This is to certify that the

dissertation entitled

DECISION MAKING IN INDIVIDUAL AND TEAM CONTEXTS:
MODERATORS OF THE EFFECTS
OF COGNITIVE FRAMES ON RISK TAKING

presented by

DEBRA ANN MAJOR

has been accepted towards fulfillment
of the requirements for

Ph.D degree in Psychology

Major professors

Date 11/10/92

DECISION MAKING IN INDIVIDUAL AND TEAM CONTEXTS: MODERATORS OF THE EFFECTS OF COGNITIVE FRAMES ON RISK TAKING

By

Debra Ann Major

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Psychology

1992

ABSTRACT

DECISION MAKING IN INDIVIDUAL AND TEAM CONTEXTS:
MODERATORS OF THE EFFECTS OF COGNITIVE FRAMES ON RISK TAKING

By

Debra Ann Major

An individual model of risky decision making was developed to further understand the effects of cognitive decision frames on risk taking and the boundaries of such framing effects. The model took issue with previous research that has shown that individuals presented with a decision framed as a loss tend to be more risk seeking than when the same decision is framed as a gain. It was argued that the differential risk seeking exhibited under gain and loss frames is a phenomenon limited to the hypothetical, lottery-type, decision tasks commonly employed in research on the effects of cognitive frames. Perceived control was hypothesized as a key moderator of the relationship between cognitive decision frames and decision riskiness. Individuals with lower perceived control were expected to make more risk averse decisions under gain frames and more risk seeking decisions under loss frames. Individuals with higher perceived control were predicted to make riskier decisions regardless of decision frame.

The individual model of risky decision making was used as a basis for the development of a model of risky decision making in a team context. The team context model focused specifically on hierarchical teams with distributed expertise and the effects of cognitive frames on risky decision making in that context. Perceived control was again hypothesized as a critical boundary condition. In addition, the team context model described the potential moderating effects of need for affiliation and team cohesiveness on the relationship between cognitive frames and decision riskiness.

To test the hypotheses derived from the two models, individuals ($\underline{n}$ = 70) and four-person teams ($\underline{n}$ = 41 teams) participated in a computerized decision making simulation called TIDE^2. Individuals and teams were assigned to either a loss or a gain condition. Perceived control was operationalized as the perceived control over the probability of making a correct decision. An attempt was made to create variance in perceived control by manipulating the ambiguity of information upon which decisions were based.

Results showed predicted main effects for framing in both the individual and team decision making contexts. At the individual level, results supported the hypothesized moderating effect for perceived control. In the team context, perceived control had a main effect on decision riskiness, but was not a significant moderator. Team cohesiveness, however, was a significant moderator of the effects of cognitive decision frames on decision riskiness. The findings were discussed in terms of their implications for risky decision making in organizations.

In loving memory of special grandparents,

Lewis Major and Helen Murphy

ACKNOWLEDGMENTS

A number of people contributed time and talent to make this dissertation possible. I would like to take this opportunity to thank them. Andy Johanson developed the basic TIDE^2 software and cheerfully worked with me to modify the simulation for the present research. Douglas Sego was also instrumental in refining TIDE^2 and establishing the Team Effectiveness Lab at Michigan State University where this study was conducted. Doug and I were fortunate to be the first graduate students assigned to the Team Effectiveness Lab and it has been a pleasure to work with him from the beginning. A number of other individuals were invaluable in recruiting subjects and collecting data for this study, including Jean Phillips, Jennifer Hedlund, Paul Barrett, Linda Barrett, Mark Roehling, and Larry Seese. Their help is greatly appreciated.

Of course without my co-chairs, Daniel Ilgen and John Hollenbeck, the Team Effectiveness Lab would not have become a reality. I would like to thank them for providing the means to do this research and also for the constant encouragement they provided and the considerable expertise they brought to all aspects of this project. My committee members, Steve Kozlowski and Kevin Ford, have been friends and mentors since my undergraduate days at Michigan State. They brought a fresh perspective to this research. Their insight was extremely valuable in developing the research and refining the final product.

Finally, I'd like to thank my friends and family for providing moral support during the "conception and birth" of this dissertation. Their patience and understanding throughout the entire graduate school process has been phenomenal. I hope I can rely on their support throughout my academic career.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Decision making is a primary topic within the field of industrial/organizational psychology. A great deal of theoretical and empirical attention has been devoted to understanding and predicting decision making processes. Within the decision making domain, risky decision making is a particularly critical topic. Decision alternatives are rarely certain. That is, the outcomes resulting from a particular decision may be unknown or only partially known. These are the circumstances that define risky decision making. Risky decision making can involve either a choice among certain and probabilistic alternatives or a decision among several alternatives, all of which have probabilistic outcomes.

From an applied perspective, risky decision making is a significant area of research because of its pervasiveness and criticality. Most decisions are probabilistic in nature. Rather than an exception, risky decision making is the norm. In addition, most decisions of extreme consequence fall under the rubric of risky decision making. Doctors, business executives, and politicians are just a few examples of individuals whose careers are based on making significant risky decisions.

Risky decision making, however, is not solely an individual phenomenon. A great deal of risky decision making occurs in a team context. In the military, for instance, command and control teams make crucial decisions regarding defensive actions against hostile forces. Cockpit crews in commercial airliners make decisions regarding aircraft operation that may have a significant impact on the safety of all those aboard. In business, management teams make decisions that have critical implications for firms' profitability and survival.

Focusing attention on the team context adds an interesting dimension to the study of risky decision making. The team context introduces several features (e.g., social processes, hierarchical structures, communication requirements) that may impinge on risky decision making processes. The unique characteristics of the team environment are likely to have an impact on risky decision making even if an individual (i.e., a team leader) is ultimately responsible for the team's decision. In other words, the individual risky decision making process is expected to be fundamentally altered by virtue of occurring in a team context. The present research is interested in risky decision making in both individual and team contexts.

The Impact of Cognitive Frames on Risky Decision Making

The more specific goal of the present research is to explore the effects of cognitive frames on risky decision making, in particular those circumstances under which frames are and are not likely to have a significant impact on decision making under risk. The notion of "framing" emerged as an issue relevant to understanding risky decision making in the late 1970s and early 1980s (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). The appearance of work related to cognitive frames coincided with a recognition in the literature that decision behavior often did not conform to the prescriptions of normative theories and perhaps should not be expected to meet the assumptions of rational models (Einhorn & Hogarth, 1981).

In the decision making context, a cognitive frame refers to the way in which a decision problem is couched or presented. Kahneman and Tversky (1979) incorporated the notion of framing into a model of risky decision making called prospect theory. The basic proposition of prospect theory is that the way in which a decision problem or choice is framed can dramatically alter the ultimate decision that is made. Prospect theory was able to account for observed decision behavior that the normative rational model (i.e., expected utility theory) could not.

The present research further explores the impact of cognitive frames on risky decision making, seeking to extend the literature in at least two respects. First, the present research examines the effects of cognitive frames in a team context, carefully considering those aspects of a team most likely to impinge on the process of decision making under risk. Second, this research attempts to identify some of the boundary conditions of framing effects by proposing and studying critical moderators of the relationship between cognitive frames and risky decision making in both the individual and team contexts.

Individual and team context issues. Most of the theoretical and empirical work related to risky decision making has been conducted at the individual level. Thus, that literature is explored first in order to build a conceptual model of risky decision making at the individual level and to derive hypotheses relevant to individual decision makers acting alone. The individual risky decision making literature also serves as the foundation for developing a model for leaders engaged in risky decision making in a team context. Constructs borrowed from the team and leadership literatures are integrated into a model of risky decision making that serve as the basis for hypotheses regarding the effects of the team context.

THEORIES OF RISKY DECISION MAKING AT THE INDIVIDUAL LEVEL

This section is devoted to a discussion of two theories of risky decision making relevant to individuals: subjective expected utility theory and prospect theory. To understand the impetus for interest in the effects of cognitive frames on risky decision making, one must first understand the rational model of decision making under risk. Subjective expected utility theory describes a classical model of decision behavior, which considers the decision making process from a normative rational perspective. Dissatisfaction with the adequacy and accuracy of the rational model prompted the development of prospect theory. The prospect theory model applied the notion of cognitive decision frames to account for the "nonrational" violations of subjective expected utility theory evident in individual decision making.

Although the two theories propose some conflicting hypotheses and each approaches decision making behavior from a different orientation, the goal is not to pit one theory against the other. Instead, the position take here is that both theories are critical to understanding risky decision making. Below, a description and critique of subjective expected utility theory is provided first, followed by a discussion and evaluation of prospect theory. As previously mentioned, it is important to first comprehend the rational model (i.e., subjective expected utility theory) before studying a model developed to account for departures from it (i.e., prospect theory). The section concludes with an attempt to reconcile the two theories by identifying the ways in which they define each other's boundaries, especially the boundaries of cognitive framing effects.

Subjective Expected Utility Theory

Subjective expected utility theory (SEU) was developed to provide a normative rational model for individual decision making. Directed mainly at predicting economic decisions, the primary underlying assumption of the model is that individuals' economic decisions are driven by the desire to maximize utility in terms of outcomes or profits. Rational behavior is equated with maximizing expected utility. Individuals' expected utilities are labelled "subjective" because SEU is concerned with individuals' beliefs or perceptions regarding the probabilities of maximizing outcomes. The mathematical roots of the SEU model are traceable to Bernoulli (1738). The original theoretical conceptualization is attributed to von Neumann and Morgenstern (1944, 1947), while Savage (1954) is credited with the most complete explication of the subjective element.

The axioms of subjective expected utility theory. The theory is based on a set of axioms that describe the expected behaviors of a rational decision maker. The descriptions of the axioms provided below are adapted from Schoemaker (1980) who provides a less technical, more applied interpretation of SEU principles (see von Neumann & Morgenstern, 1947 & Savage, 1954 for mathematical descriptions of the axioms).

(1) The complete ordering axiom: For any two outcomes, a decision maker either prefers one over the other (i.e., $A < B$ or $A > B$) or is indifferent (i.e., $A = B$). Transitivity also exists such that if A is preferred to B and B is preferred to C, then A will also be preferred to C.

(2) The continuity axiom: If A is preferred to B and B is preferred to C, then there must exist some probability (p), ranging from 0 to 1, such that an individual is indifferent to a choice between a guaranteed B outcome and the chance to obtain A or C with respective probabilities of (p) and (1-p).

(3) The independence axiom: If a decision maker is indifferent to A and B, the decision maker will also be indifferent between two lotteries, one offering A and C with probabilities of (p) and (1-p) and the other offering B and C with the same probabilities. This is true for any C and (p) value.

(4) The unequal probability axiom: If A is preferred to B, a decision maker faced with a choice between two lotteries which both offer only A and B outcomes will prefer the lottery which offers the highest probability of obtaining A.

(5) The axiom of complexity: If one lottery (L1) offers outcomes A and B and a second lottery (L2) has as its outcomes two additional lotteries which both offer only A and B as outcomes, then a decision maker should be indifferent between L1 and L2, if and only if the expected values of L1 and L2 are identical.

Since SEU theory contends that all individuals adhere to the axioms described above, the theory also posits that it is possible to use the axioms to derive a utility function that should predict or describe an individual's decision behavior for a given choice problem. In operational terms, subjective expected utility theory describes individual decision making in the following manner: (a) a given decision has a certain number of alternatives, (b) certain outcomes are associated with each alternative, (c) a decision maker assesses the value of each outcome (e.g., the attractiveness or aversiveness) and the probability that the outcome will be obtained if the associated alternative is selected, (d) the decision maker determines the expected worth of each outcome by multiplying its value by its probability, (e) the expected utility of a decision alternative is determined by summing the worth of all possible outcomes associated with it, and (f) the decision maker selects the decision alternative with the greatest worth, termed subjective expected utility.

Recall that the underlying assumption of the SEU model is that individuals desire a maximization of outcomes. In some instances, maximizing outcomes means minimizing losses or aversive events. Therefore, a decision alternative becomes more attractive as its consequences become more positive or less negative. According to the theory, highly likely positive outcomes and unlikely negative consequences are preferable to low probability positive consequences and high probability negative outcomes.

In terms of risky decision making, SEU does not predict a general tendency to prefer decision alternatives with certain or probabilistic outcomes. Instead, risky decisions are proposed to be based on the value an individual assigns to expected outcomes, combined with the perceived probability that the outcomes will be forthcoming if the associated decision alternative is selected. While the model does not deal specifically with an individual's general attitude toward risk taking, such attitudes are captured to the extent that individual risk tendencies play a role in assigning values and interpreting probabilities. For example, even if outcome A is valued over outcome B, an individual's utility function will predict the selection of outcome B if the probability associated with it is high enough so that the utility of B exceeds that of A.

For more than fifty years, subjective expected utility theory has been a principal model of risky decision making. The axioms have an intuitive appeal and empirical research has supported the efficacy of the utility function in describing and predicting decision behavior (e.g., Davidson, Suppes, & Siegel, 1957; Mosteller & Nogee, 1951; Schoemaker, 1980). The theory, however, has also generated a considerable amount of controversy based on both theoretical and empirical grounds. In the sections that follow, classical research supporting the SEU model is described and the theoretical and empirical arguments refuting the theory are enumerated.

Supportive empirical research. Literally volumes could be devoted to describing the empirical research generated by the subjective expected utility model. This work can be roughly categorized into studies that, (a) attempted to assess the viability of SEU theory as a reasonable model of decision making, and (b) those that sought to refute the theory or individual axioms. Most early empirical research based on the SEU model of decision making belongs to the former category. This work focuses on two major goals: (a) ascertaining whether or not utility functions as described by SEU theory can be derived for individuals, and (b) determining if such functions can be used to accurately predict individual decision making. Two classical studies representative of this body of research are described below.

Mosteller and Nogee (1951) conducted one of the first experimental tests of the SEU model. They engaged a sample of college students and National Guard members in a betting task using small amounts of money. Over repeated trials, preferences and indifferences for a variety of bets were determined, allowing for the construction of probabilistic utility functions. Consistent with SEU theory, Mosteller and Nogee found that bets associated with greater expected utilities had a higher probability of being selected. Furthermore, utility functions once constructed were reasonably good predictors of betting decisions and were better predictors of betting decisions than functions based solely on the monetary value of bets.

Another classic study conducted by Davidson et al. (1957) assessed utility functions for a single chance event. Using indifference judgments, six utility points were determined for each subject in their student sample. Based on their empirical results, Davidson et al. concluded the following: (a) utility functions were generally not linear, (b) subjects decisions were consistent with maximizing SEU, and (c) based on remeasurement, subjects appeared to be consistent in their decisions over time.

The two studies described above are illustrative of SEU research that has been conducted using lottery-type, gambling tasks. This research supports the proposition that individual utility functions can be derived for some decision tasks. More importantly, these studies support the basic underlying assumption of SEU theory; individuals can and do make decisions which attempt to maximize utility, at least for the tasks studied.

Contradictory theoretical and empirical arguments. Despite the body of evidence cited above, others have argued against the usefulness and accuracy of subjective expected utility theory. A primary criticism leveled against SEU is that the theory cannot be disproved given its normative nature. McCord and de Neufville (1983), for example, argued that empirical evidence suggesting that individuals do not attempt to maximize expected utilities in their decisions can be dismissed on the grounds that these individuals are not behaving rationally. Proponents of SEU may simply argue that these individuals are not cognizant of their irrational decision behavior and that once aware, they would behave rationally and attempt to maximize utility.

Given the rationality predicament, the common approach taken to refute SEU theory has been to disprove the individual axioms upon which it is based (e.g., Hagen, 1979; MacCrimmon & Larsson, 1979; Kahneman & Tversky, 1979). Compared to the other four axioms, by far the most damaging empirical evidence has been leveled against the transitivity or the complete ordering axiom. According to this axiom, if an individual prefers A to B and B to C, then A should also be preferred to C. Given equal expected values (i.e., equivalent attractiveness) and probabilities, the order of preferences is expected to hold across lotteries. As demonstrated by the considerable empirical research generated by prospect theory (Kahneman & Tversky, 1979), this is often not the case. Prospect theory offers an alternative theoretical perspective on individual risky decision making which includes propositions that contradict those generated by SEU theory. Prospect theory, its basic tenets, and empirical research generated by the viewpoint are discussed below.

Prospect Theory

Kahneman and Tversky (1979) developed prospect theory as an alternative to subjective expected utility theory, contending that the latter theory did not offer an accurate description of individual risky decision making. Prospect theory attempts to account for the nonrational violations of SEU theory that are apparent in individual decision making. At a fundamental level, prospect theory is based on three tenets or propositions which violate the axioms of the SEU model. These three tenets, labelled the certainty, reflection, and reference effects, are described below.

The certainty effect. The certainty effect is the contention that individuals overweight outcomes that are considered certain relative to outcomes which are considered probable, when choosing between two positive potential outcomes. The certainty effect, also known as the Allais paradox, is illustrated by examining the pattern of preferences generated by the following two choice problems borrowed from Kahneman and Tversky (1979):

Problem 1: Choose between options A and B:

A. $4,000 with probability .80

B. $3,000 with certainty

Problem 2: Choose between options C and D:

C. $4,000 with probability .20

D. $3,000 with probability .25

In Problem 1, 80 percent of the subjects selected Option B and 20 percent chose Option A. In terms of the subjective expected utility model, this implies that u(3,000)/u(4,000) > 4/5, where "u" denotes the utility of the outcome. However in Problem 2, 65 percent of respondents selected Option C and 35 percent chose Option D, implying the reverse inequality (i.e., u(3,000)/ u(4,000) > 4/5). Notice also, that Option C (4,000, .20) can be expressed as 25 percent of Option A (A, .25). Likewise, Option D (3,000, .25) can also be considered 25 percent of Option B (B, .25). According to subjective expected utility theory, if B is preferred to A, then (B, .25) ought to be preferred over (A, .25). However, 65 percent of Kahneman and Tversky's subjects violated the SEU prediction by selecting Option C (A, .25). It seems that reducing the probability of winning from 1.0 to .25 has a greater effect than a reduction from .80 to .20. This is not a finding that can be accounted for by subjective expected utility theory.

Kahneman and Tversky (1979) have also demonstrated the certainty effect using non-monetary outcomes. Consider the following choice problems:

Problem 3: Choose between options A and B:

A. 50 percent chance to win a three-week tour of England, France, and Italy

B. A one-week tour of England, with certainty

Problem 4: Choose between options C and D:

C. 5 percent chance to win a three-week tour of England, France, and Italy

D. 10 percent chance to win a one-week tour of England

In Problem 3, Option A was selected by 22 percent of the subjects and Option B was chosen by 78 percent. In Problem 4, however, 67 percent of the subjects chose Option C while 33 percent selected Option D. In this problem set, Option C can be expressed as (A, .10) and Option D can be rewritten as (B, .10). Nonetheless, given the strong preference for Option C it seems that a reduction in probability from 1.0 to .10 has a greater effect than the reduction of .50 to .05.

The strong tendency for individuals to overweight certainty relative to probability is not adequately captured by subjective expected utility theory. Prospect theory, however, does incorporate the certainty effect. The certainty effect is an integral aspect of the prospect theory model, which also helps describe and account for the second tenet of prospect theory, the reflection effect.

<u>The reflection effect</u>. While the certainty effect is concerned solely with positive prospects, the reflection effect describes decision behavior related to both positive and negative prospects. The reflection effect describes differences in decision making that are attributable to the way in which a choice problem is presented or the manner in which it is "framed" (Tversky & Kahneman, 1981). Kahneman and Tversky's (1979) reflection effect deals with choice problems presented or framed as gains and those presented or framed as losses. Their contention is that preference patterns for negatively framed decision alternatives (i.e., those framed as losses) are the mirror image (i.e., the reflection) of preference patterns for positively framed choices (i.e., those framed as gains). The following example, taken from Kahneman

and Tversky (1979), demonstrates the difference between gain and loss frames and illustrates the reflection effect:

Problem 5: Choose between options A and B:

A. Gain $3,000 with probability .90

B. Gain $6,000 with probability .45

Problem 6: Choose between options C and D:

C. Lose $3,000 with probability .90

D. Lose $6,000 with probability .45

Confronted with Problem 5 which is framed positively as a gain, 86 percent of the subjects selected Option A and 14 percent preferred Option B. The preference pattern for Problem 6, however, is reflected such that 8 percent of the subjects chose Option C and 92 percent selected Option D. Problem 6 is framed negatively as a loss. These results demonstrate the major implication of the reflection effect: individuals are risk averse in the positive domain (i.e., under gain frames) and risk seeking in the negative domain (i.e., under loss frames). This contention is counter to subjective expected utility theory axioms. According to SEU theory, the frame should be irrelevant and the ordering of preferences should not be reflected, but remain consistent.

