The overall model is significant ($F=2.842$, $p<0.048$) as is the variable Prime ($F=7.996$, $p<0.007$). Mode and the interaction of Prime and Mode are not significant.

5.0 CONCLUSION

5.1 Summary

This chapter includes discussion of the results of the main study as well as the supplemental analyses. Discussion of the implications of the findings, contributions, and limitations of the study follow. The chapter concludes with a discussion of future research.

5.1.1 Main Study

This study was designed to examine the extent to which escalation of commitment in capital investment decisions can be mitigated using a cognitive prime. The study evaluates capital investment decisions in three decision-making settings: (1) individual, (2) face-to-face team, (3) computer-mediated team. Participants in the cognitive prime treatment are asked to think about sunk costs prior to making a final investment continuation decision. The expectation is that priming the subjects to think about sunk costs would increase the accessibility of sunk cost knowledge. The increased accessibility to the knowledge of how to treat sunk costs should in turn reduce the likelihood of investing in the failing project. In other words, decision-makers primed to consider sunk costs will remember that such costs are irrelevant to the decision and will not fall prey to the sunk cost fallacy that drives escalation behavior. Based on Persuasive Arguments Theory, it is also expected that primed teams communicating in the computer-

mediated setting will display the lowest escalation behavior. The lower social presence of the CMC environment coupled with parallel communication capabilities will enable more arguments against escalation. Increased arguments against escalation will serve as a ‘depolarizing’ influence leading to less likelihood to continue investment in the failing project.

Table 13 contains a summary of the results from the main study. The first research question in this study is whether a cognitive prime will reduce escalation in individuals. The results support the hypotheses (H1). Priming improved decision-making in the individual setting. The mean likelihood to continue investment for primed individuals was 22.17 percent compared to 38.70 percent for individuals who were not primed (H1).

Hypothesis two addressed the second research question of whether unprimed teams would escalate more than unprimed individuals. The test of this hypothesis revealed little difference between the teams and individuals. Teams had a mean likelihood to continue investing of 39.0 percent and individuals mean likelihood to continue investment was 38.7 percent ($p < 0.969$, $\eta^2 = 0.000$).

The third hypothesis examined the decisions of FTF and CMC teams that were not primed to consider sunk cost. Although FTF teams did have a lower likelihood to continue investment than CMC teams (36.54% vs. 41.54%), the difference was not statistically significant. This result is likely due to a power issue due to the small sample size ($n=13$ in each treatment, $\eta^2 = 0.006$).

The last hypothesis addresses the final research question. Will priming and team decision-setting interact such that escalation is lowest for CMC primed teams? Couched

in Persuasive Arguments Theory and prior CMC research, it was posited that priming would have the greatest effect on CMC teams compared to primed FTF teams and teams not primed. The results support the prediction that CMC primed would have the lowest likelihood to continue investment. CMC primed were the least likely to invest than all other conditions. Compared to CMC not primed teams the difference was statistically significant ($p < 0.032$, one-tailed). CMC primed teams who were primed also performed better than FTF not primed teams ($p < 0.037$, one-tailed). The CMC primed teams had a lower likelihood to invest than FTF teams who were primed (15.00% compared to 25.00%), this difference was not statistically significant, however.

Table 13

Summary of Results

Hypothesis	Prediction	Result	p value	Table Reference
H1	Primed Individuals will have lower escalation than not primed individuals.	Supported	$p < 0.042$	Table 3
H2	Individuals will have lower escalation than Teams	Not supported	$p < 0.917$	Table 4
H3	Absent priming, FTF teams will have lower escalation than CMC teams.	Not supported	$p < 0.706$	Table 5
H4	The effect of priming will be strongest for CMC compared to FTF primed and not primed teams	Partially supported	CMC/P – FTF/P, $p < 0.381$ CMC/P -CMC/NP, $p < 0.031$ CMC/P – FTF/NP, $p < 0.037$	Table 6 & Table 7

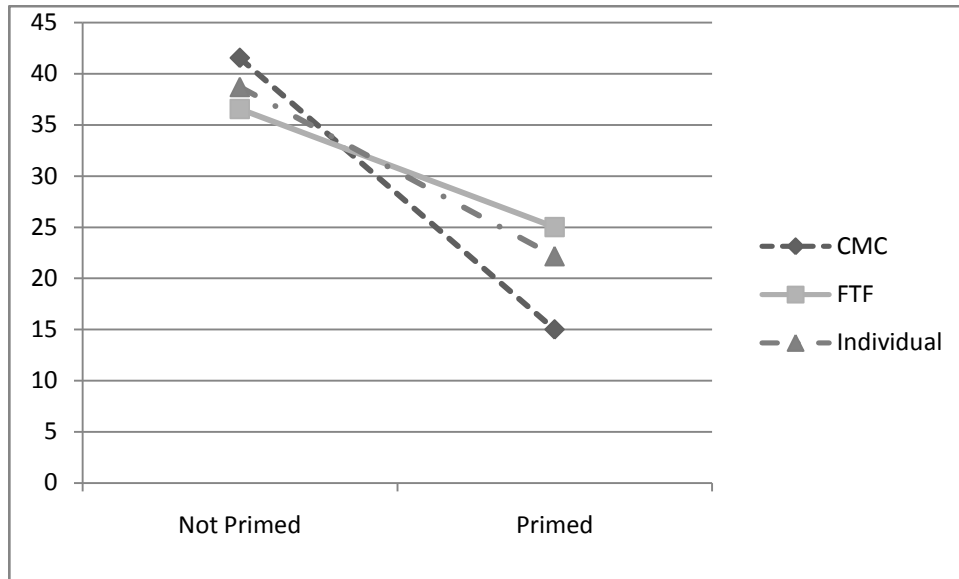
Figure 8 is an illustration of the results. Taken together it is clear that priming improves both individual and team performance. While CMC primed teams performed the best of all the treatments (i.e., exhibited the lowest escalation), CMC not primed teams performed the worst of all treatment groups. Potential explanations for the