The reflection effect has also been demonstrated with non-monetary choice problems. Of these decision tasks, the "Asian disease" problem and the results associated with it are probably the most widely known (Tversky & Kahneman, 1981). This decision problem is presented below:

Problem 7: Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

A. If Program A is adopted, 200 people will be saved.

B. If Program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved.

Problem 8: Same as Problem 7 with the following choice alternatives:

C. If Program C is adopted 400 people will die.

D. If Program D is adopted there is 1/3 probability that nobody will die, and 2/3 probability that 600 people will die.

Considering the two decision problems together, it is clear that Programs A and C offer equivalent outcomes, as do Programs B and D. Yet, in Problem 7 the majority of individuals (72 percent) selected Program A, while the majority (78 percent) chose Program D in Problem 8. As was the case in the monetary decision task, these results are attributed to differences in frame, a gain frame in Problem 7 and a loss frame in Problem 8. Similar results have been obtained using gambling and purchasing decisions (Tversky & Kahneman, 1981). Given the consistency of these results, Kahneman and Tversky (1984) have argued that framing is an extremely strong determinant of choice, stating that, "the failure of invariance is both pervasive and robust. It is as common among sophisticated respondents as among naive ones, and it is not eliminated even when the same respondents answer both questions within a few minutes" (p. 343).

The certainty effect, or the tendency to prefer guaranteed outcomes, is a phenomenon exclusive to the gain domain. However, according to Kahneman and Tversky (1979), the psychological phenomenon of overweighting certainty helps account for the differential preferences in gain and loss domains. Operating under gain frames, individuals are risk averse such that they prefer a smaller certain gain over a larger one that is probabilistic. Under loss frames, individuals are risk taking such that risking a greater loss is preferable to accepting a smaller certain loss. For gain frames certainty is overweighted in a positive manner, making small certain gains more attractive. For loss frames, certainty is overweighted in a negative manner, such that small certain losses are more aversive. Thus, overweighting certainty in both a positive and negative manner in association with gain and loss frames respectively, offers a partial explanation for the reflection effect. The reflection effect may also be understood in terms of the reference effect, described in the next section.

The reference effect. According to prospect theory, decision alternatives are not evaluated in terms of final outcomes yielded (e.g., the ultimate amount of wealth acquired). Rather, Kahneman and Tversky (1979) argued that decision outcomes are evaluated as either gains or losses relative to some neutral reference point. The status of an individual's current assets is most often considered the neutral reference point, with the understanding that the reference point may be affected by expectations of the decision maker and the formulation of decision alternatives.

The effect of a neutral reference point based on one's current assets is illustrated in the following example borrowed from Kahneman and Tversky (1979):

Problem 9: In addition to whatever you own, you have been given $1,000. You are now asked to choose between A and B.

A. Gain $1,000 with probability .50

B. Gain $500 with certainty

Problem 10: In addition to whatever you own, you have been given $2,000. You are now asked to choose between C and D.

C. Lose $1,000 with probability .50

D. Lose $500 with certainty

Notice that the two problems are equivalent in terms of final states. Selecting Option A or C affords a 50 percent chance to end up with $2,000 and a 50 percent chance to finish with $1,000. Choosing Option B or D provides $1,500 with certainty. Despite equivalent outcomes, the pattern of preference differed between the two problems. The majority of subjects confronted with Problem 9 preferred Option B (84 percent), while only 16 percent selected Option A. In Problem 10, 69 percent of the subjects selected Option C and 31 percent chose Option D.

This problem demonstrates that decisions are not made on the basis of final outcomes. Instead, decision alternatives are evaluated in terms of changes in "wealth," either gains or losses. Change is evaluated on the basis of a neutral reference point which is most typically determined by current asset levels. For example, it seems that $1,000 was the reference point in Problem 9, while $2,000 was the reference point in Problem 10. Thus, gains and losses are not objective with respect to some final asset state. Instead, whether a decision alternative is perceived as a gain or a loss depends upon an individual's reference point. This is an important distinction between subjective expected utility theory and prospect theory. SEU theory contends that utility is assessed and decisions are made on the basis of final outcomes. From the prospect theory perspective, changes in outcome level are clearly more important than the ultimate level of outcomes.

Decision making according to prospect theory. The certainty, reflection, and reference effects, discussed above are useful in describing the prospect theory model of the decision making process. Kahneman and Tversky (1979) suggest that decision making consists of two major phases: the editing phase and the evaluation phase. In the editing phase, prospects are interpreted as gains or losses in accordance with the reference effect. That is, an individual evaluates whether a decision alternative represents a gain or a loss as compared to a neutral reference point, usually the individual's current asset level.

In the evaluation phase, the individual attempts to assess the value of various prospects or decision alternatives. Determining the highest value is not a straightforward task, according the Kahneman and Tversky (1979), because individuals are subject to the biases associated with the certainty and reflection effects. In accordance with the certainty effect, decision alternatives that provide guaranteed outcomes are overweighted. In addition, the manner in which this overweighting is manifested is specified by the reflection effect. In the positive domain when gain frames are operating, certainty is overweighted such that guaranteed smaller gains are evaluated much more favorably than probabilistic larger gains. In the negative domain when loss frames are operating, certainty is overweighted such that a sure smaller loss is viewed as more aversive than a probabilistic larger loss.

The typical results of the evaluation phase can be illustrated using the hypothetical value function shown in Figure 1. According to Kahneman and Tversky (1979), "the value function is (a) defined on deviations from the reference point; (b) generally concave for gains and commonly convex for losses; (c) steeper for losses than for gains" (p. 279). As the final step in the evaluation phase, prospect theory contends that outcome values are multiplied by decision weights. Decision weights are not necessarily the same as probabilities. Kahneman and Tversky argue that a decision weight is likely to be a function of stated probabilities, but that decision weights may also be influenced by other factors (e.g., ambiguity). An individual ultimately selects the decision alternative associated with the largest product, once values and decision weights are multiplied.

Empirical research. Much of the supportive empirical research related to prospect theory has already been described in this proposal. Nonetheless, it is worth summarizing some of the key characteristics of that research. First, all of the decision problems are hypothetical situations presented in written form. Second,

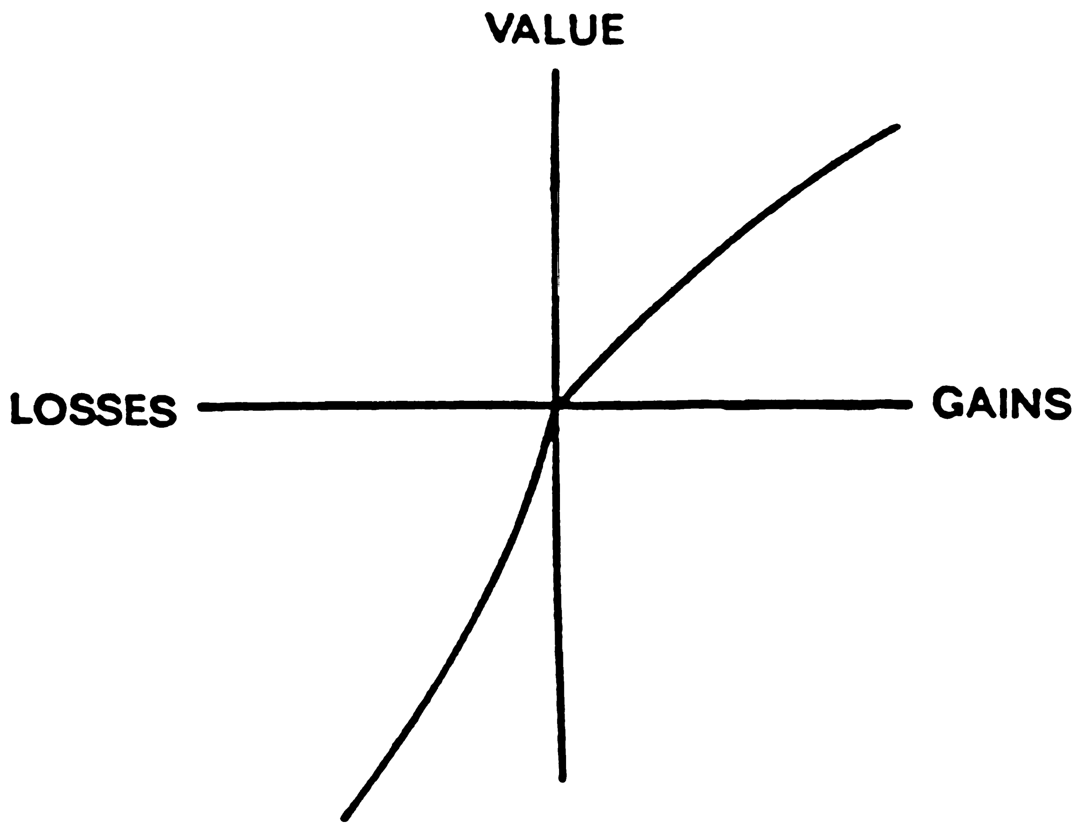


Figure 1. A hypothetical value function.

reflection decision problems are paired such that one is framed as a loss and its match is framed as a gain. Although the majority of research was designed such that different groups of subjects responded to only one problem in the pair, results consistent with prospect theory predictions were still obtained when a single group of subjects responded to both the loss and gain versions of a problem (Kahneman & Tversky, 1984). Third, the majority of subjects employed in these studies were students. Finally, the vast majority of empirical research supportive of prospect theory has been conducted by Kahneman and Tversky, the theory's founders. In each of their studies, individuals presented with a positively framed choice problem made risk averse decisions, while individuals confronted with a negatively framed choice problem made risk seeking decisions.

This is not to say that all empirical research related to prospect theory has been supportive. Using a cancer treatment decision problem, similar to Kahneman and Tversky's "Asian disease" problem, Fagley and Miller (1987) found that subjects' choices between risky and certain options were not significantly affected by decision frame. This study is interesting because Fagley and Miller originally set out to determine whether or not training in decision theory would mitigate the effects of loss and gain frames on decision riskiness. Their intent was to examine the decision patterns of 45 MBA students before and after training. However, Fagley and Miller discovered that no framing effects were present even before training in decision theory. Both before and after training, subjects generally preferred the certain decision alternative in both the positively and negatively framed conditions. Thus, their results were consistent with prospect theory for positively framed decision problems, but not for those framed negatively.

Fagley and Miller's (1987) research differed from Kahneman and Tversky's work in at least two critical ways. First, the subjects were MBA students enrolled in an advanced statistical decision theory course. Fagley and Miller speculated that perhaps these MBA students possessed some particular statistical knowledge that affected the results. They also considered it possible that simply being enrolled in a course on advanced decision theory sensitized subjects to be more aware of the implications of the decision alternatives, especially since the problems were presented during regular class time. However, these explanations seem improbable given Kahneman and Tversky's (1984) work demonstrating no framing effect differences related to expertise. Finally, given the preference for certain alternatives demonstrated in their study, Fagley and Miller also conjectured that their particular group of MBA students may have been especially conservative. However, they were unable to verify this notion.

The second critical distinction between Kahneman and Tversky's work and Fagley and Miller's (1987) study was that subjects involved in the latter were asked to explain the rationale for their choices. Asking individuals to explain the rationale is equivalent to asking them to justify their decisions. It is possible that this group of MBA students simply felt more comfortable justifying a conservative choice. It is also possible that asking individuals to focus on the decision rationale may have significantly altered the decision process itself (Ericsson & Simon, 1980; 1984).

Thus, Fagley and Miller's (1987) results may be attributable to important characteristics of the subjects or the procedures employed.

In another study, Fagley and Miller (1990) attempted to study the effects of sex and decision problem on the relationship between framing and risky decision making. Based on prior research suggesting that females tend to be more field dependent than males, Fagley and Miller argued that females may be more likely to rely on frames in making decisions. Male and female undergraduate students were employed as subjects. The five hypothetical decision problems employed were paper and pencil measures taken from previous research and based on the following issues: cancer treatment, job layoffs, dropout prevention, civil defense, and the Asian disease scenario. There was a significant framing effect for females in the direction predicted by prospect theory on four of the five decision problems (i.e., all except for the dropout prevention scenario). There were no significant framing effects for males on four of the decision problems. However, males' decisions on the cancer treatment problem were affected by gain and loss frames in the direction opposite of that predicted by prospect theory. Males were risk averse under a loss frame and risk seeking under a gain frame.

Even though results generally supported the frame by sex interaction hypothesized by Fagley and Miller (1990), many of their findings are not clearly explained. For instance, they were not able to specify which aspects of the dropout prevention problem, if any, were responsible for the lack of framing effect for female decision makers. Likewise, they were not able to explain the unexpected effects (i.e., counter to prospect theory) obtained for male decision makers on the cancer treatment problem. This finding is especially puzzling since Fagley and Miller (1987) found that individuals confronted with the cancer treatment problem generally tended to opt for the certain decision alternative, regardless of frame.

Limitations of empirical research. It is difficult to come to an overall conclusion regarding prospect theory based on available empirical evidence. Using a "scorecard" strategy to summarize the literature, it is clear that the majority of empirical studies have supported prospect theory predictions (e.g., Kahneman & Tversky, 1979, 1984; Tversky & Kahneman, 1981), while only a handful have shown no effects or effects opposite to prospect theory predictions (e.g., Fagley & Miller, 1987; 1990). Regardless, the empirical work related to prospect theory suffers from two potential limitations.

The first concerns the primary way in which prospect theory has been tested, using paper and pencil hypothetical choice problems. The problem is not inherent to paper and pencil measures. The problem arises from testing a theory using primarily as single method, regardless of what that method is (Platt, 1964.) Similar findings obtained using multiple methods provide a more persuasive case in support of any theory. There are a few prospect theory studies that have employed alternative methods and those are discussed in later sections of this proposal (e.g., Kameda & Davis, 1990; McGuire, Kiesler, & Siegel, 1987; Schurr, 1987). However, the vast majority of studies have employed similar hypothetical choice problems, prompting one to be cautious in expressing the generalizability of prospect theory.

The second problem with the empirical work related to prospect theory is similar to the first. Just as Platt (1964) cautions against using a single method, he also cautions against relying too heavily on the results of a single researcher or group. It is clear that Kahneman and Tversky's empirical work has been consistently supportive of prospect theory (e.g., Kahneman & Tversky, 1979, 1984; Tversky & Kahneman, 1981). Recently, Fagley and Miller and their colleagues have begun generating research related to prospect theory and most of it has not been supportive (e.g., Fagley & Miller, 1987; 1990). Other researchers have recently provided and will undoubtedly continue to contribute additional studies, which will help alleviate "pet theory" concerns (e.g., Kameda & Davis, 1990; McGuire et al., 1987; Schurr, 1987).

The most definitive statement that can be made regarding research on the framing effects predicted by prospect theory is that empirical findings have been inconsistent. The present challenge is to discover those conditions under which prospect theory predictions do fit the data and those circumstances under which predictions do not fit the data. In essence, this means identifying those factors that define the boundaries of prospect theory's framing effects. As an initial step in this endeavor, it seems reasonable to explore how prospect theory can be reconciled with the rational model of decision making, subjective expected utility theory.

<u>Understanding Rational and Nonrational Models of Decision Making</u>

Attempting to determine which model of risky decision making is correct, subjective expected utility theory or prospect theory, would be a futile task. Both have considerable theoretical and empirical justification. Each offers a reasonable description of risky decision making behavior under certain circumstances. Therefore, it seems that neither theory could or should be easily dismissed. A more fruitful approach to the study of risky decision making is to determine the ways in which the two theories complement one another and to ascertain how they can be used together to more fully understand risky decision making.

Subjective expected utility theory describes the rational normative model of decision making. It also describes the optimal method for maximizing outcomes. Generally, it seems reasonable to assume that individuals would like to maximize their outcomes when possible. Nonetheless, individuals' decision choices are not always consistent with the normative model. Particular influences seem to pull individuals away from the completely rational model. Prospect theory describes some of these influences (e.g., cognitive decision frames), allowing one to begin to determine the circumstances under which nonrational decision making is most likely.

According to prospect theory, cognitive decision frames have a substantial influence on risky decision making. Under gain frames, individuals tend to be risk averse, preferring smaller certain gains over larger risky gains. Under loss frames individuals are more risk seeking, chancing a larger loss to avoid a smaller certain loss.

A primary goal of the present research is to explore some of the boundary conditions of cognitive framing effects. Stated another way, I am concerned with discovering conditions under which framing effects are most likely to occur and those conditions under which framing effects are least likely to occur. To begin to understand the former, the characteristics of decision tasks known to elicit framing effects must be examined.

Recall that most prospect theory research, and all the original research by Kahneman and Tversky (1979; 1981; 1984), employs a similar type of decision task. Participants are presented with a hypothetical scenario, one that is either framed as a gain or framed as a loss, and asked to make a choice between a more risky (i.e., lower probability) option that offers greater potential outcomes and a certain alternative (i.e., the associated outcome is guaranteed) that offers a relatively lower outcome. Prospect theory predicts that under gain frames, individuals will be more likely to opt for the certain alternative that provides less of a given outcome than the risky alternative that has the potential to yield a larger outcome. Under loss frames, prospect theory makes the opposite prediction. Individuals are expected to choose the risky outcome-maximizing alterative over the certain alternative.

The following pair of decision problems, taken from Kahneman and Tversky (1979), may help clarify prospect theory predictions. The sample problems may also be useful for demonstrating how prospect theory predictions differ from those of subjective expected utility theory (SEU):

Gain Frame: In addition to whatever you own, you have been given $1,000. You are now asked to choose between A and B.

A. Gain $1,000 with probability .50

B. Gain $500 with certainty

Loss Frame: In addition to whatever you own, you have been given $2,000. You are now asked to choose between C and D.

C. Lose $1,000 with probability .50

D. Lose $500 with certainty

Recall that in research employing the above problems (Kahneman & Tversky, 1979), the majority of subjects in the gain frame condition selected Option B, the certain alternative. Under the loss frame, the majority chose Option C, the risky alternative. These findings are consistent with prospect theory.

Subjective expected utility theory, in particular the transitivity axiom, suggests that individuals will make the same type of outcome maximizing choice regardless of decision frame. Note that under both gain and loss frames, the risky alternative is always associated with a larger gain or a smaller loss. Since SEU posits that individuals behaving rationally will attempt to maximize outcomes, the theory would most likely predict that individuals will generally prefer Options A and C (i.e., those associated with higher outcomes) to Options B and D in the present example.

It is important to recognize that under loss frames both SEU and prospect theory predict the same choice, the election of the outcome-maximizing risky alternative (i.e., Option C in the example above). For gain frames, however, SEU predicts that decision making will be consistent with loss frame choices (i.e., the riskier outcome-maximizing option will be preferred), while prospect theory proposes a differential preference for certain alternatives. In terms of the decision problem presented above, SEU predicts that Option A will be chosen while prospect theory predicts that Option B will be chosen.

In an effort to reconcile SEU and prospect theory it may be useful to focus first on decision making under a gain frame, the condition under which the two theories actually make differential predictions. The primary goal is identifying some boundary defining process or condition that helps us understand when the predictions of SEU are more likely to be accurate than the predictions of prospect theory and vice versa. After a discussion of gain frames, it may then be helpful to focus on loss frames in an attempt to decipher the psychological processes that may account for frame-dependent differential decision making.

Gain frames. As mentioned previously, a major limitation of prospect theory research is the use of a single method, decision tasks that are predominantly paper and pencil, hypothetical, choice problems. These decision scenarios are essentially lotteries for which outcome probabilities are provided. By definition, a lottery is a chance event. Chance, by definition, possesses a degree of unpredictability and a lack of control. The sample decision problems provided above help clarify the significance of these definitions.

If an individual selects Option B, described earlier, he or she will definitely acquire \$500. However, if the individual selects Option A there is a 50 percent chance that he or she will gain \$1,000 and a 50 percent chance that nothing will be gained. Given that the stated probabilities are 50/50, whether the individual falls into the former or the latter category on any one trial is equally probable. Since the decision problem is a lottery, there is little reason for an individual to have greater confidence in one outcome over the other. The individual has no personal control and no reason to believe that he or she has any influence over the probabilities. Thus, instead of leaving a gain up to chance the individual can, and does according to most prospect theory research, ensure a gain by selecting Option B (i.e., the risk averse choice), even though the certain gain is smaller.

Consider a hypothetical scenario. An individual is confronted with a choice between Options A and B. If that person selects Option A, he or she must make a correct decision in order to receive the $1,000. As stated in Option A, the probability of making a correct decision is .50. If the individual chooses Option B, he or she will automatically receive $500 without needing to make a correct decision. The argument made here is that in this context, whether an individual chooses Option A or B is dependent upon that person's <u>perceived control over the probability of making a correct decision</u>. The stated probability for making an accurate decision is .50. However, the <u>perceived probability</u> may be something quite different. For instance, the individual may have any number of reasons to feel absolutely certain that he or she will answer the question correctly (e.g., the person is highly knowledgeable, very experienced, etc.). In that case, the individual's perceived probability would be 1.0. The stated probability is disregarded because the individual believes that he or she has influence or control over the probability of being correct. Given a choice between Option A and B under these circumstances, there can be no doubt that an individual would select Option A because it has as higher pay-off.

Here it is argued that the decision maker's perceived control over the probability of making a correct decision is a critical moderator of the effects of framing on risky decision making. Perceived control may be a critical boundary condition that plays a role in determine whether prospect theory predictions or SEU predictions are more likely to be accurate under gain frames. It is expected that the greater the control perceived by the decision maker, the greater the likelihood that the risky alternative (i.e., the outcome maximizing option) will be chosen and SEU predictions will be supported. The less control perceived or the more the decision task appears to be a lottery, the greater the likelihood that the certain alternative (i.e., the smaller guaranteed outcome) will be chosen and prospect theory predictions will be supported.

Loss frames. The notion of control is useful for understanding risk averse decision making under gain frames, but does not explain the risk seeking decisions made under loss frames. As typically presented, prospect theory scenarios, both those presented as gains and those presented as losses, represent low control situations. Thus, individuals do not select riskier alternatives because they perceive greater control due to the loss frame. To understand decision behavior under loss frames, one must understand the psychological meaning of the loss condition.

Essentially, potential losses are perceived as threatening. Jackson and Dutton (1988) conducted a study designed to determine the critical features that distinguish opportunities from threats. A large sample of M.B.A. alumni were asked to read several business strategy scenarios and rate them on the extent to which they represented threats or opportunities. Jackson and Dutton found that low control, potential for loss, and no potential for gain were critical features distinguishing threats from opportunities. Thus, a loss frame in a prospect theory scenario meets the definitional criteria of a threat.

Individuals are expected to respond differently to threats than to opportunities. Dutton and Jackson (1987) argued that managers dealing with strategic issues would take risks of greater magnitude in response to threatening conditions than in response to opportunities. Consistent with prospect theory predictions, managers were expected to be willing to take greater risks to avoid loss than to obtain gains. The present proposal contends that the influence of loss aversion is so great that it is present regardless of control. Under loss frames, individuals are expected to be risk seeking regardless of the level of perceived control.

Perceived Control

Perceived control may be a critical boundary condition of the effects of cognitive frames, specifically gain frames, on risky decision making. The concept of perceived control is not new to the psychological and organizational literatures. It has been a significant and prevalent construct in psychological thought for nearly 100 years (e.g., Gross, 1901). In order to more fully understand the concept of perceived control and its potential relevance for risky decision making, some of the more pertinent literature is discussed below.

Perceived control in the psychological and organizational literatures. Sutton and Kahn (1986) contended that the notion of perceived control is a particularly important construct in the organizational literature. The primary argument in the literature is that control is desirable and human beings are motivated to achieve and maintain a perception of control in the environments of which they are a part (Greenberger & Strasser, 1986; Rothbaum, Weisz, & Snyder, 1982). In general, perceptions of greater control mean that individuals feel a sense of mastery and personal competence in their environments (deCharms, 1968; White, 1959). Lower perceived control, on the other hand, creates feelings of uncertainty and lack of mastery that are undesirable and aversive (deCharms, 1968; Greenberger & Strasser, 1986). Perceived control has been linked to satisfaction (Greenberger, Strasser, Cummings & Dunham, 1989; Tetrick & LaRocco, 1987), performance (Bazerman, 1982; Glass & Singer, 1972; Greenberger et al., 1989), stress (Averill, 1973; Miller, 1977; Tetrick & LaRocco, 1987; Thompson, 1981) and withdrawal (Langer & Rodin, 1976).

Spector (1986) conducted a meta-analysis of the effects of perceived control on a variety of outcome variables in the work context. According to Spector's results, perceived control was positively related to job satisfaction, organizational commitment, job involvement, performance, and motivation. In addition, perceived control was negatively related to stress, absenteeism, intentions to turnover, and turnover.

Perceived control and risk taking. A much more limited literature addresses the relationship between perceived control and risk taking. This literature is entirely theoretical and offers no empirical data to support hypothesized relationships between perceived control and risk taking. Vlek and Stallen (1980) developed a conceptual model of the determinants of risk taking. They contended that perceived control would be positively related to risk taking (i.e., the greater the perceived control the greater the risk taking demonstrated). In particular, they argued that risk taking would be greater for skill-dependent decision tasks than for chance-dependent tasks. Baird and Thomas (1985) extended and applied this notion to a conceptual model of strategic risk taking for managers. They asserted that controllability of decision consequences would have a positive impact on the likelihood of accepting a high strategic risk. These examples from the risk literature converge to support the theoretical notion that control is positively related to risk taking.

The unique contribution of the present proposal is applying the notion of perceived control in an attempt to explain the risk averse decision making frequently evidenced under gain frames. The individual decision maker's tendency to select more certain alternatives under gain frames is hypothesized to be a function of the low perceived control, fostered by the lottery-type tasks used in prospect theory research. Control is proposed as a moderator that begins to define the boundaries of prospect theory's framing effect under gain conditions.

<u>Perceived control in the decision making context</u>. Since the present research focuses on risky decision making, perceived control is conceptualized in terms of the decision maker's perceived probability of making a correct decision. The most simple instance of a risky decision involves a choice between two alternatives where one option is correct and the other incorrect, and the lowest probability of making a

correct decision is .50. Any individual has at least a 50 percent chance of making a correct decision. The highest probability of making a correct decision is 1.0 which means the correct decision will be made with certainty. An individual's perceived probability can range from .50 to 1.0.

The perceived probability of making a correct decision may be, but does not necessarily have to be, consistent with the actual or objective probability of making a correct decision. Furthermore, perceived probabilities may not be consistent with stated or average probabilities for a given decision task. A substantial amount of research, most of it conducted under the rubric of "unrealistic optimism," indicates that individuals often perceive personally applicable probabilities as more favorable than stated or average probabilities across a variety of issues and contexts (e.g., Langer & Roth, 1975; Weinstein, 1980). The decision making literature also shows that individuals tend to believe they will make more accurate decisions than they actually do (Lichtenstein, Fischhoff, & Phillips, 1982; Slovic, Fischhoff, & Lichtenstein, 1982).

To explore the proposed moderating effect of perceived control on the relationship between decision frame and decision riskiness, it becomes important to utilize non-lottery tasks. As discussed above, the typical prospect theory decision scenario is unlikely to foster feelings of control. The effects of perceived control may be more relevant and obvious within a complex decision making environment which actually engages the decision maker. It seems, for instance, that information processing-type tasks may be more likely to provide the requisite opportunities for a decision maker's perceptions of control to come into play. These kinds of tasks require an individual to measure, process, evaluate, and combine informational cues to reach a decision. Unlike lottery tasks, information processing tasks can have qualitatively correct responses. In addition, the results obtained using information processing tasks are likely to have greater generalizability than the written hypothetical choice problems most frequently employed.

Most importantly, information processing tasks can be manipulated to be more or less like a lottery task. Using information processing tasks, variance on critical task characteristics can be achieved. For instance, the informational decision cues can vary in terms of ambiguity (i.e., the extent to which information provided is clear or unclear). Unambiguous cues are expected to make the correct decision more obvious and give the decision maker greater control. It is assumed that highly ambiguous cues reduce personal control because they provide little discriminating information. Thus, a decision maker confronted with ambiguous cues is likely to perceive less control because the lack of clarity diminishes his or her ability to make a correct decision.

Information processing tasks also allow decision makers to assess certain types of information that are likely to influence perceptions of control over the probability of making a correct decision. By definition, people cannot determine their expertise on lotteries. At least theoretically, one's previous performance history in a lottery has no bearing on current or future performance. However, an individual would be able to ascertain his or her expertise and performance history on an information processing task. Since this type of information may have a direct bearing on perceived levels of control, its availability creates the opportunity to test the predicted moderating effect of control on the relationship between decision frame and decision riskiness.

Finally, it is important to be explicit about how perceived control will be manifested in an information processing context for this study. As mentioned above, the type of information processing task used in the present research requires a decision maker to measure, process, evaluate, and combine informational cues in an attempt to reach an objectively correct decision. As with the hypothetical lottery tasks typically employed in prospect theory's cognitive framing research, decision alternatives and the potential outcomes associated with each alternative are provided. The certain alternatives have guaranteed outcomes. The risky alternatives offer greater pay-offs, provided that a correct decision is made. Individuals perceiving greater control are predicted to make riskier decisions. In this context, individuals' perceptions of control will be operationalized as the decision maker's perceived probability for making a correct decision. That is, the probability that the decision maker <u>believes applies</u>, not necessarily the stated or accurate probability. Thus, a decision maker who has greater perceived control believes the probability of making a correct decision is higher than one who perceives less control.

<u>Perceived control as a moderator</u>. The present research examines perceived control as a potential moderator of the relationship between decision frame and decision riskiness. The nature of the proposed moderator effect is shown in Figure 2.

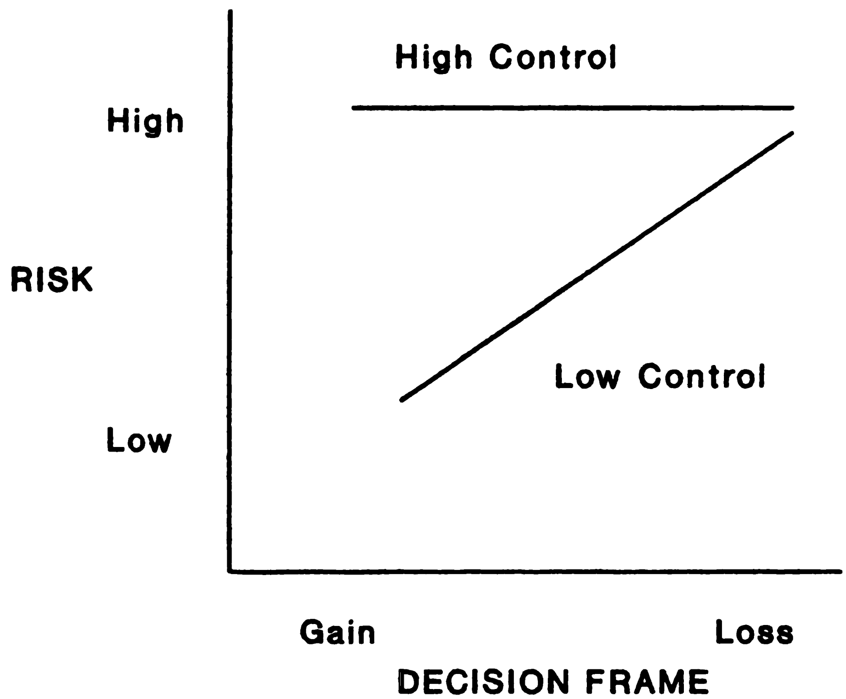


Figure 2: Hypothesized moderating effect of control

Perceived control is expected to lead to differential decision making under gain frames. Under a gain frame, an individual working within conditions of low control (i.e., typical prospect theory conditions) is predicted to make risk averse decisions. As shown in the graph, decision riskiness increases as control increases. Notice that under loss frames, individuals are expected to consistently make decisions reflective of risk seeking. Prospect theory research representing conditions of low control has shown that individuals are risk seeking under loss frames. Here it has been argued that the psychological threat produced by loss frames is likely to engender risk seeking regardless of the level of perceived control. The magnitude of perceived control's moderator effect, however, is a more difficult to predict. It is possible that the line representing high control in Figure 2, may actually be more appropriately drawn higher on the y-axis.

Summary: Risky Decision Making, Cognitive Frames, and Perceived Control

In summary, subjective expected utility theory describes a rational model of decision making based on maximizing outcomes. Prospect theory invokes the notion of cognitive decision frames to explain the deviations from rationality often observed in individual risky decision making. Positive decision frames, in particular, are associated with a preference for smaller certain gains in lieu of larger probabilistic gains.

It is suggested here, however, that this type of framing effect may be limited to the conditions of low perceived control fostered by characteristics of prospect theory decision tasks. These tasks cannot be manipulated and offer no critical discriminating information which would lead one to rely on perceptions of personal control. When discriminating information (e.g., cue ambiguity, task knowledge, performance history) is available and individuals are able to assess their own feelings of control (i.e., probability of making a correct decision), decision frames are less likely to have an effect on risky decision making. The potential moderating effect of perceived control on the relationship between framing and risky decision making would be best studied using more engaging information processing decision tasks.

The section that follows is devoted to the development of a model of individual risky decision making. The moderating effect of perceived control on the relationship between cognitive decision frame and decision riskiness forms the basis of the model. The personal and informational characteristics likely to influence perceptions of control are also considered. The section concludes with a description of individual level hypotheses derived from the model.

EFFECTS OF COGNITIVE FRAMES AND PERCEIVED CONTROL ON RISKY DECISION MAKING FOR INDIVIDUALS

The model presented in Figure 3, illustrates the linkages to be discussed in the sections that follow. Keep in mind that the present research represents an initial attempt to define and test the boundary conditions of prospect theory framing effects (Sitkin & Pablo, 1992). As such, the proposed model should be considered a heuristic designed to direct the exploration of framing boundaries, rather than a comprehensive illustration of the process. The role of perceived control as a moderator of the relationship between framing and risky decision making was extensively discussed in the previous section. A brief summary of the nature of the moderating relationship and the literature supporting it is provided below. After that, the specific ways in which the task and individual difference variables are expected to affect perceptions of control are detailed.

The Moderating Effect of Perceived Control

Recall that the nature of the moderating effect of perceived control on the relationship between decision frame and decision riskiness was shown previously in Figure 2. Under gain frames, perceptions of control are expected to influence risk taking. Here it is argued that decision situations fostering perceptions of low control are equivalent to chance lotteries. Under these circumstances, individuals operating under gain frames are likely to opt for a smaller guaranteed gain. Under conditions of high perceived control, decision makers operating under gain frames are more

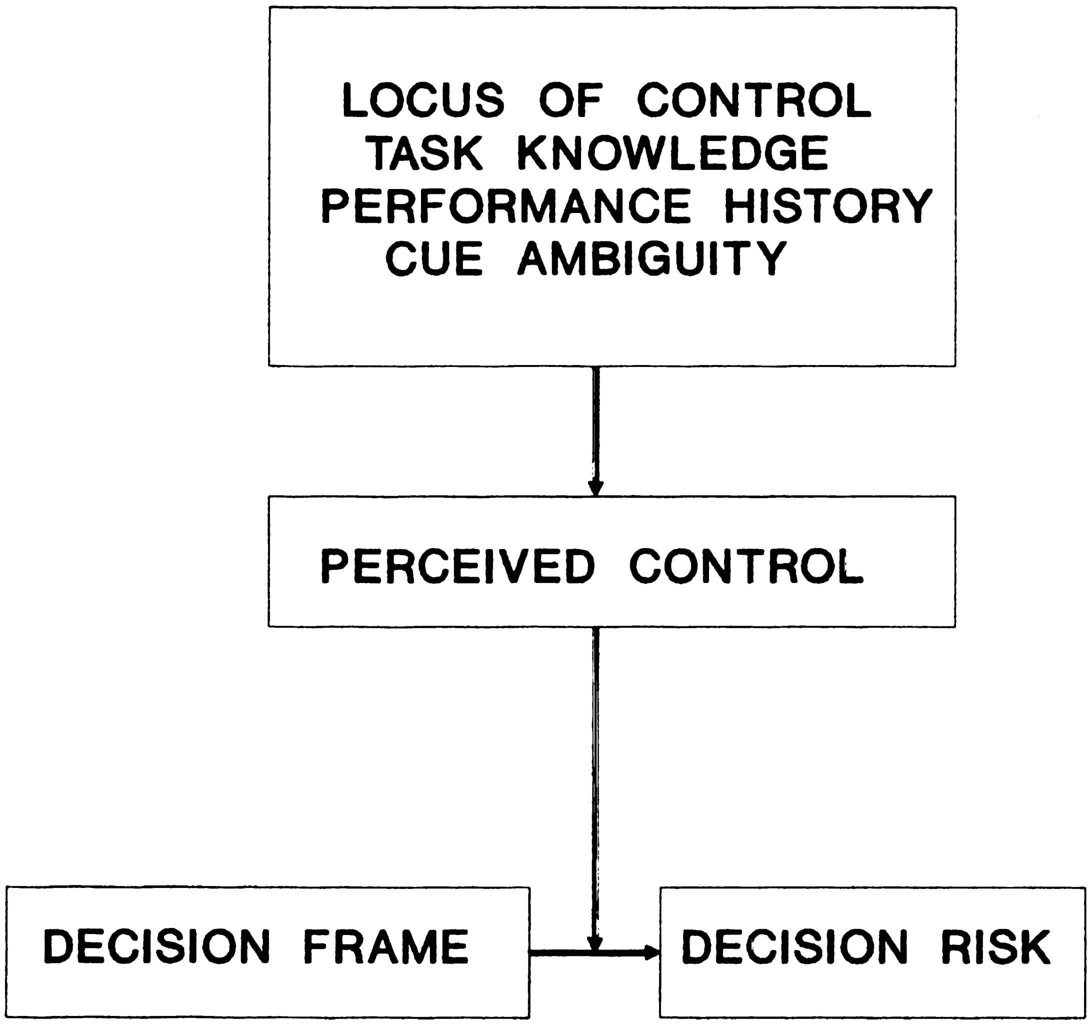


Figure 3: Model of individual risky decision making

likely to select risky alternatives to maximize outcomes. This argument has been presented elsewhere in the risk taking literature (e.g., Baird & Thomas, 1985; Vlek & Stallen, 1980).

Under loss frames, individuals are predicted to make more consistently risky decisions. Loss frames represent threatening situations (Jackson & Dutton, 1988). Individuals are expected to take greater risks to avoid losses than they are to secure gains (Dutton & Jackson, 1987). Prospect theory research representing conditions of low control has shown that individuals are risk seeking under loss frames. Here it is argued that individuals operating under loss frames will also be risk seeking under conditions of high control.

Factors Influencing Perceived Control

Perceived control has been advanced as potential boundary condition limiting the effects of cognitive frames on risky decision making. This section is devoted to an initial attempt at exploring some of the potential influences on perceived control. Three possible sources of control are introduced. Consistent with general models of perceptions, it is argued that perceptions of control are influenced, in part, by characteristics of the perceiver (i.e., the decision maker), the task, and the perceiver's history of interaction with the task. Within each of these three domains, one or more key variables have been selected from the literature based on the contention that they represent some of the more likely sources of influence on perceived control in the situation to be studied. Locus of control is the perceiver characteristic. The task variable concerns the task's predictability as represented by the ambiguity of informational cues associated with the decision (i.e., cue ambiguity). Two variables stemming from the perceiver's interaction with the decision task will be considered. The first is the perceiver's knowledge about the task, including the meaning of relevant information and appropriate methods for incorporating the information to make a decision. The second is the perceiver's past performance history on the decision task. Each of these key variables is discussed below.

Locus of control. The concept of locus of control originated in Rotter's (1966) work on the effects of rewards on behavior. According to Rotter's theory, an individual's locus of control can be captured by a continuum ranging from internal to external. Individuals closer to the internal end of the scale perceive that events and outcomes are contingent upon their own personal behavior. In contrast, individuals characterized as more external perceive outcomes as contingent upon forces outside themselves (e.g., chance, luck, other individuals). Thus, locus of control is a personality characteristic representing the tendency to attribute causality either to oneself (i.e., internal) or to the external environment (i.e., external). In the present study, locus of control is expected to influence one's perceived control or one's perceived probability of making a correct decision. Because they have a tendency to believe that events are under their personal control, individuals who are more internal are predicted to perceive greater control over decision tasks than those who are more external. Internals are likely to think it more probable that they will make a correct decision regardless of the actual probability of making a correct decision. They are more likely than externals to see themselves as personally capable (Andrisani &

Nestel, 1976). Externals are likely to view the probability of correctly making a risky decision as contingent upon external forces that are beyond their personal control, very much like lotteries. Externals are predicted to believe making an accurate decision less probable.

Task knowledge. Task knowledge in the decision making context of interest refers to the decision maker's level of expertise on the information processing task. Concentrating on information processing tasks, expertise or task knowledge would be reflected in the extent to which the meanings of informational cues are understood, the extent to which relationships among cues are understood, and the extent to which the individual understands how the above information should be combined and utilized to make decisions. In terms of the risky decision making model, individuals with greater task knowledge are expected to experience greater perceived control over the probability of making a correct decision than individuals with low task knowledge. The more knowledgeable a person is regarding decision relevant information cues, the more likely that person is to feel a correct decision can be made (assuming that the person believes he or she is knowledgeable).

Baird and Thomas (1985) considered the effect of knowledge in their conceptual model of strategic risk taking. They argued that a decision maker's knowledge would have a positive impact on that individual's confidence. They further theorized that greater knowledge and confidence would result in greater strategic risk taking. Here the prediction is similar. High task knowledge is predicted to lead to increased perceived control, which ultimately results in greater risk taking.

Performance history. Performance history refers to an individual's pattern of results or outcomes resulting from previous decision making on a particular task. An individual's performance history captures all previous choice-outcome relationships. In order for performance history to impact upon an individual's perceived control for a subsequent decision, the individual must be aware of the performance history. That is, previous decisions must have provided the individual with feedback.

Positive feedback is strongly related to feelings of personal control (Averill, 1973). Furthermore, a positive performance history which demonstrates that previous choices have been correct, encourages future risk taking in order to obtain higher outcomes (Sitkin & Pablo, 1992). A similar effect has been demonstrated with gambling tasks involving actual monetary outcomes (Thaler & Johnson, 1990). Thaler and Johnson found that when their subjects' risky gambles resulted in gains, they were more likely to continue to take risks. The assumption of the present model is that if a positive performance history increases risk taking for a lottery-type task, it is even more likely to increase risk taking in an information processing task. In the latter task, high performance is likely to be attributed to meaningful personal and situational sources, thereby increasing perceived control. Thus, a positive performance history is expected to influence perceptions of control, ultimately leading to increased risk taking. Conversely a negative performance history is proposed to reduce feelings of control. Recall that the effect of low control on risk taking depends upon the decision frame. Individuals working under gain frames are likely to be more risk averse when perceived control is low. Individuals operating under loss frames are likely to take risks regardless.