difference in performance across priming and decision settings are discussed further in the additional analyses discussion below.

FIGURE 8

DECISION

Mean Likelihood to Continue



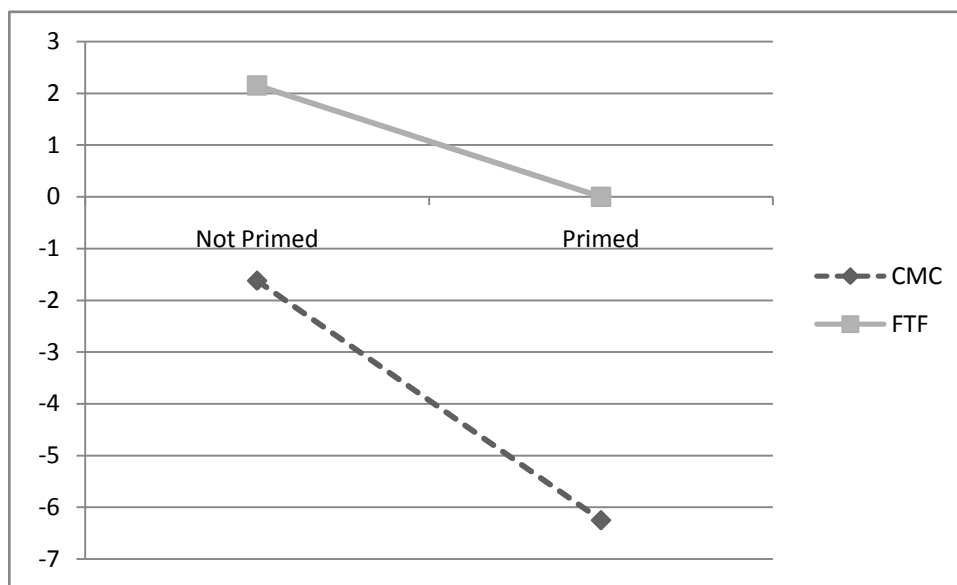
5.1.2 Additional Analyses

5.1.2.1 Team discussion logs

Persuasive Arguments Theory posits that team discussion can lead to more arguments being presented in the direction of the collective average of the team members' beliefs. As team members contribute arguments in favor of the group position, the strength of the initial group decision tends to increase. This tendency is particularly troubling in an escalation context as the average team member belief going into the discussion will be leaning toward escalation. An analysis of the team discussion logs was

conducted to assess the number of arguments in favor of and against continued investment in each of the treatment groups. I computed a measure of “net arguments” comprising the number of arguments against escalation subtracted from the number of arguments in favor of escalation. If the resulting net argument number is negative that would indicate that there were more arguments against continuing than in favor of continuing. Figure 9 below depicts the mean number of net arguments by prime and mode.

FIGURE 9
Net Arguments (Continue – Against)



The analysis revealed the CMC primed teams had a negative mean net arguments indicating that arguments against continuing outnumbered arguments to continue investment (primed, -6.25, not primed -1.62). FTF primed teams had a mean of zero net arguments and not primed FTF teams had the highest net arguments in favor of continuing (2.15). The difference between the mean net arguments of the treatment

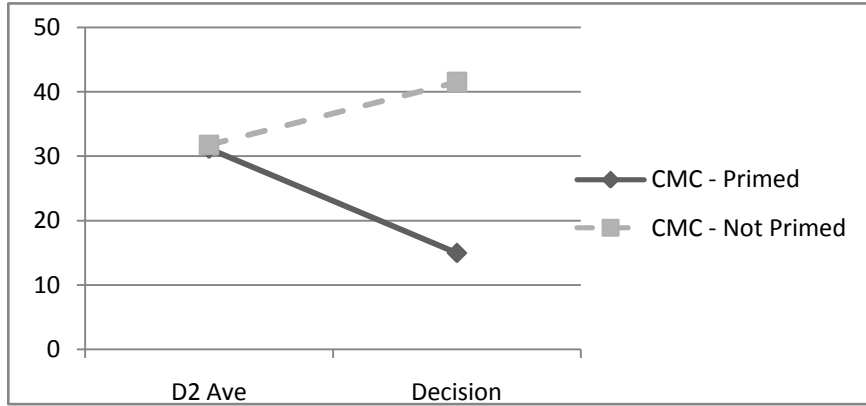
groups is significant (Model, $p < .011$, Prime, $p < .004$ one-tailed, Mode, $p < .031$ one-tailed).

5.1.2.2 Choice-Shift

The question as to whether the arguments for and against continuing caused a shift in the group decision was addressed next. Again, Persuasive Arguments Theory posits that the preponderance of arguments in one direction will cause a shift in the group decision in that direction. In the not primed setting it is expected that there would be more arguments in favor of continuing which in turn would increase escalation. In the primed setting it was expected that the prime would induce more arguments against continued investment. Further, in the CMC setting it was predicted that the effect of PAT would be stronger. In other words, CMC primed teams would have the largest shift away from escalation as the prime would have a depolarizing effect. The CMC not primed teams were expected to have the greatest shift towards escalation. The FTF teams were expected to have the same directional effect, but not as strong as the CMC teams. In other words, FTF primed will shift away from escalation and FTF not primed will shift toward escalation. Figures 10 and 11 below illustrate the shift from the collective average team members' decision prior to team discussion and the final group consensus decision for the CMC teams and for the FTF teams.

FIGURE 10

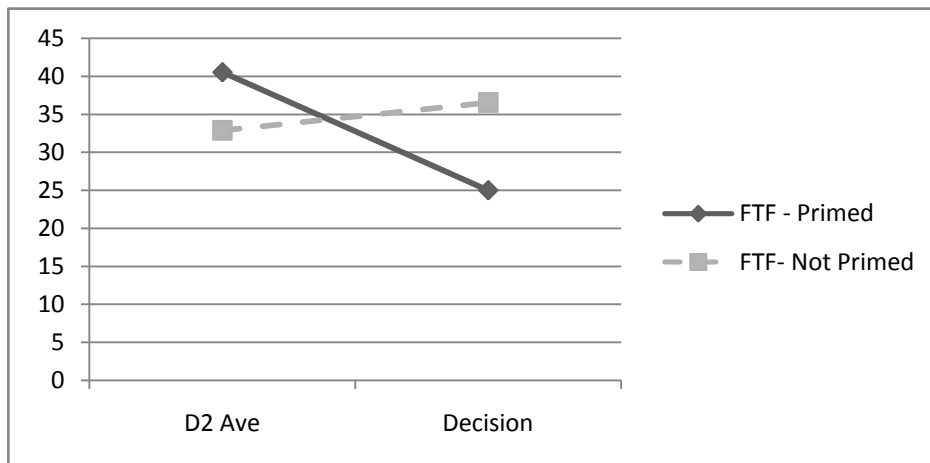
Choice Shift - CMC



D2 Ave = collective team members' decision prior to team meeting
Decision = group consensus decision after meeting.

FIGURE 11

Choice Shift - FTF



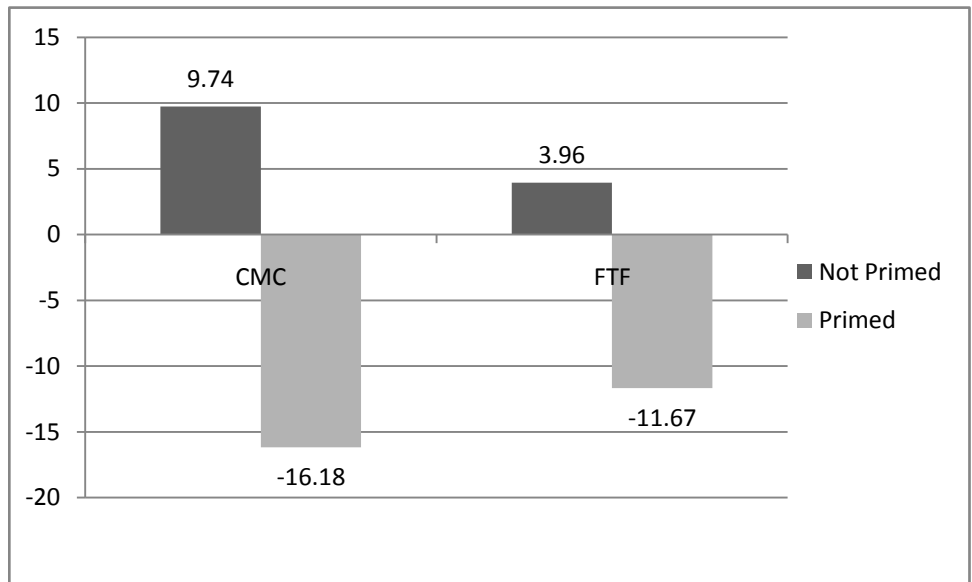
D2 Ave = Collective team members' decision prior to team meeting.
Decision = group consensus decision after meeting.

The D2 Ave was not statistically different for any of the team treatments. The difference between the final decision in the primed and the not primed conditions was statistically significant ($p < .769$).

Figure 12 is the comparison of the choice-shift between CMC and FTF teams.