Cue ambiguity. Cue ambiguity refers to the extent to which informational cues are clear or unclear in terms of their implications for making a correct decision. For instance, suppose the task is to decide whether or not prospective students should be accepted into graduate school. Assume that there are two relevant factors, grade point average and letters of recommendation. Applicant A has a 4.0 grade point average and glowing letters of recommendation. Applicant B has a 1.5 grade point average and uncomplimentary letters of reference. Clearly, Applicant A should be accepted and Applicant B should be rejected. In each case, the informational cues are unequivocal. Now consider Applicant C who has a 3.0 grade point average, one superb letter of recommendation, and two mediocre letters. It is more difficult to decide whether or not to admit Applicant C because the information is ambiguous.

Notice that the difficulty does not reside in the amount of information available. Ambiguity may be high even when there is an ample quantity of information. Ellsberg (1961) pointed out that ambiguous information reduces confidence at least as much as a lack of information. A cue can be ambiguous because its individual meaning is unclear or because it conflicts with other informational cues (Ellsberg, 1961). In the example above, for instance, Applicant C's 3.0 grade point average is ambiguous in itself because it is neither outstanding nor exceptionally poor. Applicant C's letters of recommendation are ambiguous because they conflict with each other. Furthermore, when the informational cues are combined they represent an ambiguous picture that makes decision making difficult.

In the present model of risky decision making, individuals faced with ambiguous cues are expected to perceive less control than decision makers confronted with unambiguous informational cues. Similar arguments have been made in the context of risk taking. Vlek and Stallen (1980), for example, argued that individuals are averse to ambiguity because it reduces control. Armelius (1979) examined the effect of cue ambiguity on confidence in making correct decisions. Armelius found that confidence in accurate decision making was a direct function of decision task predictability. In this study, predictability was defined as the certainty of the relationships among informational cues. Thus, the relationship between cue ambiguity and perceived control proposed here has both theoretical and empirical support.

Individual Level Hypotheses

The primary linkages in the risky decision making model depicted in Figure 2 have now been described. In addition, some potential influences on perceptions of control have also been considered. Before turning to team context issues and risky decision making, the relationships illustrated in Figure 2 will be summarized as formal hypotheses.

The model of Figure 2 shows a direct relationship between cognitive decision frame and decision riskiness. This linkage recognizes the main effect for framing, proposed and supported in the prospect theory literature. Recall that the nature of that effect is as follows:

H1: Decision frames have a direct effect on decision riskiness. Under conditions where alternatives are equal in subjective expected utility and unequal in risk, individuals presented with a gain frame will be more likely to select a less risky alternative than those presented with a loss frame. Under the same conditions, individuals presented with a loss frame will be more likely to select a riskier alternative than those presented with a gain frame.

Figure 2 depicts perceived control as a moderator of the relationship between decision frame and decision riskiness. In general, greater perceived control is expected to increase risk taking. Under conditions of high perceived control, decision riskiness is not expected to differ between gain and loss frames. Under conditions of low perceived control, prospect theory framing effects are predicted. That is, decisions should be more risk averse under gain frames and more risk seeking under loss frames.

H2: Perceived control will moderate the relationship between decision frame and decision riskiness. Specifically, risk seeking will be greater under loss frames than under gain frames when perceptions of control are lower. When perceptions of control are higher, there are no predicted differences for decision riskiness between gain and loss frames.

Finally, several factors are predicted to influence of perceived control. Individual and task characteristics are both included in the model.

H3: Across decisions, individuals with a more internal locus of control, greater task knowledge, and a more positive performance history will have higher perceptions of control than individuals with a more external locus of control, less task knowledge, and a more negative performance history. For specific decisions, individuals with less informational cue ambiguity will have higher perceived control than individuals with greater informational cue ambiguity.

RISKY DECISION MAKING IN THE TEAM CONTEXT

Individual level risky decision making is an interesting and significant topic in its own right. However, in the present study the individual level model also serves as the basis for considering risky decision making in the team context. As stated in the introduction, one of the major goals in developing a model of individual risky decision making was to apply it to decision making in teams. This chapter is devoted to that endeavor.

Team Versus Individual Decision Making

There are some definitional issues that must be addressed before the application of the individual model to risky decision making in the team context can be considered. It is important to understand the way teams are defined here, and how that definition differs from traditional definitions of "small groups." In order to contemplate the effects of team context issues on risky decision making, an understanding of the critical features that distinguish teams is essential. In the sections that follow, teams are defined and the key aspects of decision making in teams are described.

Teams defined. Much of the literature and research relevant to teams has been presented under the label of "small groups." As treated here, however, teams and groups are not synonymous. For present purposes, teams will be thought of as a qualitatively different from small groups. Not all small groups meet the particular criteria used here to define teams.

Small groups are typically defined as (a) a collective of two or more individuals who, (b) interact with one another, and (c) are interdependent in some way. McGrath (1984) has elaborated on this definition contending that small groups in real world settings must exist in some time frame. That is, a small group has a past, a present, and a future.

Teams share the four above characteristics with small groups but can be distinguished by several additional critical features. To begin, a key difference between small groups and teams is that interdependence in teams typically takes the form of differentiated and assigned roles (Dyer, 1984). That is, each team member performs a unique and specific function within the team. Differentiated roles are not a defining characteristic of small groups. Although small groups are also interdependent, that interdependence is not captured by unique roles among members.

Two other key features of teams are related to the notion of differentiated roles. Unlike small groups, teams exist expressly for some task oriented purpose (Ilgen, Major, Hollenbeck, & Sego, in press). Furthermore, in attempting to fulfill that purpose, team members have shared goals and objectives. These goals are usually explicit, and each team member typically has some level of awareness of these goals (Ilgen et al., in press). A team's task or purpose could be balancing a budget, flying an aircraft, or playing a basketball game. The compatible goal may be to cut the budget by ten percent, safely land the aircraft, or win the game. The differentiated roles within a team can be useful in helping the team realize the goals related to its purpose.

Coordinated behavior, a final distinguishing feature of teams, is also essential in order for a team to attain its objectives (Fleishman & Zaccaro, 1992). Although each team member performs specific tasks in accordance with his or her defined role within the team, individual members must also coordinate their performance on those tasks or bring their individual efforts together in some way to fulfill a common purpose (Fleishman & Zaccaro, 1992). This coordinated behavior is most instrumental in the achievement of the team members' shared goals.

Morgan, Glickman, Woodward, Blaiwes, and Salas (1986) provide a definition that seems to capture the essence of a team succinctly. They state that teams are, "distinguishable sets of two or more individuals who interact interdependently and adaptively to achieve specified, shared, and valued objectives." (p. 3) Their definition will be adopted here.

Hierarchical teams with distributed expertise. There are many varieties of teams that fit the definitional criteria provided above. A primary distinction among these teams, is the way decisions are made. For instance, in some teams each member participates in all aspects of the decision process and each assumes equal responsibility for the team's decision, reaching a final decision by consensus. Juries are a good example of this type of decision making team. Other teams use a democratic decision making process. In these teams, every member has an equal voice and decisions are reached by majority rule.

In hierarchical teams with distributed expertise, an individual decision maker, the team leader, has decision making responsibility. Subordinate members may have a voice in team decisions in that they may be able to make recommendations to the leader, but it is the team leader who is ultimately responsible for making the team decision. The distributed expertise distinction means that the knowledge (i.e., expertise) relevant to decision making is disbursed across team members. Each team member is an expert in some area of potential consequence to the decisions being made; no individual team member is expert in all aspects. A flight crew is a good example of this type of team. The flight captain is the team leader. He or she has ultimate decision making responsibility. Other members of the team, however, have critical areas of specialization and may contribute to the decisions that are made (e.g., the co-pilot, the navigational officer).

The present research is interested specifically in the decision making of leaders in hierarchical teams with distributed expertise. This type of team was chosen for two primary reasons. First, hierarchical teams are representative of the teams making critical decisions in a variety of applied settings (e.g., military command and control teams, top management teams, flight crews, surgical teams). Second, hierarchical teams represent the next logical step in a progression moving from the individual to the team level. Even though decision making takes place within a team context, it is still an individual, the team leader, who is actually making the decision. Since most of the work on risky decision making has been conducted at the individual level, the existing literature is more likely to apply to hierarchical teams than to other types of teams in which decisions are reached through dramatically different processes (e.g., democratic teams, consensus-seeking teams).

The brief description of hierarchical teams with distributed expertise is provided as background for considering the applicability of existing literature to leaders making decisions in that context. Further elaboration, however, will be necessary in developing a model of risky decision making applicable to the team context when there is distributed expertise. The requisite detail is provided in a later section.

Empirical Research: Application to Hierarchical Teams

The literature related to risky decision making at the individual level was reviewed in the first section of this proposal. The literature reviewed in this section is focused on risky decision making in a team context. A primary goal of this review is to evaluate the relevance of existing theoretical and empirical work for understanding the risky decision making of hierarchical team leaders. Two research domains address risky decision making in a team context, risky shift and prospect theory. Each literature is considered below.

Risky Shift

Most often in the literature, "risky shift" refers to the phenomenon which demonstrates that individuals advocate greater risk taking after participating in a group discussion. A smaller subset of research compares the riskiness of decisions made by individuals to the riskiness of a consensus decision made by the same group of individuals. The study of risky shift began with Stoner (1961) who found that business students opted for higher degrees of risk taking after participation in a group discussion than they had previously when working in private. Similar findings have been obtained using a variety of samples (see Clark, 1971; Pruitt, 1971; Vinokur, 1971b for comprehensive reviews).

Typically, subjects participating in risky shift research read a scenario in which they are asked to offer advice to a hypothetical person confronted by a choice dilemma. The choice is usually between a safe less attractive alternative and an uncertain more attractive alternative. The most widely used instrument in risky shift research is the Choice Dilemmas Questionnaire (CDQ), a paper and pencil measure consisting of 12 hypothetical situations like the one described above (Stoner, 1961). Risky shift research as a whole has been criticized for the extensive and almost exclusive use of the CDQ. While the lack of methodological variety has certainly been a concern, the instrument itself has also been criticized for presenting all scenarios in a positive frame (Bazerman, 1984).

Individual decisions. The majority of risky shift research focuses specifically on individual decisions before and after group participation. There has been considerable debate in the literature over the most appropriate theoretical explanation for the risky shift phenomenon. The major rationales advanced include: diffusion of responsibility (e.g., Wallach, Kogan, & Bem, 1964), familiarization (Bateson, 1966), and risk-as-a-value theories (Levinger & Schneider, 1969). The diffusion of responsibility argument contends that group participation induces risky shift because accountability for any negative consequences resulting from risk taking can be shared among group members, rather than by single individuals (e.g., Wallach, Kogan, & Bem, 1964). Familiarization theory argues that group discussion reduces uncertainty, thereby making individuals more comfortable with risky choices (e.g., Bateson, 1966). The risk-as-a-value explanation alleges that risk is a stronger cultural value than caution (e.g., Levinger & Schneider, 1969). In group settings, individuals are exposed to positions that are riskier than their own. According to the risk-as-a-value explanation, risky shift results because individuals attempt to be at least as willing to accept risk in their personal decisions as other people.

Although these theories constitute an interesting area of research, they are not particularly relevant to the issue of risky decision making in a team context. They focus on individual decision riskiness before and after group discussion. Leaders in hierarchical decision making teams must operate in the team context before, during, and after decision making. "Risky shift" seems to have been more popularized, but the decision making literature also offers considerable evidence for conservative shifts (e.g., Vinokur, 1971a; 1971b). These theories are also limited because although each can potentially explain risky shift, none of them can account for shifts toward caution.

Team decisions. The discussion in this section focuses on the small subset of research conducted under the rubric of risky shift that (a) describes team decision riskiness, and (b) attempts to explain both risky and cautious shifts. This theoretical and empirical work compares the riskiness of choices made by individuals to the riskiness of a consensus choice (i.e., one made by mutual agreement) made by the same individuals as a team (e.g., Hartnett & Barber, 1974; Neale, Bazerman, Northcraft, & Alperson, 1986). Relevant theories include: subjective expected utility (e.g., Vinokur, 1971a; 1971b), leadership/persuasion (e.g., Burnstein, 1969), group polarization (Lamm & Meyers, 1978; Meyers & Lamm, 1975), and group attenuation theories (e.g., Neale et al., 1986). Each is discussed below.

Subjective expected utility theory has been proposed to account for both risky and cautious shifts. Vinokur (1971a, 1971b) argued that new information raised in team discussion results in more accurate assessments of utility, which in turn, affect the riskiness of a team's decision. This explanation, labelled the informational influence hypothesis, was supported by data from a series of four empirical studies (Vinokur, 1971a). Subjects in each study worked on hypothetical choice problems independently first, then as members of four or five person groups. Results demonstrated that groups assessed utilities more accurately in a team context and that resulting choice shifts were appropriately more conservative or risky, depending upon whether initial individual utilities were too risky or conservative.

While the informational influence explanation is relevant for risky decisions made in a team context, it is limited to certain situations. Not all team discussions result in the consideration of new information. On the contrary, more recent empirical research suggests that discussions tend to focus on information that team members hold in common and information that is consistent with initial preferences (Stasser & Titus, 1985).

Originally, leadership or persuasion theory focused solely on risky shift. Proponents of this theory claimed that high risk takers are more persuasive in group discussions, resulting in a general shift toward risk (Collins & Guetzkow, 1964; Marquis, 1962). Empirical evidence, however, refuted the theory in this form (see

Clark, 1971). The revised leadership/persuasion explanation attempts to account for both risky and cautious shifts. The updated theory contends that the most confident individual exerts the most influence in a discussion (Burnstein, 1969). Therefore, whether a risky or cautious shift occurs depends on the orientation of the most confident member.

Group polarization theory also accounts for both risky and cautious shifts. According to this hypothesis, the average position or the position most commonly held by individuals will be reinforced and become more pronounced in group discussion (Lamm & Meyers, 1978; Meyers & Lamm, 1975). Figure 4a provides an illustration of the polarization hypothesis. Risky shift occurs when the average individual stance on risk is at about Point C. It is posited that group discussion polarizes this position, and the team makes a decision in the more extreme direction toward Point D. A cautious shift is evidenced when the average individual attitude toward risk is at about Point B. Here, polarization creates a shift toward Point A.

Recently, a phenomenon opposite to group polarization, group attenuation, has been proposed to account for choice shift. The group attenuation notion contends that cognitive framing is a critical variable in understanding choice shift (Hartnett & Barber, 1974). Advocates of the group attenuation hypothesis believe that individuals' initial risk orientations are greatly influenced by the way the choice problem is presented or framed (Neale et al., 1986). Group discussion is thought to encourage the consideration of multiple frames, thereby limiting the effects of the original frame on team decisions. In addition, discussion is expected to direct

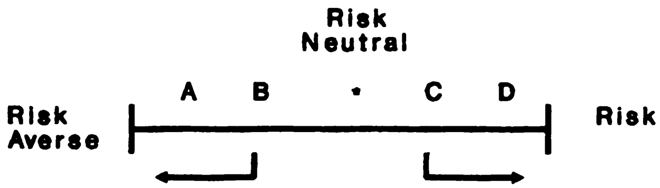


Figure 4a: Illustration of group polarization effects

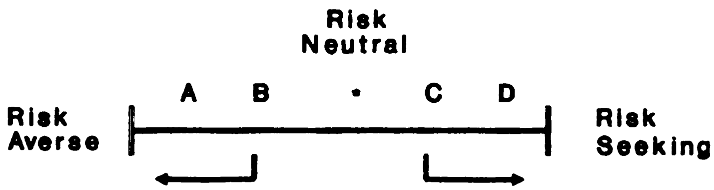


Figure 4b: Illustration of group attenuation effects

attention away from frames and focus it on more relevant aspects of the decision problem (Neale et al., 1986). The point of this theory is not that the team adopts a frame that overpowers initial individual frames. On the contrary, the theory argues that potential framing effects are diffused and less relevant in a team context. As a result, teams' decisions are expected to be attenuated relative to individuals' more extreme decisions that are heavily influenced by frame.

Figure 4b is useful in illustrating the expected group attenuation effects. Relying on prospect theory research, the contention is that, under gain frames, the average riskiness of individual decisions is represented by Point A. Under loss frames, Point D reflects the average riskiness of individual decisions. Team decisions are expected to show attenuation, as attention is directed away from the decision frame. Thus, individuals originally at Point A should end up at Point B as a team after group consensus, reflecting a risky shift. Individuals originally at Point D should show a cautious shift toward Point C. Note, however, that teams are still relatively risk averse under gain frames and risk seeking under loss frames.

Empirical results relevant to the attenuation hypothesis have been mixed. Using a negatively framed version of the CDQ, Hartnett and Barber (1974) found that teams were even more risk seeking than individuals, supporting polarization and refuting attenuation theory. The results of Neale et al. (1986), however, were supportive of attenuation theory. Under positive or gain frames, teams selected riskier alternatives than individuals. Under negative or loss frames, teams opted for less risky alternatives than individuals. Rather than the CDQ, Neale et al. employed adaptations of Kahneman and Tversky's (1979) prospect theory problems. Referring back to Figures 4a and 4b may help reconcile these findings and the differential predictions of polarization and attenuation theories.

The direction of the shift in risk when team and individual decisions are compared, appears to be constrained by the initial individual average. For example, if the average is represented by point A there is not much room to show a shift toward greater caution. A shift toward increased riskiness is much more likely. Similarly, if the individual average is represented by Point D, there is less chance to show a risky shift than a cautious shift. Results under these conditions would appear to support attenuation theory.

Now consider Points B and C as indicators of the average risk of individual decisions. If individuals are initially risk averse at Point B, it appears as though a team decision could shift risk in either direction. However, assuming that prospect theory does account for choice shift as the proponents of attenuation theory claim (Bazerman, 1984; Neale et al., 1986), a shift toward point A is much more likely than a shift toward Points C and D. The rationale is as follows. The average of individual decisions should be risk averse under gain frames. To remain consistent with the gain frame, the team's decision can only move to Point A. There is no empirical or theoretical evidence to suggest that teams' reactions to frames should be the opposite of individual reactions. The same logic would suggest a greater likelihood of a choice shift from Point C to Point D, compared to the likelihood of a shift from Point C toward Points A and B.

It appears as though the group polarization and group attenuation theories use similar logic to arrive at contradictory conclusions. In actuality the theories are not inconsistent, they simply describe two different potential sets of circumstances. The within groups nature of the risky shift studies comparing individuals to teams makes drawing conclusions about the relative riskiness of team decisions compared to individual decisions difficult. For present purposes, the primary usefulness of both theories comes from demonstrating that the riskiness of team decisions does not differ radically from the riskiness of individual decisions. On the basis of the evidence cited above, it appears that, regardless of whether team decisions become polarized or attenuated, they remain consistent with prospect theory framing predictions, just as individual decisions do.

Conclusions. The majority of risky shift research is concerned with individual decisions and has little relevance for risky decisions made in a team context (e.g., Bateson, 1966; Levinger & Schneider, 1969; Wallach et al., 1964). The applicability of the work examining risk as it varies across individual and team decisions to hierarchical teams with distributed expertise must be considered cautiously. Risky shift research has focused exclusively on consensus decisions made by teams. Even though the contribution is still minimal, the group polarization and group attenuation theories have the greatest potential relevance to decision making in hierarchical teams with distributed expertise.

The polarization and attenuation theories both suggest that decision frames operate in both individual and team decision making contexts. Since an individual (i.e., the leader) makes the decisions in a hierarchical team, one might expect decision frames to have a similar effect. The risky shift literature suggests that prospect theory framing effects can occur in collectives. Empirical research attempting a more direct test of prospect theory in the team context is discussed in the section that follows.

Prospect Theory Framing Effects

An argument was made above for the existence of framing effects in team decision making contexts. Using the polarization argument, some have even contended that the effects of framing are likely to be more pronounced in teams (e.g., Whyte 1989). The problems inherent to a within groups comparison of the riskiness of individual and team decisions were previously discussed. A few studies have attempted to directly assess framing effects on risky decision making in team contexts. Those studies are described below.

Schurr (1987) purported to study the effects of framing on risky team decisions involving a bargaining task. However, in my opinion, Schurr failed to accomplish this objective because he did not use teams in his research. Each participant played the role of a commodity broker. Individual "brokers" assigned to different teams negotiated with one another for a specific quality level for each commodity. The goal was to maximize net profit. The winning team was determined by totaling the net profit associated with each individual transaction.

The study's results were supportive of prospect theory predictions for both gain and loss frames. However, in my opinion, the results cannot be interpreted at the team level. Schurr's intention was to study risky team decision making, yet individuals worked on the bargaining task independently. Subjects were simply told that they belonged to one team or the other and that individual bargaining profits would be combined to measure team performance. The definition of a team utilized here requires that individual team members interact. The subjects in Schurr's study did not interact with assigned teammates at all. Consequently, Schurr's results do not speak to risky decision making in a team context. They do, however, demonstrate that the effects of framing on complex decision making tasks are consistent with results obtained using simple choice tasks.

Schurr's study included a unique conceptualization and operationalization of risk and a complex decision task. Tversky and Kahneman's (1981) work and most of the empirical research on prospect theory has focused on whether individuals select a certain or a risky alternative. The bargaining task allowed Schurr to explore degrees of risk taking on a continuum of risky outcomes. In addition, decision makers were actively engaged in a decision task substantially more complex than the typical prospect theory choice problem. Thus, Shurr's study demonstrated the effects of framing on risky decision making for individuals working on a task more complex and engaging than the traditional binary choice task. However, this research does not fill the need for empirical work related to the team decision making context.

McGuire, Kiesler, and Siegel (1987) studied the effects of framing on risky decision making in face-to-face and computer mediated groups using a complex budgeting task. In addition to comparing risky decision making using the two modes of communication, this study sought to test explicitly the notion that individual level framing effects become more pronounced in a team context. The budgeting task consisted of four hypothetical scenarios (two gain and two loss) which each offered two investment alternatives. Each individual was asked to first indicate a preference between alternatives privately, before attempting to reach a consensus decision with team members.

Results related to the first phase, the individual decisions, did not consistently conform to prospect theory predictions. Therefore, it was not possible to determine if individual level framing effects were exacerbated at the team level. McGuire et al.'s explanation for the lack of conformity to prospect theory predictions was that some subjects misunderstood the decision task. Another possibility is diffusion of treatments. Research at the individual level has shown that the effects of initial frame persist, even when a new frame is presented (e.g., Levin, Johnson, & Davis, 1987; Loke, 1989). Nonetheless, decision behavior in face-to-face teams did conform to prospect theory predictions. Framing, however, had no effect in the computer mediated teams. Under both modes of communication, the best predictor of a team's final decision was the judgment or position first advocated.

This study's results are a bit difficult to interpret. The differential findings related to framing in the computer mediated and face-to-face conditions could not be adequately explained. Since teams were required to reach consensus, different theories derived from the consensus literature were offered to explain the "first position advanced" results (e.g., the individual with the most influence states a position first, individuals conform to the voiced alternative). However, none of the explanations could be verified. Essentially, this study demonstrated the existence of framing effects in a team context. It also demonstrated that the effects are not consistent and must be subject to certain boundary conditions and moderating influences. Unfortunately, this particular piece of research offers few clues as to what the limiting conditions and moderators may be. It simply identifies the need for further research using computer mediated technologies.

One final study examined the effects of actual loss on risky decision behavior in a team context. Kameda and Davis (1990) examined the effects of individual loss on subsequent decision making as part of a team. Using a gambling task which offered actual monetary outcomes, they found that when placed in a team, individuals who had experienced a loss wanted to make riskier choices than individuals who had not experienced loss. However, these individuals were not able to influence nonloss members and were overridden by the majority. In this instance, team membership prevented risky decision making largely because of majority rule. This study shows that loss in an individual's performance history does not necessarily determine subsequent team decisions made on the basis of majority rule. The implication, however, is that if team members have similar performance histories the impact on subsequent risky decisions may be great. In the discussion of individual level risky decision making presented earlier, performance history was expected to have a direct impact on perceived control.

The research reviewed above dealt with framing effects for teams in which decisions were made by consensus (i.e., McGuire et al., 1987) and majority rule (i.e., Kameda & Davis, 1990). Recall, however, that the present research will focus on hierarchical teams with distributed expertise in which the team leader makes the team decision. Therefore, a key issue is predicting the impact that the introduction of "hierarchy" is likely to have on observed framing effects. In a hierarchical team, the most relevant frame is likely to be that of the decision maker, the team leader. The research of Kameda and Davis (1990) suggests that the leader's performance history will have considerable influence on the riskiness of the decisions made. The team decisions in their study were consistent with majority rule. The leader of a hierarchical team, however, is not required to accommodate the majority and can make decisions on the basis of his or her own perceptions of the frame.

The sparse research conducted to date has detected the framing effects predicted by prospect theory in team contexts, but not consistently. There is an obvious need for team research utilizing complex and engaging decision tasks (e.g., Schurr, 1987). There is also some indication that computer mediated technologies should be explored further (e.g., McGuire et al., 1987). These needs will be addressed as a model for risky decision making in hierarchical teams is developed. First, however, one additional literature will be considered for application to risky decision making in hierarchical teams. Since team leaders bear decision making responsibility in hierarchical teams, selected literature on leader decision making will be discussed in the following section.

Leader Decision Making

The Vroom-Yetton contingency model of leader behavior is probably the most widely known model of leader decision making in the organizational literature. It is also indirectly applicable to present research purposes. Developed by Vroom and Yetton (1973), the model specifies the type of decision making strategy that should be used by a leader, based on an assessment of the situational demands. More specifically, the model outlines seven rules to be used in choosing among five decision making processes. The rules are broadly divided between two categories, those that protect the quality of the decision and those that protect the acceptance of the decision (see Table 1). The five decision making processes enumerated in Table 2 range from making a completely autocratic decision (i.e., the leader decides alone on the basis of information available at a given point) to making a totally participative decision (i.e., subordinates generate and/or consider alternatives and the leader accepts any agreed upon decision).

The Vroom-Yetton model provides a leader with a useful tool that may be used in determining the best method of making a decision under a given set of circumstances. Thus, in one sense, the model is more prescriptive than descriptive. The model developed here is meant to be a description of risky decision making in a hierarchical team context. Even though there is not a perfect marriage between the goals of the Vroom-Yetton model and those of the present model, the rules offered by the Vroom-Yetton model can serve as catalysts for thinking about the different

Table 1

Rules that Protect Decision Quality

1. The Leader Information Rule: If the quality of the decision is important and the leader does not possess enough information or expertise to solve the problem by himself, then AI is eliminated.

2. The Goal Congruence Rule: If the quality of the decision is important and subordinates are not likely to pursue the organization goals in their efforts to solve this problem, then GII is eliminated.

3. The Unstructured Problem Rule: In decisions in which the quality of the decision is important, if the leader lacks the necessary information or expertise to solve the problem by himself, and if the problem is unstructured, the method of solving the problem should provide for interaction among subordinates likely to possess relevant information. Thus, AI, AII, and CI are eliminated.

Rules that Protect the Acceptance of the Decision

4. The Acceptance Rule: If the acceptance of the decision by subordinates is critical to effective implementation and if it is not certain that an autocratic decision will be accepted, AI and AII are eliminated from the feasible set.

5. The Conflict Rule: If the acceptance of the decision is critical, an autocratic decision is not certain to be accepted and disagreement among subordinates in methods of attaining the organizational goal is likely, the methods used in problem solving should enable those in disagreement to resolve their differences with full knowledge of the problem. Accordingly, under these conditions, AI, AII, and CI, which permit no interaction, are eliminated.

6. The Fairness Rule: If the quality of the decision is unimportant but acceptance is critical and not certain to result from an autocratic decision, it is important that the decision process used generate the needed acceptance. The decision process used should permit the subordinates to interact with one another and negotiate over the fair method of resolving any differences with full responsibility on them for determining what is fair and equitable. Under these circumstances, AI, AII, CI, and CII are eliminated.

7. The Acceptance Priority Rule: If acceptance is critical, not certain to result from an autocratic decision, and if subordinates are motivated to pursue the organizational goals represented in the problem, then methods offering equal partnership in the decision-making process can provide greater acceptance without risking decision quality. Thus, AI, AII, CI, and CII are eliminated.

Adapted from Vroom and Jago (1978).

Table 2

Decision Processes

AI You solve the problem or make the decision yourself using the information available at present.

AII You obtain necessary information from subordinates, then decide on a solution to the problem yourself. You may or may not tell subordinates the purpose of your questions or give them any information about the problem. The input provided by them is clearly in response to your request for specific information. They do not play a role in the definition of the problem or in generating or evaluating alternative solutions.

CI You share the problem with the relevant subordinates individually, getting their ideas and suggestions without bringing them together as a group. Then you make the decision. This decision may or may not reflect your subordinates' influence.

CII You share the problem with your subordinates in a group meeting. Your obtain their ideas and suggestions. Then, you make the decision, which may or may not reflect your subordinates' influence.

GII You share the problem with your subordinates as a group. Together you generate and evaluate alternatives and attempt to reach agreement (consensus) on a solution. Your role is much like that of a chairman. Your can provide the group with information or ideas that you have but you do not try to "press" them to adopt "your" solution and are willing to accept and implement any solution that has the support of the entire group.

Adapted from Vroom and Jago (1978).

methods a leader of a hierarchical team may use to make the team's decisions and the conditions under which certain methods are more likely to be utilized.

A list of different leader decision strategies proposed by the Vroom-Yetton model are shown in Table 2. Although the individual strategies as stated are not directly relevant to leaders in hierarchical teams, taken as a whole they do provide some indication of the range of potential methods available to a leader making a team decision. For instance, a leader in a hierarchical team with distributed expertise may choose to obtain information from subordinates and make a decision on the basis of that information alone. At the other end of the continuum, the leader may rely solely on the recommendations of subordinate team members in making a decision. Again, the taxonomy of decision processes presented in Table 2 is not necessarily applicable to hierarchical teams as specifically stated, but it can serve as a heuristic for thinking about the way decisions are made.

The list of rules for determining decision strategy provided in Table 1, may be helpful in considering differential decision making strategies under gain and loss frames, to the extent that they describe characteristics of the two conditions. For instance, the Acceptance Priority Rule describes conditions where support for a decision is necessary and unlikely, conditions more likely to exist under a loss frame than a gain frame. When there is only potential to lose the team's existing outcomes (i.e., loss frames) acceptance may be more important as compared to a situation in which there is only potential to gain additional outcomes (i.e., gain frames). Under these circumstances the Vroom-Yetton model recommends a leader decision strategy that relies heavily on subordinates. In the present context, that could mean relying more on subordinate judgements than raw informational cues. The Fairness Rule, which suggests the same type of decision strategy as the Acceptance Priority Rule, also seems likely to be invoked under a loss frame.

The Vroom-Yetton model has the potential to provide insight into how decisions are made in a team context. The empirical literature based on the model is also encouraging. First, research has shown that the five decision processes outlined by the model do result in predicted effects on decision quality and decision acceptance (Field, 1982; Vroom & Jago, 1978). In addition, leaders report that their own decision making practices conform to the decision making processes recommended by the model (Field & House, 1990). Finally, the rules for choosing a decision strategy are perceived as appropriate and valid, at least by leaders (Heilman, Hornstein, Cage, & Herschlag, 1984).

In the section that follows, a model of risky decision making in the team context is developed. The model draws on the literatures that consider risky decision making in individual and team contexts. The model also utilizes the leader decision making literature. The specific contributions of each literature will become more apparent as hypotheses related to decision making in the team context are derived.

RISKY DECISION MAKING IN HIERARCHICAL TEAMS

A primary goal of the present research is to study cognitive framing effects and their boundary conditions in the team decision making context. In the preceding section, literature with potential relevance to comprehending risky decision making in hierarchical teams was explored. The review of the risky shift and "team" level prospect theory literatures demonstrated a general paucity of research focused on risky decision making in the team context. No theoretical attention has been paid specifically to risky decision making in hierarchical teams, even though this type of team represents the next logical step in a progression moving from the individual to the team level. The Vroom-Yetton model of leader decision making was reviewed, demonstrating some indirect linkages to the present research.

Hierarchical Decision Making Teams with Distributed Expertise

A preliminary definition of hierarchical teams with distributed expertise was provided previously. However, a more detailed description is required to begin developing a model of risky decision making for leaders in hierarchical teams. In the sections that follow, both the characteristics of hierarchical teams in general and the more specific characteristics of the hierarchical teams of interest here are discussed.

General characteristics. Hierarchical decision making teams have three primary characteristics: status differences (i.e., hierarchy), distributed expertise, and a communication structure (Ilgen et al., in press). In a hierarchical team, members do not have equal status. In the simplest case, there are two levels to the hierarchy, leader and subordinates. The present research will focus on teams where status among subordinates is equal, but this is not a definitional characteristic of all hierarchical teams. The leader has ultimate decision making responsibility. All members of the team (i.e., the leader and each subordinate) are subject to the consequences of the leader's decision. Thus, unlike an individual decision maker, the team leader is accountable to others. The subordinates, all of whom have lower status than the leader, may contribute to the decision by offering the leader recommendations. That is, subordinates may suggest that the leader make a certain decision. Whether or not subordinate judgments are taken into account in making a final decision, however, is at the discretion of the leader. Brehmer and Hagafors (1986) described this type of hierarchical decision making structure as "staff decision making."

As discussed in a previous section, teams structured on the basis of distributed expertise have clearly defined and differentiated roles. Each team member is considered an expert in certain aspects of the decision task and is responsible for attending to those aspects. As a result, no individual team member, including the leader, is likely to be knowledgeable in all aspects of the decision task. To a large extent, expertise is determined by the allocation of information across team members. Teams in which each member has access to all relevant information have redundant structures. They are not structured according to distributed expertise. In teams with distributed expertise, members have direct access to some information relevant to their areas of expertise, but they must interact and communicate with other members to have complete information. Thus, decision making in a team context has process costs (i.e., required interactions) that are not necessary for individual decision makers.

The final characteristic, communication structure, is very important. A team's communication structure defines which members may communicate directly and which are linked only indirectly. In many cases, each member of a team can communicate directly with every other member of the team. However, it is also possible for communication to be more limited. For example, subordinates may only be able to communicate with one another by going through the leader.

Specific characteristics. The decision making task is described in detail in the method section, however, to grasp the implications of this particular information processing simulation for the team model, some of the features must be mentioned here. In the present research, each experimental condition is comprised of four-person teams (i.e., a leader and three subordinates) that make decisions under a hierarchical structure with distributed expertise. Subordinates have direct access to an equal number of informational cues, but must communicate with one another in order to have complete information about their areas of expertise. The leader has direct access to some, but not all informational cues. The leader, however, knows which team members have direct access to which informational cues. The communication structure will be such that each team member can communicate with all others. In each case, subordinates will be able to provide recommendations to the leader. Responsibility for the team's decision, however, is the leader's.

Critical Features of the Team Context

Great care must be taken in applying the individual model of risky decision making in order to understand risky decision making in the team context. The previous chapter assessed several literatures to determine their relevance for risky decision making in the team context. The definitional characteristics of teams in general and hierarchical teams with distributed expertise in particular have also been discussed. The remaining objective is to distinguish those critical features of the team context that are likely to have implications for the riskiness of decisions made in teams.

Since the present research is expressly interested in the context created by hierarchical teams with distributed expertise, the team context issues that may influence the team leader's decisions are the focus. Decision cues, the decision making process, and decision outcomes in a team context are substantially different from those in an individual decision making context. Each of these aspects is considered below.

Decision Cues

Individual decision makers process informational cues in order to reach a decision. Team leaders also process informational cues, but in addition they may often have recommendations from other team members to consider. In essence, recommendation cues are suggestions or judgments offered to influence the team leader's decision.

Recommendation cues are qualitatively different from informational cues. They are evaluative rather than objective. The recommendations can vary in their accuracy. Taken collectively, the recommendations offered by subordinate team members can vary in their consistency (i.e., individual subordinates may make different recommendations). One may think of recommendation cues as "active" in that the cue providers (i.e., subordinate team members) are able to respond to the team leader. All of these qualities make using recommendation cues different than using informational cues to make a decision.

For instance, a leader may assess the quality of recommendation cues before using them. The recommendation cue can be accurate or inaccurate, as can the leader's evaluation of it. If a team leader receives conflicting recommendations, using the cues becomes even more problematic. There may be repercussions resulting from using one subordinate's recommendation instead of another's. The way a leader handles recommendations provided for one decision may affect the type of recommendations offered for future decisions.

Specific hypotheses regarding recommendation cues are provided in a subsequent section. The primary point here is that recommendation cues are unique to the team decision making context. Such cues are not relevant for individual decision makers acting alone.

Decision Making Process

The notion of distributed expertise was considered previously. Hierarchical teams with distributed expertise are structured in such a way that the decision maker in that context is, in a sense, "dependent" on subordinate members. By definition, distributed expertise means that no single team member, including the leader, is expert in all areas relevant to the decision task. Instead, the expertise is disbursed among team members. A team leader, then, must rely on subordinate members to provide and interpret information relevant to their particular areas of expertise. An individual decision maker is not dependent upon others in this way. This is another way in which the team context of interest here differs from the individual decision making context.

Decision Outcomes

The leader of a hierarchical team with distributed expertise may be dependent upon subordinate members for their expertise, but subordinate members are also, in a sense, dependent on the team leader. The team leader has ultimate decision making authority. The leader's decision and all its ramifications stands for the entire team. Thus, any outcomes associated with the leader's decision apply not only to the leader, but to all members of the team.

For an individual decision maker, a decision has only individual consequences. In the team context, a decision has consequences for others. These are individuals upon whom the leader must rely, individuals who may respond and react to the leader's decision and its outcomes. Thus, the implications of a decision are different for a team leader. There are potential costs and benefits associated with the decision that are not relevant for an individual decision maker.

These are the type of context issues that may have implications for the decision making of a leader in a hierarchical team. These factors distinguish the team decision making context from the individual decision making context. This is not to say that decision making in a team context is radically different from individual decision making, in all respects. As the team context model is developed in the following section, the ways in which individual and leader decision making are similar and different will be elaborated more fully.

The Team Context Model of Risky Decision Making

The central focus of the model of individual risky decision making developed previously was the hypothesized moderating effect of perceived control on the relationship between cognitive decision frames and decision riskiness. Perceived control is also proposed as moderator of the same relationship in the model developed for the risky decision making of team leaders. However, in elaborating and distinguishing the team leader model, it is also important to consider the unique factors that may moderate the relationship between decision frames and decision riskiness only in the team context. Two such moderators, need for affiliation and cohesiveness, are advanced below following the discussion of perceived control for team leaders.

Moderators in the Team Context

Perceived control. One reason for the consideration of individual risky decision making was to provide a basis for the development of a model relevant to risky decision making in hierarchical teams. The core of the individual model is composed of two key linkages. The first is the relationship described by prospect theory, the linkage between cognitive decision frame and decision riskiness. The second is the moderating effect of perceived control on the relationship between decision frame and decision riskiness.

This core serves as a starting point for the team context model of risky decision making. Framing effects have been demonstrated at the team level (e.g., McGuire et al., 1987) and are expected to persist for decisions made in a hierarchical team context. To reiterate, team leaders are expected to be risk averse under gain frames and risk seeking under loss frames. There is some suggestion in the literature that framing effects may be more pronounced for teams than for individuals (e.g., Whyte, 1989). This is largely an empirical question that can be tested.

There is also some indication that the leader's perceived control may have a significant impact on the riskiness of team decisions (e.g., Burnstein, 1969). The predicted moderator effect can be tested empirically, but there is less chance of detecting it in the team context. A team leader's situation is substantially different from that of an individual decision maker. The leader's perceptions of control are likely to be affected by the team context. The leader has ultimate decision making responsibility and the outcomes of those decisions affect others. Subordinates are likely to react to the outcomes they receive. They may have advice for the leader, in addition to the capability to express their satisfaction or dissatisfaction with the decisions a leader makes. Essentially, the team context may create "noise" not present at the individual level. Therefore, even given equal levels of power, it is likely to be more difficult to detect a moderator effect in the team context. The nature of perceived control's moderator effect in the individual model (see Figure 2) is also hypothesized to apply in the team context model.

Need for affiliation. Need for affiliation is an individual difference variable that was not included in the individual model of risky decision making. The need for affiliation, along with the need for achievement and the need for power, comprise the trichotomy of needs that drive human behavior according to McClelland's theory of human motivation (e.g., McClelland, 1961; 1975; McClelland & Winter, 1969). The need for affiliation refers to an individual's desire to be liked by others. This trait seems to be particularly relevant for leader's making risky decisions in a team context.

Previous research has shown that leaders (e.g., effective managers) tend to have a particular motive pattern. Of most importance for present purposes, is the finding that effective leaders tend to have a low need for affiliation coupled with a high need for achievement (McClelland & Boyatzis, 1982). Apparently a lower need for affiliation allows a leader to make and execute important and sometimes unpopular decisions without being hampered by concern about being liked by others. A leader in a hierarchical team faced with a risky decision is responsible for the outcomes of subordinate team members. The decisions the leader makes affect those outcomes. A leader who has a higher need for affiliation is more likely than a leader lower in the need for affiliation to try and make decisions that satisfy subordinates.

According to the threat literature, people perceive potential gains as opportunities and potential losses as threats (Dutton & Jackson, 1987; Jackson & Dutton, 1988). A leader with a high need for affiliation is expected to take advantage of opportunities by securing certain gains for team members. Leaders higher in the need for affiliation are also expected to thwart threats to the team by making every effort to avoid the loss of existing outcomes. Stated in terms of risky decision making under cognitive frames, leaders with a higher need for affiliation are expected to be risk averse under gain frames and risk seeking under loss frames. On the other hand, since leaders lower in the need for affiliation are supposed to be more effective leaders (McClelland & Boyatzis, 1982) they are more likely to focus on maximizing outcomes regardless of decision frame. Specifically, leaders lower in the need for affiliation are predicted to make more risk seeking decisions (i.e., outcome maximizing decisions) regardless of the cognitive frame (i.e., loss or gain). The nature of the moderating relationship is shown in Figure 5.