FIGURE 12

Choice Shift *



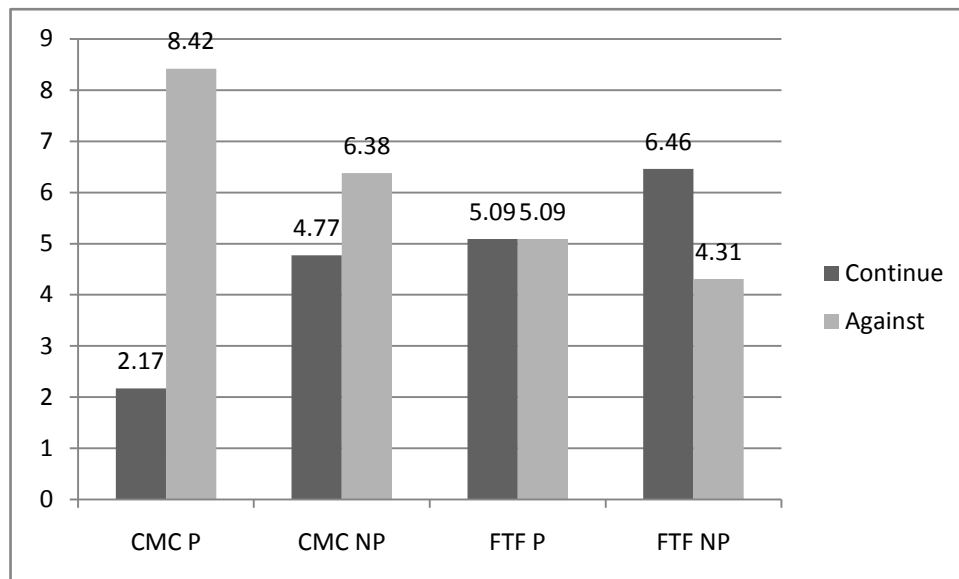
*(Collective average of team members' decision prior to meeting less the final group decision)

Consistent with expectations, Figure 12 shows that CMC primed had the largest shift away from escalation, but was this due to the 'preponderance of arguments' against continuing investment? The analysis of Net Arguments in Table 9 provides some insight. CMC primed teams had the highest negative Net Arguments mean (-6.25). In other words, on average, CMC primed teams had more arguments against continuing the

project than arguments to continue with the project. Examining the arguments separately provides additional clues to the dynamics of the team discussions. Figure 13 below charts the mean number of arguments for continuation of the project and the mean number of arguments against continuation. Not only did CMC primed teams have the highest number of arguments against continuation, they also had the lowest amount of arguments in favor of continuing.

FIGURE 13

Comparison of the Mean Number of Continue and Against Arguments



CMC P = computer-mediated-communication, primed
 CMC NP = computer-mediated-communication, not primed
 FTF P = face-to-face communication, primed
 FTF NP = face-to-face, not primed

As discussed in the development of hypothesis four, CMC was predicted to have more arguments in the direction of the collective group decision. Since the initial collective group decision was expected to be in the direction of escalation, CMC teams were predicted to have the highest amount of escalation, absent priming. Once priming is

introduced it is expected that CMC teams will outperform all other groups. Priming will increase the likelihood of at least one member discussing the prime, which will be even more likely to occur for CMC teams because of the parallel communication ability afforded by the CMC technology. In other words, CMC primed teams will be more likely to raise arguments against continued investment and have more opportunity to do so, which would lead to the CMC primed group having the lowest escalation. Lower escalation by CMC primed teams would be consistent with the theoretical prediction that the lower social presence of CMC combined with priming would generate more arguments against escalation. As can be seen in Figure 13, CMC primed teams had the highest number of arguments against continued investment and the least amount of arguments in favor of project continuation. Based on this analysis, it would seem that CMC primed teams should have the lowest escalation, followed by CMC not primed, FTF primed and then FTF not primed. CMC primed did have the lowest likelihood to continue investment (15.00%) but they were followed by FTF primed, FTF not primed, and then CMC not primed. The question remains as to why CMC teams who were not primed performed the worst but had more arguments against investment than FTF primed and FTF not primed teams. A possible explanation for this behavior could be due to the strength of the individual arguments or perhaps the order in which the arguments were presented. Both of these explanations are explored further in the future research section.

5.2 Implications

There are several implications of the research findings. First, it is clear that priming always improves decision-making. Priming can be a low-cost way to alleviate

the high cost of continued investment in failing projects. A prime can be introduced in a number of ways. In this experiment it was simply part of the instructions prior to making the decision. In a real world setting this can be introduced via a decision aid or instruction. If teams are meeting via computer-mediated communication, a prompt can be given to the meeting participants to be sure they have accessed their knowledge of the proper treatment of sunk costs. If teams are meeting face-to-face, firms can use a paper-based decision aid that requires participants to list the sunk costs prior to team discussion.

The second implication relates specifically to the communication mode employed for team meetings. Sometimes it may be more cost effective for teams to meet virtually. If teams meet virtually firms should be aware that escalation is even more likely. A prime should always be used in CMC meetings and firms should use caution in CMC decision making if a prime cannot be provided.

5.3 Contributions

This study contributes to the literature in several ways. Escalation research is extended by examining priming as a way to mitigate escalation. The result of the study confirmed that priming is an effective way to reduce escalation in both individual and team decision-making. Further, the differential effect of priming in decision-making settings extends the current research comparing FTF and CMC team performance using an intellectual task.

The analysis of the team meeting discussions provides much insight into the “black box” of decision-making. The evaluation of the team discussions extends both PAT research and team communication research. Specifically, it extends the team

communication research comparing CMC and FTF teams by illustrating the differential effect of arguments in those modes. Future research can build on these findings.

5.4 Limitations

As with all experiments, this study is subject to certain limitations. Although the use of a controlled laboratory experiment strengthened internal validity, the limitation is that some external validity is sacrificed. The decision scenario was shorter and more limited in scope than a real-world project continuation decision is likely to be. In addition, it was essentially a one shot decision. There were no real consequences to the participants for a ‘wrong’ decision as there might be in an actual project continuation decision.

The teams were ad hoc in this experiment, in that participants had no prior experience working with each other, which may or may not be the case in an actual project team. As such, it is an open question whether the results would hold if team members have a shared history of working together in prior project evaluation scenarios.

The lack of inter-rater reliability on two of the variables is a limitation of the study. The coding for valid and novel arguments is potentially an important aspect of explaining the team behavior. As discussed in the next section, this provides a future research opportunity.

Finally, the cell sizes for the team treatments are small. The lack of power in the team setting is a potential explanation for the lack of support for some of the hypotheses.

5.5 Future Research

The results of this study provide several opportunities for future research using the current data set. The surprising result of the CMC not primed teams exhibiting escalation behavior raises the question as to why they would escalate even though they had more arguments against continuation. Similarly, why did the FTF teams perform better than the CMC not primed teams? The FTF teams had an equal number of arguments for and against in the primed condition and more arguments for continuation in the not primed condition than the CMC not primed teams. A possible explanation is that some of the arguments presented may not be perceived as strong as others. It is also possible that the order in which the arguments are presented may make a difference, creating a recency bias in the final decision. Both of these questions can be answered in future research using the current data set. An analysis of the order in which arguments for and against are presented and the final decision outcome is one avenue for future research.

The strength of the arguments presented can be determined by the number of valid and novel arguments presented. Recall that the valid and novel argument data coding was not used in the current analysis due to poor inter-rater reliability. This was likely a combination of inexperienced coders and inadequate training. I plan to have the data recoded to allow for analysis of the valid and novel arguments. This analysis may help explain the strength of the arguments presented. If arguments are seen as valid and/or novel, PAT posits that they will influence the group decision to a greater degree. It is possible that even though the CMC not primed teams had more arguments against than

the FTF primed and not primed, those arguments may not have been as valid or novel as those presented in the FTF team meetings.

Finally, it is possible that a dominant group member could have influenced the team outcome. The current data can be used to assess if one member contributed more frequently than other group members and if that dominant member's opinion was reflected in the group decision.

Future experimental studies can address the limitations in this study and expand on the findings. For example, students were used as subjects in this experiment and although they had the appropriate task knowledge, prior research has shown that managers tend to escalate more than students (Chang and Ho, 2004). The prime was effective with students but will it be strong enough to mitigate the escalation tendencies of managers? Future studies using managers as participants can help to answer this question.

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APPENDICES

Appendix A: Experimental Materials

Appendix A-1: CMC Treatments

Each Participant is given a color coded folder with the experimental materials. The following is an example:

INSTRUCTIONS: YELLOW TEAM H2

1. Open a web browser on the laptop and type in the following web address:

<http://tinyurl.com/2osuha>

2. Press Enter
3. Follow the instructions given in the online survey.
4. Do NOT turn this page until you finish the online survey.

Team Discussion Instructions:

1. Now that you have finished the online survey, you will join an online discussion with your team about the project.
2. On the computer, open Windows Live Messenger.
3. There is an instruction sheet following this page that gives you a log on ID (Email address) and your password.
4. After all your team members have signed in, the research administrator will send a welcome message and indicate you may begin group discussion.

(The research administrator posts this message once all team members have signed in to Messenger:

“Welcome Team!! Now you may begin discussion. Continue discussion until your team is given further instructions.”)

5. Do not use your real name in the discussions. Each member has been given a participant number by which they will identify themselves
6. As a group, list the sunk costs (if any) for the project. (For the no-prime condition, this statement is excluded.)
7. Discuss, as a group, if the project should be continued.
8. Continue discussion until given further instructions by the research administrator.

** Teams discuss the project for 15 minutes (this is based on pilot study data indicating that 15 minutes was about how long teams discussed the case).

At the end of 15 minutes, the research administrator sends the following message to the team and hands an answer sheet to one team member for each team:

“One team member has been handed a team answer sheet. Please discuss this question and come to a team decision. When you have finished, please have the team member with the answer sheet bring it to the research administrator. At that time each team member will be handed a paper with further instructions”

The team answer sheet has this question:

1. What is the team's decision about the likelihood that they would invest in the new product? 0 % = Definitely would NOT, 100% = Definitely Would

Definitely
Would NOT

Definitely
Would

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Participants are given this sheet after the team has handed in the team answer sheet.

FINAL INSTRUCTIONS:

9. Sign-off Windows Live Messenger
10. Maximize the survey screen
11. Open a new web browser and enter the following URL:
<http://tinyurl.com/2fmkrp>
12. Complete the online survey.