Cohesiveness. Cohesiveness is another construct that is unique to risky decision making in the team context. Since cohesiveness is a team characteristic, it was not relevant to the individual level model. The problems associated with defining cohesiveness are well documented (Mudrack, 1989). Like many constructs in the psychological literature, the term cohesiveness has been defined in so many ways and used with such generality that it has become virtually meaningless in many contexts. Nonetheless, the problem cannot be solved by coining a new term in an attempt to avoid the "baggage" associated with the label, cohesiveness. Instead, the original and

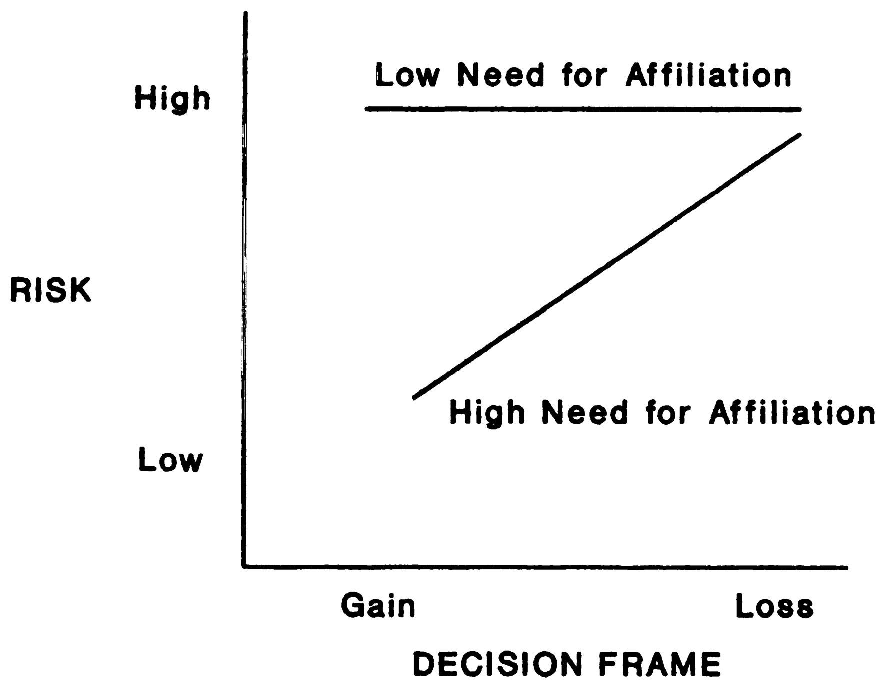


Figure 5: Hypothesized moderating effect of need for affiliation

most relevant definition of cohesiveness will be employed. Cohesiveness was originally and is still most frequently defined as attraction to the group, or in this case, attraction to the team (Libo, 1953; Pepitone & Kleiner, 1957; Van Bergen & Koekebakker, 1959).

Empirical research has shown that cohesiveness is related to a number of important outcome variables. For example, several laboratory studies have found a positive relationship between cohesiveness and performance (e.g., Bakeman & Helmreich, 1975; Bird, 1977; Dorfman & Stephan, 1984; Hoogstraten & Vorst, 1978; Zaccaro & McCoy, 1988), a relationship also supported in a recent meta-analysis (Evans & Dion, 1991). Cohesiveness is also positively related to more affective outcomes, such as satisfaction (Dailey, 1978; Dobbins & Zaccaro, 1986) and perceived social support (Griffith, 1989).

In the empirical study most directly relevant to the present research purposes, Yinon & Bizman (1974) examined the relationship between cohesiveness and risk taking. Their study employed three-member teams in which one individual was responsible for the making the team's decision. They found that decision makers in more cohesive teams made less risky decisions than decision makers in less cohesive teams. They argued that decision makers in highly cohesive teams had more to lose socially by subjecting their teams to failure. Thus, they tended to be more risk averse. On the other hand, they contended that a decision maker in a less cohesive team could only improve the team's circumstances through achieving successes (i.e., maximizing outcomes). Therefore these decision makers behaved in a more risk seeking manner.

Based on Yinon and Bizman 's (1974) results, the present research will examine the interaction between cohesiveness and cognitive decision frames in predicting decision riskiness. Leaders of highly cohesive teams should be motivated to avoid failure. Therefore, under gain frames they are likely to be risk averse. Avoiding failure under loss frames may mean that they cannot accept the certain loss. Thus, leaders of highly cohesive teams are likely to be risk seeking under loss frames. Leaders of less cohesive teams may be more concerned with maximizing outcomes and less concerned with maintaining attraction bonds. Thus, leaders of less cohesive teams are predicted to make more consistently risk seeking decisions regardless of decision frame. The moderating effect of cohesiveness is depicted in Figure 6.

The inclusion of cohesiveness in the team context model raises a measurement issue that was not pertinent until this time. There are several ways to measure the team characteristic, cohesiveness. One way would be to take a measure of cohesiveness from each team member and aggregate (i.e., average) those ratings. Another way would be to decide which member is most representative of the team and use his or her rating of cohesiveness in the analyses. One other method, the one used in this study, is to consider the hypothesis and choose the measure that seems most relevant. In this case, cohesiveness is expected to impact on the relationship between frame and the riskiness of decisions. Since the decisions are made by the

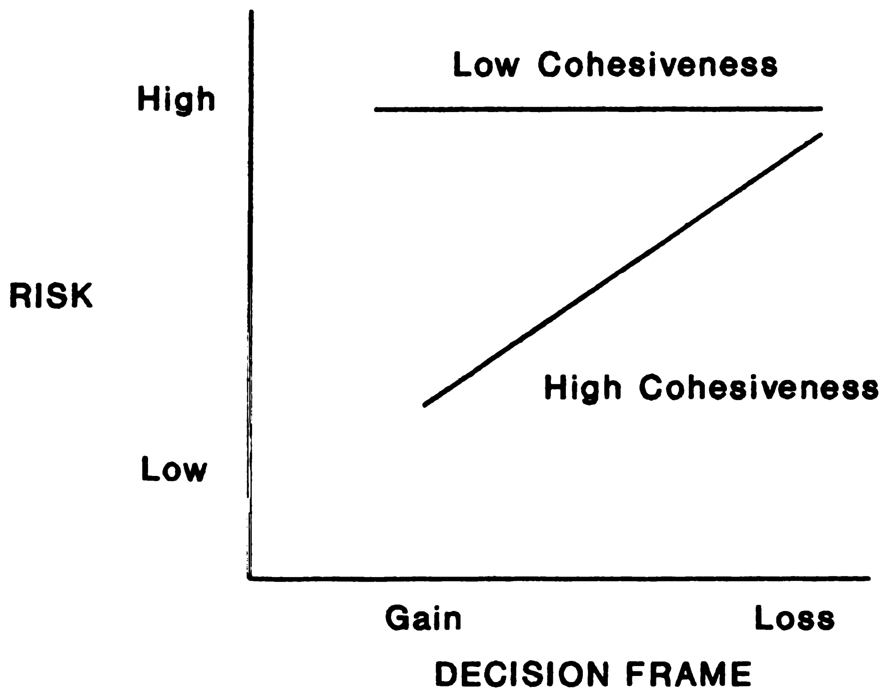


Figure 6: Hypothesized moderating effect of cohesiveness

team leader, the leader's rating of cohesiveness is used. Cohesiveness is conceptualized as attraction to the team. Given the hypothesis, the leader's attraction to the team seems most germane.

The Team Context Model

Figure 7 shows the direct linkage from cognitive decision frame to decision riskiness and the three proposed moderators of that relationship: perceived control, need for affiliation, and cohesiveness. Recall that under gain frames leaders with higher perceived control are expected to make riskier decisions than those with lower perceived control. Leaders are expected to be consistently risk seeking under loss frames, regardless of perceived control. Leaders with a lower need for affiliation are predicted to make more risk seeking decisions (i.e., outcome maximizing decisions) regardless of the cognitive frame (i.e., loss or gain). The decisions of those with a higher need for affiliation are expected to conform to the predictions of prospect theory (i.e., risk seeking under loss frames and risk averse under gain frames). The decisions of leaders in more cohesive teams are also expected to conform to prospect theory predictions. Leaders of less cohesive teams are predicted to make more consistently risk seeking decisions under both gain and loss frames. Figure 7 captures the basic model of team leaders' risky decision making. To clarify measurement considerations, a superscript is attached to each variable indicating whether that variable is measured at the decision (D) or the individual (I) (i.e., team leader) level.

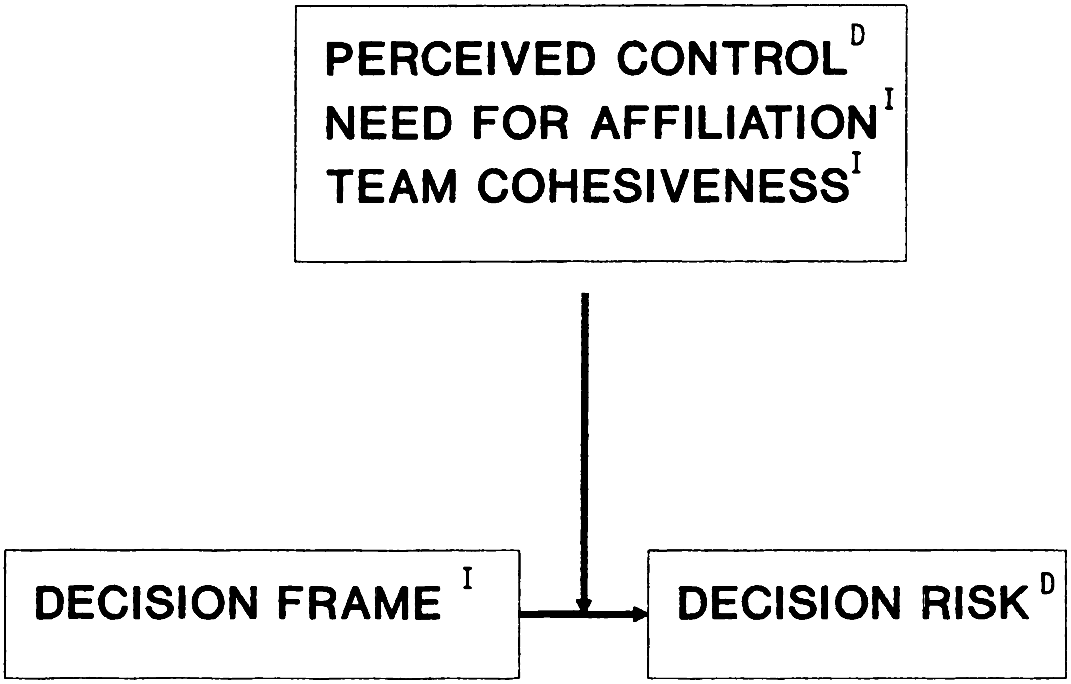


Figure 7: Primary model of risky decision making in a team context

Predictors of Leader Perceived Control

At the individual level, predictors of perceived control were considered in the model of risky decision making. The team context model is much too preliminary for anything more than a speculative consideration of such factors. However, to maintain symmetry between the models, the factors that may influence a team leader's perceptions of control will be considered from an exploratory perspective.

Applications of the Individual Model

Once again, the individual model will be used as a starting point. Four factors were considered at the individual level: locus of control, task knowledge, performance history, and cue ambiguity. These same factors are also considered for teams, although their treatment is somewhat more problematic. As previously mentioned, there is likely to be less variance in perceptions of control of team leaders. Thus, there will be less variance in the criterion when perceived control is the dependent variable. The hypothesized predictors were fairly straightforward at the individual level, but they will be more complex as team context is considered.

Locus of control. Locus of control refers to whether events and outcomes are more likely to be viewed as contingent upon personal behavior or seen as caused by external forces (Rotter, 1966). Those toward the internal end of the scale tend to believe the former, while those closer to the external end are prone to maintain the latter. At the individual level, decision makers with a more internal locus of control were expected to perceive greater control over decision tasks than externals. Internals were expected to view themselves as having a greater probability of making a correct decision. The position taken here is that, in a hierarchical team where the ultimate authority for the team's decision rests with the leader, it is the leader's locus of control that is important to the team's decision.

As at the individual level, leaders with a more internal locus of control are expected to have greater perceived control than those with a more external locus of control. However, the magnitude of locus of control's influence is not likely to be as strong in the team context as at the individual level. While likely to be somewhat influenced by locus of control, a personal characteristic, the perceived control of a team leader is probably more susceptible to situational aspects of the task and team structure. Even though the decision processes are somewhat similar for individuals and team leaders, the leader is continuously confronted with the team context and all its implications. The leader of a hierarchical team with distributed expertise must deal with the team in getting decision relevant information, in making an actual choice, and in receiving the resulting outcomes. The team is the most salient issue.

Task knowledge. Task knowledge refers to the decision maker's level of expertise on the decision task. For an information processing task, expertise or task knowledge is reflected in the extent to which the meanings of informational cues are understood, the extent to which relationships among cues are understood, and the extent to which an individual understands how the above information should be combined and utilized to make a decision. At the individual level, greater task knowledge was expected to be associated with greater perceived control or increased belief in a high probability for making a correct decision.

While a team leader's task knowledge should also be positively related to perceived control, the strength of this relationship is likely to be dependent upon the distribution of information. At least initially, a leader in a team with distributed expertise, knows fewer informational cues and fewer interactions among cues than an individual decision maker who has direct access to all cues. The leader is responsible for only a specific portion of the decision task. Additional information can potentially be acquired from other team members, but the information cannot be guaranteed (i.e., by direct access). (More will be said about information sharing later.) Even if obtained, the use of the information is likely to be less effective because it is outside the leader's specific area of expertise. Therefore, the relationship between task knowledge and perceptions of control is likely to be weaker for leaders of distributed expertise teams than for individuals.

Performance history. Performance history refers to the pattern of results or outcomes resulting from previous decision making on a particular task. For individuals, positive feedback or a positive performance history was expected to be strongly related to increased perceptions of control. Here, the relationship is expected to be just as strong.

A team's performance history provides more than a summary of correct choices and acquired outcomes. A positive performance history informs the leader that the strategy being used to make decisions is effective. This is critical information because the leader can make the decisions using a variety of criteria and programs, some of which are outlined in the Vroom-Yetton model of leader behavior (Vroom &

Yetton, 1973). For instance, a leader may simply make decisions based on the average of subordinates' judgments. The leader may base decisions solely on the informational cues, ignoring judgments completely. The leader may also use some weighted combination of judgments and cues to make a decision.

Clearly, just deciding how best to make a decision is a complicated process for team leaders. Thus, positive information indicating that whatever strategy being used is effective is likely to go a long way to enhance perceived control. In contrast, individual decision makers only have informational cues at their disposal. Therefore, deciding how to make a decision is a less critical issue for individuals.

Cue ambiguity: Informational and recommendation. Cue ambiguity refers to the extent to which informational cues are clear or unclear in terms of their implications for making a correct decision. A cue can be ambiguous because its individual meaning is unclear or because it conflicts with other informational cues. At the individual level, decision makers faced with ambiguous cues were expected to perceive less control than decision makers confronted with unambiguous informational cues. A similar relationship is predicted to hold for distributed expertise teams, but it is expected to be more pronounced and more complicated as compared to the individual level.

The increased complexity results from the fact that, in the team context, two different types of cues may be more or less ambiguous. Recall that team leaders may utilize informational cues and judgment cues in making a decision for the team. Informational cue ambiguity was described previously. Judgment cues are ambiguous to the extent that they do not converge. For example, consider an investment scenario in which the leader must decide whether to invest \$100, \$500, or \$1,000 for the team. Assume that there are three subordinates and that each one advocates a different investment amount. Under these circumstances, the team leader is confronted with ambiguity. That ambiguity can be exacerbated to the extent that informational cues are also ambiguous.

Contrast the scenario described above with one in which all three subordinates recommend investing \$1,000. Convergent judgments are expected to operate like a preponderance of the evidence. Under these circumstances, there is little ambiguity, especially if the informational cues are also straightforward. The team leader should perceive much greater control, feeling that the probability of making a correct decision is quite high.

Ambiguous cues of both types may also erode perceptions of control in another way. Curley, Yates, and Abrams (1986) contended that ambiguity is aversive because it makes behavior difficult to justify to others. In the team context, the relevant others are subordinate team members. A team leader is likely to feel less confident and less control in making a decision on the basis of ambiguous cues because the justification for the decision will be less evident than for a decision based on unambiguous cues.

Predictors of Perceived Control Derived from the Team Context

Having considered the predictors of perceived control suggested by the individual model, potential predictors unique to the team context may now be explored. The decision making process of a leader in a team context is qualitatively different from the process of an individual acting alone. Certain team phenomenon impinging on the leader may affect perceptions of control. The discussion that follows addresses two factors unique to decision making in a team context that may influence perceptions of control: centralization and coordination.

Centralization. Centralization is a phenomenon unique to the team decision making context. Here, centralization refers to the extent to which communication within a team is concentrated around the team leader. In certain hierarchical teams, communication linkages may be restricted such that all team members cannot directly communicate with one another (see Ilgen et al. in press for a complete discussion). For present purposes, however, recall that unrestricted communication paths (i.e., each team member can communicate with all other team members) will be used.

Even when communication is unrestricted, it may still follow an identifiable pattern. To the extent that the majority of communication is directed toward the team leader, communication is centralized. For distributed expertise teams, the pattern of communication may be a critical determinant of the leader's perceived control.

In the section on task knowledge, a leader's task knowledge was described as a partial function of the extent to which other team members share their unique informational cues and expertise with the leader. The extent to which this type of sharing exists is represented by the centralization of communication around the leader. Thus, task knowledge and centralization are partially redundant. Only partially, because the leader's task knowledge also depends upon the leader's understanding of the shared information. Like task knowledge, centralization ought to have a direct impact on perceived control. Under high centralization, perceptions of control ought to be greater than under conditions of low centralization.

Coordination. By definition, a team with distributed expertise must share information if team members, in particular the team leader, are to have access to all informational cues. In this context, coordination refers to the extent to which these information sharing interactions among team members are effectively orchestrated. More highly coordinated teams are able to operate smoothly and efficiently without a substantial amount of process loss. More uncoordinated teams are characterized by wasted motions, inefficiency, and a lack of organization in necessary operations.

In the present research, subordinates will have direct access to an equal number of informational cues, but they will need to communicate with one another in order to have complete information about their areas of expertise. (Note that this is a definitional characteristic of distributed expertise.) The leader will also have direct access to some, but not all informational cues. The leader, however, will know which team members have direct access to which informational cues. The communication structure will be such that each team member can communicate with all others.

Given the experimental configuration and the requirements of distributed expertise, the only way a team leader can obtain all necessary information is through interaction with other members. The more efficiently the leader obtains the information, the greater the opportunity to use it in making a decision. That is, given a fixed amount of time to make the team's decision, the leader who obtains the relevant information more quickly will have a greater amount of time to contemplate and process that information. Teams that communicate with minimal inefficiency, providing the leader with necessary information as quickly as possible can be thought of as coordinated. In this context, coordination is expected to be positively related to the team leader's perceptions of control.

Additional Issues Relevant to the Team Context

Before concluding the discussion of risky decision making in a team context, two additional issues merit mention. The first concerns the potential for the decision making process to vary in the team context. The second deals with the relative magnitude of effects in the individual and team contexts, an issue dealt with poorly in the existing literature.

Cue Weighting

Cue weighting refers to the relative importance assigned to different cues in making a decision. Cue weighting at the individual level is an interesting issue in itself. In fact, a substantial literature conducted under the rubric of "policy capturing" is concerned with this issue. Individual decision makers may differentially weight various informational cues. However, cue weighting in the team context is likely to be a much more complex and significant process. Team leaders have two potential sets of cues to consider in making a decision, task specific informational cues (i.e., the raw data) and recommendation cues (i.e., subordinate team members' judgments). The relative weights assigned to the two sets of cues in the leader's decision are likely to be influenced by whether the decision frame represents a loss or a gain.

In order to more fully understand the way in which frames might affect weighting, it is important to understand the basics of attribution theory. In general, people prefer to take personal responsibility for success and attribute failure to external forces (Miller & Ross, 1975; Zuckerman, 1979). Gain frames present opportunities for success; they offer a chance to gain and no chance of loss. Loss frames, on the other hand, present opportunities for failure; there is no chance of gain only the potential for loss. In the decision making context, then, it is hypothesized that a team leader should be more willing to take personal responsibility for decisions under positive frames and more likely to defer responsibility for decisions made under negative frames.

The leader may be able to defer responsibility by basing the team's decision on the judgments or recommendations of subordinate team members. By weighting others' judgments more heavily than other potential decision cues (e.g., the raw data, leader's personal preference), the leader defers responsibility for the decision and resulting outcome, diffusing it among subordinate team members. Thus, under negative frames, leaders may be more likely to base decisions on subordinate members' judgments.

The Vroom-Yetton model of leader decision making also supports this notion. When subordinate acceptance is important and unlikely the model recommends using a completely participative process, which essentially means that decision responsibility is transferred to subordinates, and the leader accepts the decision they provide. If a team incurs a loss, as is possible under a loss frame, acceptance is both important and unlikely. Thus, a leader may safely make decisions autocratically provided that the decisions are correct and losses are not incurred by the team. However, given the potential for loss coupled with the threat created by that potential (Jackson & Dutton, 1988), a leader is expected to defer responsibility and use subordinate judgments.

Magnitude of Framing Effects

Using the polarization argument described in the risky shift literature, some have contended that the effects of framing are likely to be more pronounced in a team context (e.g., Whyte, 1989). As discussed in the section on risky shift, there are numerous problems inherent to a within groups comparison of the riskiness of individual and team decisions (see Figure 4). Given those problems attempting a within groups comparison using teams seems inadvisable. The comparison could, however, be made across the broad categories of individual and team decision making. Since teams are expected to exhibit the same tendencies as individuals in more extreme form, the prediction would be for greater risk aversion in gain conditions and greater risk seeking in loss conditions. In the present study, team leaders are predicted to be more risk averse under gain frames and more risk seeking under loss frames than individual decision makers. This type of comparison has not been made in the existing literature.

Hypotheses for Risky Decision Making in a Team Context

The risky decision making of leaders in a team context was considered using an application of the individual model. The nature of the linkages among variables were largely unaltered in moving from the individual to the team context. However, considering risky decision making in the team context required considering factors uniquely applicable to teams. The three variables predicted to moderate the relationship between cognitive frames and decision riskiness are shown in Figure 7. These linkages constitute the formal team context model. Figure 8 depicts the model with the predictors of perceived control included. It should be understood that these predictors are considered more speculative than the core model. Also notice the superscript indicating the level of measurement attached to each variable in the model. Variables were either measured at the decision level (D) or at the individual level (I) (i.e., team leader). Below, specific hypotheses based on the preceding discussion are derived.

The core of the model shown in Figure 7 consists of a direct linkage from cognitive decision frame to decision riskiness. There is some suggestion that the effects of frames predicted by prospect theory are at least as likely for teams as for individuals (e.g., Whyte, 1989). Thus, the following hypothesis is suggested:

H4: Decision frames will have a direct effect on team leader decision riskiness. Under conditions where alternatives are equal in subjective expected utility and unequal in risk, team leaders presented with a gain frame will be more likely to select a less risky alternative than those presented with a loss frame. Under

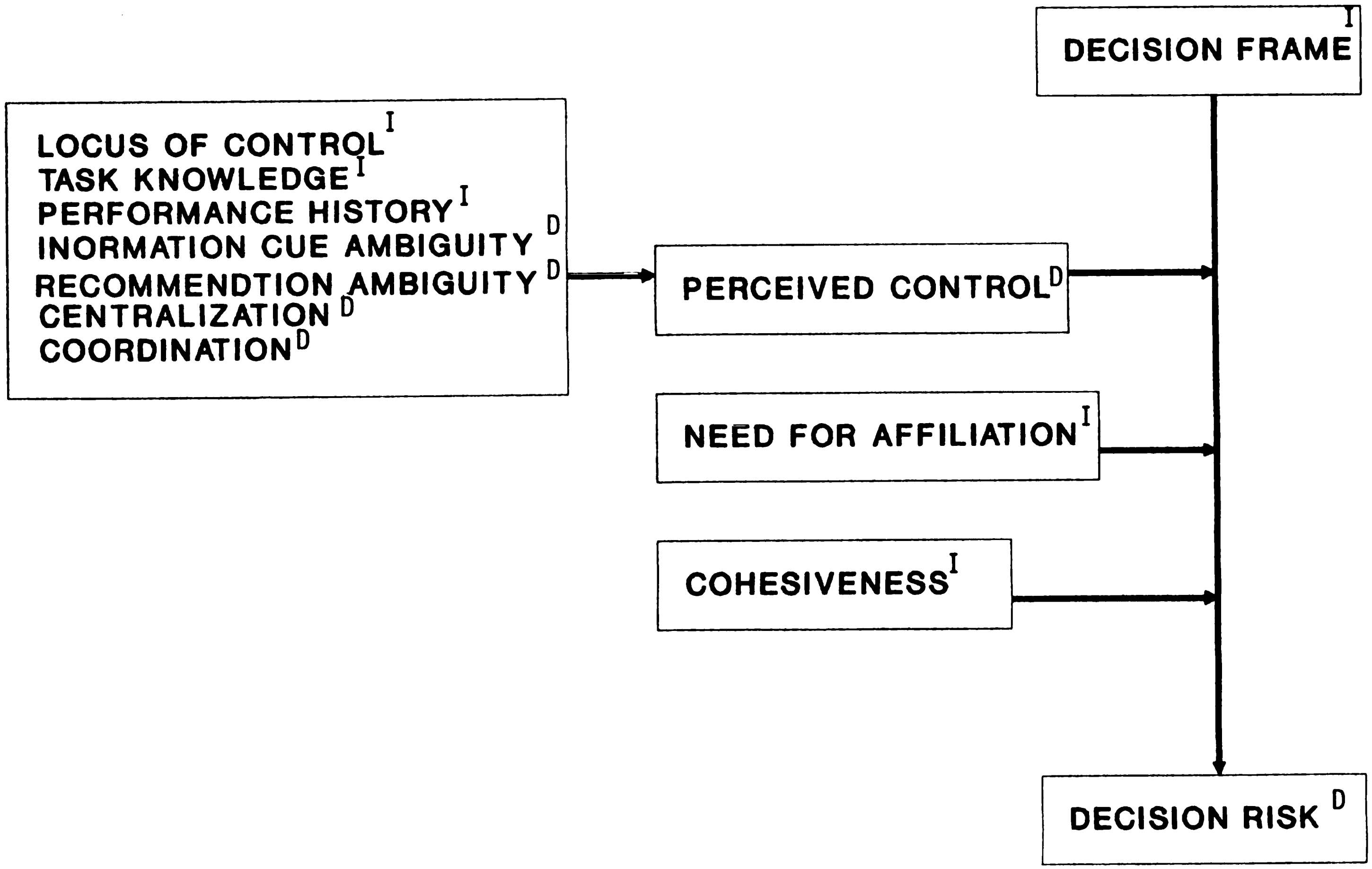


Figure 8: Elaborated model of risky decision making in a team context

the same conditions, team leaders presented with a loss frame will be more likely to select a riskier alternative than those presented with a gain frame.

Perceptions of control were predicted to moderate the relationship between cognitive decision frames and decision riskiness in both the individual and team contexts. However, the moderating linkage was expected to be more difficult to detect in the team context. The following hypothesis describes the nature of the moderating effect.

H5: Perceptions of control will moderate the relationship between decision frame and decision riskiness for team leaders' decisions. Specifically, risk seeking will be greater under loss frames than under gain frames when perceptions of control are lower. When perceptions of control are higher, there are no predicted differences for decision riskiness between gain and loss frames.

Two additional variables were expected to moderate the relationship between cognitive decision frame and decision riskiness. The first variable, need for affiliation, is a personal characteristic of the team leader. The second variable, cohesiveness, is a team characteristic. The nature of the predicted moderator effects are detailed in the following hypothesis:

H6: Across decisions, the leader's need for affiliation and the team's cohesiveness will moderate the relationship between decision frame and decision riskiness for a team leader's decisions. Specifically, risk seeking will be greater under loss frames than under gain frames when the need for affiliation and team cohesiveness are higher than when the need for affiliation and team cohesiveness are lower. When the need for affiliation and team cohesiveness are lower, there are no predicted differences for decision riskiness between gain and loss frames.

The same variables predicted to influence the perceived control of individual decision makers were also expected to impact the perceived control of team leaders. Locus of control, task knowledge, performance history, and cue ambiguity, were proposed to affect team leaders' perceptions of control. In addition, Figure 8 shows a direct linkage from centralization and coordination to perceived control that was not relevant at the individual level.

H7: Across decisions, team leaders with a more internal locus of control, greater task knowledge, and a more positive performance history will have higher perceptions of control than team leaders with a more external locus of control, less task knowledge, and a more negative performance history. For specific decisions, team leaders with less informational cue ambiguity, less recommendation cue ambiguity, greater centralization, and greater coordination will have higher perceived control than team leaders with greater informational cue ambiguity, greater recommendation cue ambiguity, less centralization, and less coordination.

Two additional propositions were developed for team leader risky decision making. The first concerns decision making processes of leaders. In the team context, leaders have the potential to use two types of decision cues: informational and recommendation cues. Since loss frames have the potential to be perceived as more threatening, negative, and undesirable (Jackson & Dutton, 1988; Miller & Ross, 1975; Zuckerman, 1979), the following hypothesis was derived:

H8: Under loss frames, team leaders are more likely to base decisions on subordinate recommendations than under gain frames.

The second proposition describes the relative magnitude of cognitive framing effects in the individual and team contexts. The present research will not make a within groups comparison given the numerous problems with that approach. Instead, team leaders will be compared to individual decision makers to test the following hypothesis.

H9: The effects of decision frame on decision riskiness are likely to be stronger for team leaders than for individuals.

The next section describes an empirical study designed and conducted to test the hypotheses developed here. The study is meant to provide an initial test of some of the relationships described by the individual and team context models of risky decision making.

METHOD

Participants

Participants were 94 male and 140 female undergraduate students recruited from two introductory management courses. Participation was voluntary, and students received course credit for taking part in the study. In addition, all participants had the potential to earn up to $15.00 based upon performance on the decision making task. The average amount of money actually earned during the experiment was approximately $10.50 per person.

Design

The research was conducted using a 2 (gain frame, loss frame) X 2 (ambiguous cues, unambiguous cues) X 20 (perceived control) repeated measures design. This design was applied to both the individual and team contexts. In each setting, cue ambiguity and trials were within subjects variables. Framing was not manipulated as a within subjects variable due to evidence that the effects of an initial frame persist, even after the frame is changed (e.g., Levin, Johnson, & Davis, 1987; Loke, 1989). In total, the study included 41 experimental teams (20 under a loss frame and 21 under a gain frame) and 70 individual decision makers (35 in each framing condition).

Decision Task

The decision making task employed in the research was an interactive, computerized, naval command and control simulation called TIDE[2] (see Hollenbeck, Sego, Ilgen, & Major, 1991 for a detailed description). The context for the scenario is a naval carrier team consisting of four stations. Each team member role plays the commanding officer of a different station. The primary tasks of the team are to monitor the airspace over their location for unidentified aircraft, evaluate the level of threat that each aircraft represents, and respond appropriately to the aircraft based on the threat level. An unidentified aircraft is described by nine attributes. These are: speed, direction, range, altitude, radar, angle, size, corridor status, and identification fried or foe (IFF). The level of threat represented by an aircraft is based upon the configuration of these attributes. Once an unidentified aircraft appears in the airspace, participants in the simulation have three minutes to measure the attributes and decide how to respond to the aircraft. The three potential responses range from ignoring friendly aircraft that are non-threatening to defending against hostile enemy aircraft by shooting them down. Participants are provided with rules that describe the meanings of the attributes and their values (see Appendix A). The rules also explain how cues are combined to determine the level of threat an aircraft represents. The simulation can be set up for one to four players so it can be used to study both individual and team decision making. The team and individual versions are described in more detail later.

A trial or game in the simulation begins when an unidentified aircraft enters the airspace. The presence of an aircraft is indicated by a beeping noise and a red asterisk in the middle of the computer screen. In addition, a digital clock begins to count down the time available before a decision about how to respond to the aircraft must be made. In the present study, each trial lasted 180 seconds, and a decision had to be made before the clock reached zero. Participants (i.e., both teams and individuals) were presented with 30 trials.

Mathematical structure underlying the decision task. As was mentioned, nine attributes about the aircraft (labelled cues) provided the information needed to reach a decision about the aircraft's level of threat. The instructions to participants, shown in Appendix A, described the range of values for each cue and how to interpret the level of threat for each cue. The manner in which cues had to be combined to make a correct decision was established a priori and communicated to the participants as a set of "rules" in the training they received on the simulation. If one considers the nine cues independent variables in a regression equation predicting threat, each cue could assume a value ranging from zero (i.e., a non-threatening value) to two (i.e., a very threatening value). In addition, the set of rules defined the main effect and interactions among cues that determined the correct decision. In the present research, the equation consisted of one main effect and four interactions. Table 3 lists the nine cues and provides the equation used to determine the correct decision a priori. As shown in the equation in Table 3, the four interactions received unit weights and the one main effect for IFF had a weight of two. The equation also shows which specific cues composed each interaction (i.e., speed and direction, altitude and corridor status, size and radar type, angle and range). The specific cue values and cue interactions, as provided to participants, are provided in the set of role instructions in Appendix A. Since the cue values ranged from zero to two, the true score ranged from 0 to 20. Ranges of true score values were associated with levels of threat. True scores

Table 3

The Nine Informational Cues and the Regression Equation for the Correct Decision

Cue Label	Cue Attribute
(#1)	Speed
(#2)	Altitude
(#3)	Size
(#4)	Angle
(#5)	IFF
(#6)	Direction
(#7)	Corridor Status
(#8)	Radar Type
(#9)	Range

Level of Threat = 2^{a}[#5][b] + 1[#1][#6][c] + 1[#2][#7] + 1[#3][#8] + 1[#4][#9]

[a]Weight for cue.

[b]Cue (cue #5 or IFF in example).

[c]Interaction between two cues (between cue #1 and cue #6 or speed and direction in example.

ranging from 0 to 10 were labelled "Ignore," and those ranging from 11 to 20 were labelled a "Defend." Participants were instructed to choose Ignore as the response to unidentified aircraft they viewed as non-threatening and Defend as the response to unidentified aircraft they felt were threatening. In addition, participants also had the option of selecting a response labelled "Warn" that was a moderate response between Ignore and Defend. More will be said about the selection of Warn relative to Ignore or Defend later. Note for now, however, that although Warn was a response option, Warn never represented a true score value presented as one of the aircraft that entered the airspace during the course of the study's 30 trials. Participants were instructed as to this fact in their training.

Feedback. Performance feedback for each decision (i.e., every trial) was provided to all participants, but the feedback was delayed by one trial. For instance, feedback for Trial 10 was provided after Trial 11. To determine the performance outcome to be fed back, the decision registered by the individual or team was subtracted from the correct decision. There were three possible decisions (i.e., participant responses) so the performance outcome ranged from -2 to +2. An outcome of zero indicated that a correct decision had been made. Since the sign of the outcome is not important in the present research, it is sufficient to note that an absolute value of one meant that the decision was off by one on the scale and an absolute value of 2 meant that the decision was off by two. Figure 9 shows the potential performance outcomes for all combinations of correct and actual decisions. Recall that participants had to choose among three responses: (1) Ignore, (2) Warn,

Actual Decision

Correct Decision	(1) Ignore	(2) Warn	(3) Defend
(1) Ignore	0	1	2
(3) Defend	2	1	0

0 = HIT

1 = MISS

2 = DISASTER

Figure 9: Performance outcomes

and (3) Defend. The true score or correct response was always either Ignore or Defend. From the chart in Figure 9, one can see that when the correct and actual decisions were the same, the outcome was zero (see the upper right and lower left boxes). Selecting a response completely opposite of the true score (i.e., Ignore when Defend was correct; Defend when Ignore was correct) yielded a performance outcome of two. An actual decision of Warn always resulted in a performance outcome of one. In the simulation, the numerical performance outcomes were represented by the labels Hit (0), Miss (1), and Disaster (2) for feedback purposes. A Hit meant that the decision was completely appropriate (i.e. a zero). A Miss meant that the decision was somewhat too passive or somewhat too aggressive (i.e., a one). A Disaster meant that the reaction was completely inappropriate and that the opposite action should have been taken (e.g., Ignore was selected when Defend was the correct response; a two).

Simulation Configuration and Cue Access

The $TIDE^2$ simulation is a very flexible program in that a number of structural parameters can be altered to suit particular research needs. For instance, the program allows you to specify who has access to what informational cues. It also allows you to determine who may communicate with whom. The specific configurations for the team and individual versions of the simulation used in the present research are described below.

Individual version. In the individual version, the decision making task was performed by single subjects. The participants were stationed at a computer terminal where they requested information about the unidentified aircraft that appeared in each decision trial. (Recall that there were 30 trials in the present study.) Individual participants only had to execute two functions, labelled Measure and Judgment in the TIDE^2 simulation. Measure means directly accessing an informational cue (e.g., size, speed, direction, etc.) by calling it up on the computer screen. An individual participant was able to request all nine cues. After cues were measured, it was up to the individual to combine appropriately the cues using the provided rules. Once the participant felt ready to make a decision and before time ran out, a Judgment had to be made. That is, the subject had to register a decision of Ignore, Warn, or Defend. Individual participants received performance feedback for their decisions one trial later.

Team version. In the team version of the simulation, four participants interacted in a network of four computers. Each computer was a separate work station. The team leader was called the Carrier station, and the person assigned that role was the team leader. The three subordinate stations were the Coastal Air Defense (CAD), the Cruiser, and the AWACs. TIDE^2 was configured so that each team member was able to communicate with all others. However, in order to simulate a team with distributed expertise, each member of the team was given direct access to only five of the nine informational cues. That is, each team member could request five cues from the computer's file without asking other team members for the information. Table 4 shows which team members had direct access to which informational cues. Each subordinate team member had direct access to one unique

Table 4

Direct Access to Informational Cues and Rules Describing Interactions among Cues

	Informational Cue	Station(s)			
(1)	Speed:	CAD(a)		Cruiser	Carrier(d)
(2)	Altitude:	CAD		Cruiser(c)	
(3)	Size:	CAD			
(4)	Angle:	CAD	AWACs(b)		Carrier
(5)	IFF:	CAD	AWACs		
(6)	Direction:		AWACs		
(7)	Corridor Status:		AWACs	Cruiser	Carrier
(8)	Radar Type:		AWACs	Cruiser	
(9)	Range:			Cruiser	

Table 4 (continued)

Direct Access to Informational Cues and Rules Describing Interactions among Cues

(a) SPEED and DIRECTION go together, so that fast targets coming straight in are most threatening. Speed alone and direction alone mean nothing. There is nothing to fear if fast targets are not headed toward the group. There is nothing to fear from objects headed directly for the group that are moving slowly.

(b) ANGLE and RANGE go together, so that descending targets that are close are especially threatening. Angle alone and range alone mean nothing. Descending targets that are far away, or close targets that are on the way up are not threatening.

(c) SIZE and RADAR go together, so that small objects with weapons radar are especially threatening. There is nothing to fear from small targets with weather radar or from large targets with weapons radar.

(d) ALTITUDE and CORRIDOR STATUS go together, so that low flying targets that are way outside the corridor are especially threatening. Altitude alone and corridor status alone mean nothing. There is nothing to fear from high flying targets well outside the corridor or low flying targets in the middle of the corridor.

piece of information (i.e., could measure a cue that no other team member could measure). In particular, only the person at the CAD station could measure Size, only the AWACs could measure Direction, and only the Cruiser station could measure Range. The Carrier had access to no unique informational cues, but the Carrier was unique in that this person knew what all the other stations could measure. Each of the four team members was responsible for understanding one of the four interactions among cues. Each of the rules and the station responsible for it is listed in Table 4. (Note that each team member received instruction regarding all four interaction rules, but was instructed to be responsible for and become expert in only one.) Since the expertise in the team needed to be distributed, team members were not allowed to directly access both cues relevant for their interactions. For example, the CAD station was able to access Speed directly, but not Direction. Thus, the CAD station had to communicate with another team member in order to find out the value for Direction (e.g., the CAD could have gotten Direction from the AWACs). Essentially, team members were required to share information to perform effectively.

Information could be shared using a variety of mechanisms. In each instance, it was necessary for one station to Measure (i.e., access it directly from the computer) a cue before sharing it with another station. Once an informational cue was Measured, three different computer communication functions had the potential to be invoked in order to share information with other team members. The three functions involved requesting, transmitting, and receiving information. The least expedient method of sharing information involved four steps once a cue had been measured.

For instance, the CAD measured Speed, the AWACs requests Speed, the CAD receives the request and transmits Speed, and the AWACs receives Speed. Each of the functions was required to be conducted via the computer; participants were not allowed to speak directly to each other. A more expedient example of information sharing occurs when team members share information without being asked. For instance, the CAD could send Speed to the AWACs without being asked and the AWACs could receive it. Since the time to make a decision was limited to 180 second, expedient information sharing was desirable. The simulation included an additional communication function that allowed team members to type in and send any sort of brief message to another team member.

In the team version of the task, each subordinate station sent a judgment regarding the appropriate decision to the Carrier. The Carrier then made a decision for the entire team. Each trial ended as soon as the Carrier made a decision. The entire team received feedback on that decision, one trial later. The feedback screen included the team's decision (made by the Carrier), the correct decision, and the judgments of subordinate members.

Procedure

Study participants were scheduled to come to the laboratory in groups of six, allowing for a maximum of one team and two individual sessions at one time. Upon arrival, subjects were randomly assigned to either a team or an individual condition and to a loss or gain frame condition. Individuals within teams were further randomly assigned to one of four roles within each team (i.e., the decision making leader or one of the three subordinate team members). Those assigned to the individual conditions worked independently on a computerized decision making task. Those in the team condition worked as teams on a networked version of the same task. All subjects signed a consent form indicating willingness to participate in the study.