Appendix A-2: FTF Treatments

INSTRUCTIONS : PURPLE TEAM G2:

1. Open a web browser on the laptop and type in the following web address:

<http://tinyurl.com/35bl7x>

2. Press Enter
3. Follow the instructions given in the online survey.
4. Do NOT turn this page until you finish the online survey.

Team Discussion Instructions:

1. Do not use your real name in the discussions. Each member has been given a participant number by which they will identify themselves.
2. Before beginning group discussion about the case, please introduce yourself as your participant number into the voice recorder. For example,

“Hello, I am Participant Number one”

Be sure EACH member does this.

3. Your team’s objectives:
 - a. List the sunk cost amount (if any) from the product information given. List them below: (In the no-prime treatment, this objective is not listed)
 - b. Discuss the case. A copy of the case is in this folder.
 - c. Use the paper provided if you would like to write down any discussion points.
 - d. The Research Administrator will indicate when your discussion should end and give you the next set of team instructions.
4. Complete the instructions and return the team folder to the Research Administrator and receive your final instruction.

**Teams discuss the case for 10 minutes (this is based on pilot study data indicating that FTF teams discussed the case for approximately 10 minutes).

The research administrator brings each team a team answer sheet and instructs them to discuss the question as a group and decide on a team answer. They are instructed to bring the team folder to the research administrator after they finish discussion and have answered the question.

The team answer sheet has this question:

What is the team's decision about the likelihood that they would invest in the new product? 0% = Definitely would NOT, 100% = Definitely Would

Definitely
Would NOT

Definitely
Would

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Appendix A-3: Exit Questionnaire

1. Please enter your Participant number. You will find this written on the outside of your folder. _____.

Please read the following questions and circle your response.

2. What was your team's decision about the likelihood that they would invest in the new product? 0% = Definitely would NOT, 100% = Definitely Would

Definitely
Would NOT

Definitely
Would

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

3. My team is committed to this new product. 1 = Strongly Agree, 7 = Strongly Disagree

Strongly
Agree

Strongly
Disagree

1	2	3	4	5	6	7
---	---	---	---	---	---	---

4. I am committed to this new product. 1 = Strongly Agree, 7 = Strongly Disagree

Strongly
Agree

Strongly
Disagree

1	2	3	4	5	6	7
---	---	---	---	---	---	---

5. I would feel guilty if I stopped funding this new product. 1 = Strongly Agree, 7 = Strongly Disagree

Strongly
Agree

Strongly
Disagree

1	2	3	4	5	6	7
---	---	---	---	---	---	---

6. I believe that this new product will be a success. 1 = Strongly Agree, 7 = Strongly Disagree

1	2	3	4	5	6	7
---	---	---	---	---	---	---

7. I feel a sense of loyalty to this new product. 1 = Strongly Agree, 7 = Strongly Disagree

1	2	3	4	5	6	7
---	---	---	---	---	---	---

8. I believe that this new product will contribute negatively to my annual performance rating. 1 = Strongly Agree, 7 = Strongly Disagree

1	2	3	4	5	6	7
---	---	---	---	---	---	---

9. My team worked well together. 1 = Strongly Agree, 7 = Strongly Disagree

1	2	3	4	5	6	7
---	---	---	---	---	---	---

10. I was EXPLICITLY asked in the instructions to list sunk costs.

YES	NO
-----	----

11. In the experimental scenario, I was personally responsible for the design of the new product

YES	NO
-----	----

Think about the computer mediated communication used to meet with your team during the experiment and answer the following questions. (Note – questions 12 – 16 were only completed by the CMC treatments)

12. One does not get a good enough idea how people at the other end are reacting. 1 = Strongly Agree, 7 = Strongly Disagree*

Strongly
Agree

Strongly
Disagree

--	--	--	--	--	--	--

13. One gets no real impression of personal contact with the people in the group 1 = Strongly Agree, 7 = Strongly Disagree*

Strongly
Agree

Strongly
Disagree

--	--	--	--	--	--	--

14. One can easily assess the other people's reactions to what has been said. 1 = Strongly Agree, 7 = Strongly Disagree

Strongly
Agree

Strongly
Disagree

--	--	--	--	--	--	--

15. People in the online group did not seem 'real'. 1 = Strongly Agree, 7 = Strongly Disagree

Strongly
Agree

Strongly
Disagree

--	--	--	--	--	--	--

16. I couldn't get to know people very well if I only met them over this system. 1 = Strongly Agree, 7 = Strongly Disagree

Strongly
Agree

Strongly
Disagree

--	--	--	--	--	--	--

17. The following pairs of words describe how you could have perceived the communication environment of your team discussion. Please check the number that corresponds to your impression*

Impersonal (1)----- Personal (7)
Cold (1)----- Warm (7)
Insensitive (1)----- Sensitive (7)
Unsociable (1)----- Sociable (7)
Negative (1)----- Positive (7)

18. Briefly describe what you think the purpose of this research study is

Thank you for participating in this experiment!!

IT IS VERY IMPORTANT THAT YOU DO NOT DISCUSS DETAILS OF THIS EXPERIMENT WITH ANY OTHER STUDENTS AT USF.

Appendix B: Analysis of Meeting Logs

All meeting computer logs and audio recordings will be analyzed by two independent coders. Neither of the coders will be familiar with the hypotheses in the study. The coders will be trained to identify instances of valid arguments and novel arguments.

A valid argument is one that contains facts in support of the collective position or reinforces a previously mentioned argument. According to El-Shinnaway and Vince (1998) there are four argument attributes for valid arguments:

Valid Argument Attribute	Definition to be used for coding
Truth	Statement is supported by the parameters defined by the problem.
Fit	Statement fits views previously expressed by the participant or the statement fits the current discussion thread
Follow	Statement follows from accepted facts <i>or</i> follows previously expressed views
Contribute	Statement supports, represents, or uses in some form one of the options for the final decision

A novel argument is one that contains facts in support of the collective position and brings new insights (argument not previously mentioned). Based on the El-Shinnaway and Vince (1998) coding scheme, there are two attributes of a novel argument:

Novel Argument Attributes	Definitions to be used for coding
New way	Statement indicates a new form of organizing the information
New idea	Statement provides information not previously used to conduct the discussion

Appendix C: Pilot Study

C.1 Background

Sixty-six undergraduate students participated in a pilot study. All students were enrolled in a Principles of Managerial Accounting course and received course credit for participation. The decision to use undergraduate students as participants was made for two reasons. First, students in this course would have completed one accounting course and will have been exposed to the concept of sunk costs. Second, the primary goal of the pilot study was to test the experimental materials. As such, it is important that the materials induce escalation prior to introducing the treatments to mitigate escalation. Undergraduate students tend to escalate less than graduate students and professionals; therefore, escalation found in undergraduate students should be even stronger with the subjects of interest for the main study (Chang and Ho, 2004).

C.2 Pilot Study Design

The pilot study was a 2 x 2 design. Only CMC and FTF teams were examined. In the final study individual decision making is also examined, resulting in a 3 x 2 design with decision setting manipulated at three levels (individual, CMC team, FTF team) and priming at two levels (primed and non-primed). Figure 14 summarizes the hypotheses tested in the pilot study.

FIGURE 14: Tests of Pilot Study Hypotheses 1 - 3:

Decision-making setting		
Knowledge Accessibility	CMC	FTF
Prime	A	B
No Prime	C	D

Decision-making setting:

H1a: Teams using computer-mediated communication (CMC) will be less likely to invest less in failing projects than teams meeting face-to-face (FTF). Team likelihood $C < D$

H1b: Teams using computer-mediated communication (CMC) will invest smaller amounts in failing projects than teams meeting face-to-face (FTF). Team dollars invested $C < D$

Priming:

H2a: Teams primed to consider sunk costs will have a lower likelihood of investing in failing projects than not primed. Team likelihood $B < D$

H2b: Teams primed to consider sunk costs will invest smaller amounts in failing projects than not primed. Team dollars invested $B < D$

Mode * Priming:

H3a: High construct accessibility CMC teams will be less likely to invest less in failing projects than all other teams. $A < B, C, D$

H3b: High construct accessibility CMC teams will invest less in failing projects than all other teams. $A < B, C, D$

C.3 Descriptive Statistics

The average number of accounting, finance, and economics course taken were 1.03, .24, and 1.23, respectively. The participants had an average of 4.9 years work experience. Fifty-two percent of the participants were female.

C.4 Statistical Tests

A 2 x 2 between-groups multivariate analysis of covariance was conducted to assess the effectiveness of decision-making setting and priming on group escalation decisions. Tabachnick and Fidell (2001) recommend that MANOVA works best with highly negatively correlated dependent variables and acceptably well with moderately correlated dependent variables in either direction. In addition, the use of MANOVA addresses concerns about an increase in Type I errors that results from using multiple univariate ANOVA analyses. Three dependent variables were used: team likelihood of investing, team dollar amount invested, and the choice shift from individual pre-group decision to the group consensus decision. The independent variables were decision-making setting (face-to-face or computer mediated) and priming (primed or no prime). The dependent variables were tested for correlation using a Pearson Correlation. The results indicate that the dependent variables are significantly correlated. Pearson correlations indicate that Team Likelihood is moderately correlated with Team Dollars and highly negatively correlated with Choice Shift. Team Dollars is also negatively correlated with Choice Shift.

Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and

multicollinearity. The assumptions of normality and homogeneity of variance-covariance matrices were not met. MANOVA is robust to violations of these assumptions if the sample size is large enough in each cell and if cell sizes are approximately equal.

Although the sample size in three of the cells is over 30, the cell sizes are unequal; therefore the results should be interpreted with caution. The data met the assumptions for linearity; there were no influential outliers.

The Wilks' Lambda test for each independent variable is significant. The covariate ECON is marginally significant ($p = .071$) and the covariate FINANCE is significant ($p = .016$). The omnibus MANCOVA test of between-subjects effects indicates a significant model for each dependent variable. The independent variable PRIME is significant for each dependent variable and the interaction of PRIME and MODE is significant for the dependent variable TEAM DOLLARS (Table 5). The number of economics classes (ECON) was found to be a significant covariate for the Team Likelihood dependent variable and the number of finance classes taken was significant for Choice Shift. Following a significant MANCOVA test, ANCOVAs are recommended for interpreting group differences (Bray and Maxwell, 1982). The results are discussed next.

C.5 Team Likelihood

A 2 x 2 between-groups analysis of covariance was used to determine the effect of decision-making setting and priming on team decision of likelihood of investing. Likelihood of investing was assessed on an 11 point scale with 0 as "definitely would not" and 11 as "definitely would." Primed groups had a lower mean escalation than the non-primed groups (3.33 vs. 5.63). The group with the lowest likelihood of investing

was the FTF primed (mean = 2.55), followed by the CMC primed, CMC no prime and FTF no prime respectively (4.20, 5.60, 5.67). The ANCOVA model is significant ($p = .018$) and the effect of priming is also significant ($p = .009$). Neither the mode nor the interaction of prime and mode are significant.

H1a posited that CMC teams would be less likely to invest in the failing project than FTF teams. Since mode is not significant in the model, H1a is not supported.

Hypothesis 2a predicted that teams primed to think about sunk costs would be less likely to invest in failing projects. A comparison of the mean likelihood of investing by FTF teams and CMC teams indicated a significant difference with the primed teams investing less ($p < .050$).⁹ H2a is supported

C.6 Team Amount Invested

Participants were also asked to choose an amount they would be willing to invest in the project. There were five choices ranging from \$0 to \$4 million in \$1 million dollar increments. For example, if a team chose the option of \$1 million - \$1,999,999 that was coded as a 3. The group investing the lowest amount in continuation of the project is the FTF- primed group (mean = 1.86), followed by CMC-no-prime, CMC-primed and FTF no-prime, respectively. On average, the FTF-primed group chose to invest between \$0 and \$999 thousand.

The ANCOVA results indicate a significant model ($p = .001$) and a significant interaction between prime and mode ($p = .000$). A pairwise comparison of the four

⁹ t-test for equality of means. Equal variances were not assumed. p-value is two-tailed.

treatments is presented in Table 8. The difference between FTF no-prime to CMC no-prime is positive and significant ($p = .006$) indicating that in a situation where a prime is not introduced, computer mediated communications would result in a significantly lower dollar investment for continuation of the project. There is a significant difference between the amount invested by FTF primed and FTF not primed groups with the primed group investing less ($p=.001$). Therefore, H2b is supported.

C.7 Interaction of Prime and Mode

The interaction of prime and mode is hypothesized in H3a and H3b. These hypotheses posit that CMC teams in the primed treatment will have lower escalation behavior than all other team combinations. Although a significant interaction is found the group with the lowest escalation is FTF primed and not CMC primed. In the team likelihood decision model, the interaction of mode and prime is not significant. Therefore, H3a and H3b are not supported.

C.8 Choice Shift

The final dependent variable of interest in the study is the difference between what the individual decided prior to the group meeting and the group consensus decision. This dependent variable is calculated as the difference between the team likelihood decision and the likelihood decision made by the participant prior to the group meeting. A positive difference indicates that the individual's prior likelihood decision was lower than the group decision. A negative difference indicates that the individual's prior likelihood decision was higher than the group decision. On average, the individuals in the no prime

groups tended to increase their likelihood of investing as a group. The primed groups' likelihood decision shifted away from escalation. The treatment with the largest shift toward increasing escalation is the FTF no prime groups (mean = 3.44) followed by CMC no prime (mean= 1.60). The primed treatments shifted toward lower escalation. Face-to-face primed decreased likelihood the most (mean = -1.82) followed by CMC primed (mean = -.70). The ANCOVA model for Choice Shift is significant ($p = .003$) (Table 9). Prime is significant in the model ($p=.001$) as is the covariate Finance. Mode and the interaction of Prime and Mode are not significant. H4 posits that teams will exhibit a significant shift from the team member's initial individual decision and the team consensus decision. The significant ANCOVA model for choice shift provides support for H4.

Hypothesis 5 predicts that CMC teams will exhibit less of a shift toward escalation than all other teams. The variable mode is not significant in the choice shift model, therefore H5 is not supported.

C.9 Additional Tests

The dependent variables measured in the preceding analyses represent each participant's response to the questions regarding the Team Likelihood of investing and the Team Dollar Amount Invested.¹⁰ A potential concern is the violation of independent observations since the participant first decides individually and then makes the same decision as a team. Stevens (1996) recommends setting a higher alpha value if you

¹⁰ This method is similar to that used by Schmidt et al (2001).

suspect that this assumption has been violated. Using an alpha of .01, the model for Team Likelihood becomes marginally significant ($p = .018$), but the models for Team Dollars and Choice Shift remain significant.

ABOUT THE AUTHOR

Dr. Ann Dzurainin was born in Newark, New Jersey and has lived in New Jersey, Ohio, California, and Florida. She and her husband David Dzurainin have two children, Gregory and Jennifer.

Dr. Dzurainin earned her Bachelor of Science degree from Fairleigh Dickinson University and her Masters of Business Administration from New York University. She received her Doctor of Philosophy degree from the University of South Florida in 2009.

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