Procedure for individual participants. Once assigned to conditions, subjects in the individual task had 15 minutes to read instructions (see Appendix A) orienting them to the decision making scenario (i.e., the context, the informational cues, and the interactions among cues), their role in the scenario, and the computerized task itself. The role instructions also included the framing manipulation. This manipulation described how performance was determined and the monetary outcomes associated with each decision alternative. Outcomes were presented as either potential gains or potential losses. Questions regarding any of the introductory material were addressed. Next, subjects completed a manipulation check for the appropriate framing condition to ensure that they understood the implications of the decision frame for scoring points on the computer task and earning money. Any missed questions on the manipulation check were covered with subjects until the issue was understood. Subjects then had the opportunity to study their role instructions for an additional five minutes before completing a task knowledge test.

Once task knowledge tests were completed, an experimenter conducted a two-trial interactive training session to familiarize subjects with the operation of the computer terminals. Subjects responded to verbal instructions during the first trial.

During the second trial, they worked independently, asking questions as necessary. At the conclusion of training, the 30 experimental decision trials began. The first ten were considered learning trials, during which subjects were expected to become more familiar with the simulation and more comfortable with operating the computers. After each decision on Trials 11 through 30, subjects were asked to indicate the probability that they had just made a correct decision. Feedback was delayed by one trial to allow subjects the opportunity to make their ratings before learning about their performance.

Once all 30 decision trials were finished, subjects completed individual difference measures. Before leaving, subjects were paid on the basis of points earned during the decision making task. Subjects received a general debriefing and were asked not to divulge the details of the research to others. Finally, subjects were thanked for their participation.

Procedure for team participants. The procedure for distributed expertise teams was very similar to the procedure for individuals. Once assigned to a gain or loss condition, team members had 15 minutes to read instructions appropriate for orienting them to their unique roles, the scenario, and the decision making task. Role instructions included information regarding the informational cues each team member could measure and the interactions among cues for which each person was responsible (i.e., the distributed expertise pattern). The role instructions also included the appropriate framing manipulation which described the scoring and monetary outcomes associated with each decision alternative. Questions regarding any of the introductory material were addressed before presenting a 30 minute training video. The video explained how to execute all computer functions. Questions were entertained at the end of the video and subjects were given an additional five minutes to look over their role instructions.

Each team member completed a manipulation check to ensure that the framing condition was understood. Further instruction regarding the framing condition (i.e., the scoring and monetary pay-offs associated with different decision alternatives) were provided as necessary until each team member understood the condition. All team members then completed a task knowledge test before beginning the interactive training.

The two-trial interactive training session allowed the team to practice computer functions described in the training video. Subjects responded to scripted verbal instructions covering all functions during the first trial. They worked independently during the second trial, asking questions as necessary. At the conclusion of training, subjects were instructed not to talk with each other, and the 30 experimental decision trials began. Just as with individuals, the first ten trials were considered an opportunity for learning, during which subjects could become used to the simulation and the computer functions. After each decision on trials 11 through 30, team leaders were asked to indicate the probability that they had just made an accurate decision for the team. Feedback was delayed by one session to allow leaders the opportunity to make their ratings before learning about their performance.

Once all 30 decision trials were completed, team members completed a set of individual difference measures (e.g., need for affiliation, locus of control) and a series of team process measures (e.g., cohesiveness, centralization). Each team member was then paid an amount commensurate with points earned during the decision making simulation. Teams received a general debriefing and were asked not to discuss the research with classmates in their management course (i.e., other potential subjects) until the project was concluded. Team members were thanked for their participation before leaving.

Manipulations

Framing. The study contained two framing conditions, gain and loss. Both conditions contained the same 30 decision trials. Participants had to decide among the Ignore, Warn, and Defend response options for each trial. Ignore and Defend were established as risky alternatives relative to Warn, the certain alternative, in instructions to participants. Warn was the decision alternative for which the outcome was certain. That is, there was no risk. The outcomes associated with selecting Ignore and Defend were contingent on performance. In other words, if the actual decision was Ignore, participants only received a reward if Ignore was the correct decision. The same was true for defend. Table 5 presents the outcome contingencies for the various combinations of actual and correct decisions.

For purposes of illustrating the relative riskiness of choosing Ignore or Defend as opposed to Warn, it is best to compare the columns in Table 5. Notice that when Warn was chosen, the outcome was a Miss regardless of the correct decision. Thus,

Table 5

Decision Outcomes

		Actual Decision		
		Ignore	Warn	Defend
Correct Decision	Ignore	Hit	Miss	Disaster
	Defend	Disaster	Miss	Hit

Warn was a certain choice; it always resulted in a Miss. The outcome associated with choosing Ignore was contingent upon whether or not Ignore was the correct decision. If Ignore was correct, then the outcome was a Hit. If Ignore was chosen, but not correct then the outcome was a Disaster. Similar contingencies applied when the actual decision was Defend. The outcome was a Hit if Defend was the correct decision and a Disaster if Defend was not correct.

Pretesting was required to determine what the outcome associated with Warn had to be relative to the outcomes offered for the correct selection of either Ignore or Defend. In the pretest using the same experimental targets used in the actual research, subjects were correct on 70 percent of the decision trials when using a risk seeking strategy (i.e., choosing either Ignore or Defend). Thus, to make the pay-offs associated with the risk averse strategy (i.e., selecting Warn) equivalent to the pay-offs for a risk seeking strategy (i.e., selecting Ignore or Defend), a 7 to 10 ratio was established for awarding points for certain versus risky alternatives. In general terms, selecting Warn always yielded a certain outcome that had a lower value as compared to the correct selection of either Ignore or Defend. Likewise, the correct selection of either Ignore or Defend was always associated with higher outcomes than choosing Warn. However, the incorrect selection of Ignore or Defend was detrimental to monetary rewards.

The manner in which monetary rewards were determined is the key to the framing manipulation. Gain and loss were manipulated by the way in which pay was provided for performance. Pay was based on points and each point was worth 5 cents. Recall that the pay-off for selecting Warn was equal to 70 percent of the pay-off for correctly selecting either Ignore or Defend. In the gain condition, subjects began with zero points and earned points for performance. Whenever Warn was selected, subjects automatically received 7 points. Subjects received 10 points for correctly selecting either Ignore or Defend. No points were awarded if subjects incorrectly chose Ignore or Defend. Table 6a shows the gain frame pay-offs in terms of the points awarded per decision or trial. Warn represented the certain decision alternative and Ignore and Defend represented risky decision alternatives. To determine an individual's or a team member's total monetary outcome, final points were multiplied by 5 cents. Thus, the maximum that could be earned was $15.00. The equation used to determine pay in the gain condition is also provided in Table 6a.

In the loss condition, an individual or each team member was told that they were starting the game with $15.00. They were instructed that 5 cents would be subtracted for each point incurred and that points would be assigned as described in Table 6b. The table indicates that 7 points were automatically accumulated for selecting Warn. When Ignore or Defend were chosen correctly, zero points were added to the score. When Ignore or Defend were chosen incorrectly, 10 points were added to the score. At the end of the game, points were multiplied by 5 cents. That amount was then subtracted from $15.00 and the difference was the received monetary outcome. This equation is also provided in Table 6b.

Ambiguity. Cue ambiguity was manipulated in the both individual and team simulations. Before beginning the simulation, subjects were provided with

Table 6

Points Awarded under Gain and Loss Frames

6a. Gain Frame

		Gain Frame		
		Actual Decision		
		Ignore	Warn	Defend
Correct Decision	Ignore	10	7	0
	Defend	0	7	10

Pay = (# points)(.05)   10 points = 50 cents   7 points = 35 cents

6b. Loss Frame

		Loss Frame		
		Actual Decision		
		Ignore	Warn	Defend
Correct Decision	Ignore	0	7	10
	Defend	10	7	0

Pay = 15.00 - (# points)(.05)   10 points = 50 cent loss   7 points = 35 cent loss information about the meanings associated with ranges of cue values. For example, they were told that speed ranged from 100 to 800 miles per hour. Cue values were categorized as either non-threatening or very threatening. These ranges, however, were not continuous. That is, between the two categories there were certain values that did not fall into either range. These values were considered ambiguous; subjects could not be certain exactly how they should be categorized. Using speed as an example, the non-threatening range was 100 to 275 miles per hour and the threatening range was 525 to 800 miles per hour. Thus, a speed from 276 to 524 would be ambiguous. Across the 30 experimental trials, 15 contained ambiguous cues and 15 contained unambiguous cues. Targets with ambiguous and unambiguous cues were randomly presented in three blocks consisting of ten trials. Each block of ten contained five ambiguous and five unambiguous targets presented randomly within the block.

In the team context, a second type of ambiguity was also relevant. Each subordinate member provided a decision recommendation to the team leader. These judgments, then, could be combined and used by the leader as an additional informational cue (i.e., a recommendation cue) in making the team's final decision. To the extent that subordinates' judgments were consistent with each other, the recommendation cue was unambiguous. However, the cue became more ambiguous with greater disagreement. For each experimental decision trial, the three recommendation cues were coded and combined post hoc to form a scale indicating the level of ambiguity in the set of recommendation cues. For instance, when all three subordinates suggested the same decision, the recommendation cue was coded "1," representing the lowest possible ambiguity. When only two subordinates' judgments were the same, the recommendation cue was coded "2," representing moderate ambiguity. Finally, when all three subordinates offered different judgments, the recommendation cue was coded "3," representing high ambiguity.

Measures

Decision riskiness. The level of risk represented by a decision was assessed by examining the decision alternative selected on experimental decision Trials 11 through 30. (Recall that Trials 1 through 10 were excluded to allow participants with a learning period.) For both individuals and team leaders, the extreme choices (i.e., Ignore and Defend) were coded as risk-seeking and the middle alternative or the certain option (i.e., Warn) was considered risk averse.

Perceived Control. Perceived control was also measured on decision Trials 11 through 30. As soon as the decision for a trial had been made, individuals and team leaders were instructed to record their perceived probability that the decision they just made was a correct decision. Instructions for making the probability ratings had to be carefully articulated because if the decision just made was "Warn," it was obviously not correct in an objective sense because the targets were constructed so that Warn was never the correct response. Thus, subjects were asked to rate the probability that they would have been correct had they attempted to make a correct decision (i.e., if they had responded with Ignore or Defend). Subjects were told to use this strategy even if they had actually selected the Warn option. (See Appendix B for the perceived probability measure and instructions.) Thus, after making a decision on Trials 11 through 30, individual decision makers and leaders used a rating scale ranging from .50 to 1.0 to indicate the probability that a correct decision could have been made on that trial. They were allowed to write in any value for perceived probability that fell within the range from .50 to 1.0 (see Appendix B).

Task knowledge. Task knowledge tests relevant to the individual simulation and the team leader position in the team simulation were developed and used in previous research using the $TIDE^2$ paradigm. Those tests were used in the present research (see Appendix C). Both tests included items related to the specific cues the particular station could measure, the meanings of the cue values, and the interactions among cues. The team leader's test also included items regarding which subordinate stations could measure which cues. Each test consisted of 13 multiple choice items. The internal consistency reliabilities for the individual and team leader tests in this study were .66 and .69, respectively.

Locus of control. Locus of control was measured using a 29-item, forced-choice scale developed by Rotter (1966). For each of the 29 items, subjects were asked to chose which of two statements they agreed with more. Items were coded so that higher scale scores indicated a more internal locus of control (i.e., 1=external and 2=internal). In previous research, split-half and test-retest reliabilities associated with the scale ranged from .65 to .70. The alpha computed for the present research was .77.

Performance history. Performance history was measured by averaging the decision outcomes (i.e., performance) on the second block of experimental trials (i.e., 11 through 20). The first set of 10 trials was excluded because learning was expected to occur within that block and was considered likely to make performance unstable. Each trial was scored either zero if an incorrect response was made or 1 if a correct decision was made. The 10 scores were then averaged to create an overall measure of performance history.

Need for Affiliation. The need for affiliation of team leaders was assessed using a scale derived from Jackson's (1965) Personality Research Form. Jackson's original scale consisted of 20 true/false items. In the present research, 10 of the seemingly more face valid items were used and rated on a four-point rating scale ranging from 1 = "very false" to 4 = "very true." The internal consistency reliability for this adapted scale was .71.

Cohesiveness. Cohesiveness was measured using a three item scale previously employed in team decision making research using the $TIDE^2$ program. The five-point response format for each item ranged from "strongly agree" to "strongly disagree." Coefficient alpha for that scale was .81.

Centralization. Centralization was assessed by examining the patterns of communication during each decision trial (i.e., experimental trials 11 through 30) in the simulation. Specifically, the number of communications directed at the Carrier (i.e., the leader and decision maker) were compared to the average number of communications directed at subordinate stations. This ratio (i.e., Carrier communication over other) provided a non-perceptual index of centralization for each of the experimental trials.

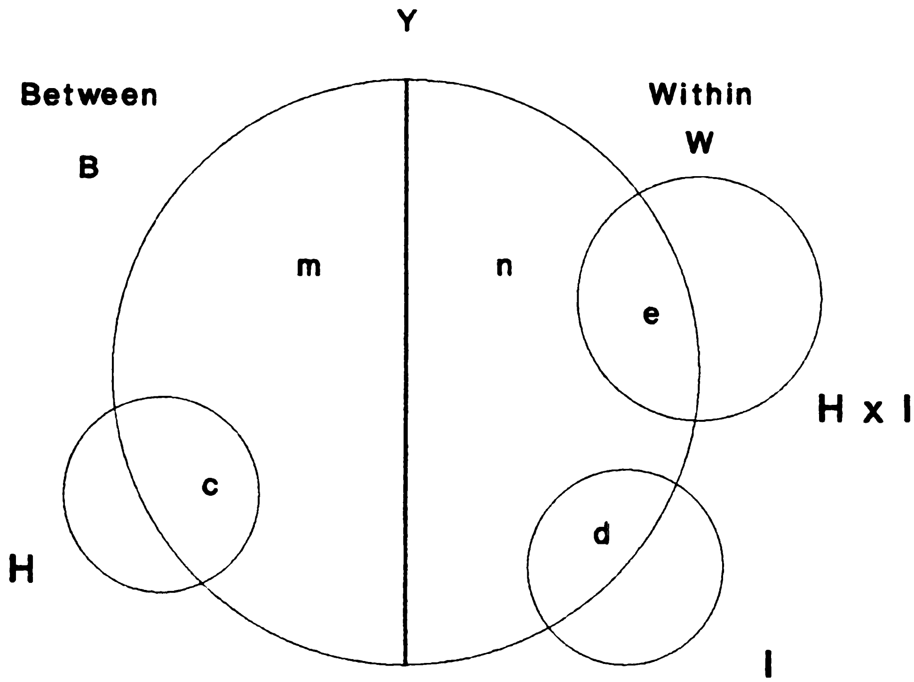
Coordination. Recall that the objectively correct decision for a given trial was determined by a regression equation involving four interactions and one main effect. To be completely knowledgeable, a team leader should know all five components before making a decision. Within in the $TIDE^2$ simulation the leader could obtain each of these five components with varying efficiency. Thus, coordination was operationalized as the number of components possessed by the leader (i.e., zero to five) divided by the number of inefficiencies involved in obtaining each component.

RESULTS

The majority of hypotheses were tested using repeated measures regression for within and between subjects variables, as described by Cohen and Cohen (1983). Before discussing the tests of specific hypotheses, the general data analytic strategy is described.

The first step in a repeated measures regression analysis with between and within subjects effects is partitioning the variance in the criterion. A heuristic illustrating the partitioning of between and within subjects variance is presented in Figure 10. The diagram is an adaptation from Cohen and Cohen (1983). The large circle (Y) represents the total variance in some dependent variable, the criterion. The circle (Y) is first bisected into the portions representing the total between and within subjects variance. In Figure 10, the left-hand portion of the circle represents the total between subjects variance and the right-hand portion represents the total within subjects variance. The smaller circles each represent independent variables used to predict some portion of (Y). Predictor (H) is a between subjects factor. Predictor (I) is a within subjects factor. The predictor labelled (H x I) is the interaction of the between and the within subjects predictors (H) and (I).

In partitioning the variance in (Y) into the between and within subjects components, we can fully define variance associated with areas (m + c) and (n + d + e) respectively. Once the between and within subjects variance has been determined, the R square for each predictor (i.e., H, I, and H x I) can be calculated. The regression analysis is conducted hierarchically such that all the within subjects



Y=Total variance in dependent variable

B=Between subjects variance in Y

W=Within subjects variance in Y

H=A between subjects predictor

I=A within subjects predictor

H x I=A within/between interaction

Adapted from Cohen and Cohen (1983), p. 440.

Figure 10: Partitioning the between and within subjects variance

effects (i.e., within subjects main effects and interactions involving only within subjects variables) are entered first. The between subjects effects are entered next, followed by interactions involving between and within subjects variables. A unique R square can be calculated for each within subjects effect, each between subjects effect, and each within/between interaction.

Using the area labels in Figure 10, the R square for the between subjects predictor (H) in the diagram is defined as the ratio: $c/(c + m)$. Notice that at this point we are only interested in the proportion of (B) variance accounted for by (H). This is the unique R square for the between subject effect of (H). The areas represented by (n), (d), and (e) are not relevant for the between subjects analyses. Later we will calculate the percentage of total (Y) variance accounted for by (H). Focusing on the unique within subjects effects, we disregard the areas (c) and (m) and focus instead on (d), (e) and (n). For instance, the R square for (I) is calculated using the proportion: $d/(d + e + n)$. The R square for the (H x I) interaction is computed by: $e/(d + e + n)$. The unique between and within subjects R squares can then be tested for significance with separate F-tests. One can also assess the proportion of total variance accounted for by a given predictor (e.g., H, I, or H x I). In the ratio representing this type of R square, the denominator includes the total variance instead of the unique variance associated with the between or within subjects effects. For instance, the ratio for the total proportion of variance accounted for by (H) is: $c/(c + m + n + d + e)$. Similarly, the ratio for the total proportion of variance accounted for by (I) is: $d/(c + m + n + d + e)$. These effects can be tested for significance using corresponding F-tests. See Cohen and Cohen (1983) for a more detailed description of the data analytic strategy and the specific equations used in computing R squares and corresponding F-tests (pages 437-448).

Test of Individual Hypotheses

Having described the general analysis strategy, it can now be applied in testing the hypotheses developed in the present research. The individual level hypotheses are addressed first. The means, standard deviations, and meaningful correlations among individual level variables are presented in Table 7. As noted in the table, the n for correlations between variables that were measured between subjects was 70 (i.e., the number of subjects) and the n for correlations between the within subjects variables was 1400 (i.e., 70 multiplied by the 20 decision trials).

Hypotheses 1 and 2 address the relationship between cognitive frame, perceived control, and risk taking. These hypotheses are restated below:

H1: Decision frames have a direct effect on decision riskiness. Under conditions where alternatives are equal in subjective expected utility and unequal in risk, individuals presented with a gain frame will be more likely to select a less risky alternative than those presented with a loss frame. Under the same conditions, individuals presented with a loss frame will be more likely to select a riskier alternative than those presented with a gain frame.

H2: Perceived control will moderate the relationship between decision frame and decision riskiness. Specifically, risk seeking will be greater under loss frames than under gain frames when perceptions of control are lower. When

Table 7

Individual Level Correlation Table

Variable	Mean	sd	1	2	3	5	7
(1) Frame							
(2) Risk	.89	.31	-.226*				
(3) Perceived Control	79.31	17.54	-.087*	.359*			
(4) Cue Ambiguity				-.303	-.652*		
(5) Task Knowledge	9.34	1.98	-.159	.301*	.305*		
(6) Locus of Control	1.44	.17	-.041	-.093	.022	-.131	
(7) Performance History	.73	.14					
(8) Late Perceived Control	80.30	7.02					.513*

Note. Correlations involving variables 5, 6, 7, and 8 are based on n = 70. Correlations involving any other variables are based on n = 1400.

perceptions of control are higher, there are no predicted differences for decision riskiness between gain and loss frames.

Since H2 introduces perceived control as a moderator of the relationship between framing and risk taking described in H1 (i.e., H2 is an elaboration of H1), these hypotheses were tested together using repeated measures regression. In this analysis, decision frame was a between subjects variable and perceived control was a within subjects variable. Partitioning the variance in decision riskiness showed that 14 percent of the variance was due to between subjects factors and 86 percent was due to within subjects factors. The results of the regression analysis are presented in Table 8. Decision frame, perceived control, and their interaction were all significant predictors of decision riskiness. Decision frame accounted for 26 percent of the <u>between subjects variance</u>. Perceived control and the interaction between decision frame and perceived control accounted for 15 and about 4 percent of the <u>within subjects variance</u>, respectively. The nature of the interaction between decision frame and decision riskiness, plotted in Figure 11, was as predicted in H2. Individuals were generally taking risks under loss frames across levels of perceived control. Individuals under gain frames tended to be risk averse when perceived control was low, but risk seeking when perceived control was high. Given the significant main effect for decision frame and the significant frame by perceived control interaction, which was in the predicted direction, both H1 and H2 were supported. Finally, the

Table 8

Repeated Measures Regression Results for Hypotheses 1 & 2

Dependent Variable = Decision Riskiness

Independent Variables	Unique R^2	F-Value	df	Total R^2
(1) Perceived Control	.15[w]	15.10*	(19,1292)	.129*
(2) Decision Frame	.26[b]	23.89*	(1,68)	.165*
(3) (1) * (2)	.035[w]	3.49*	(19,1292)	.195*

*p. < .05

[w]Within subjects effect

[b]Between subjects effect

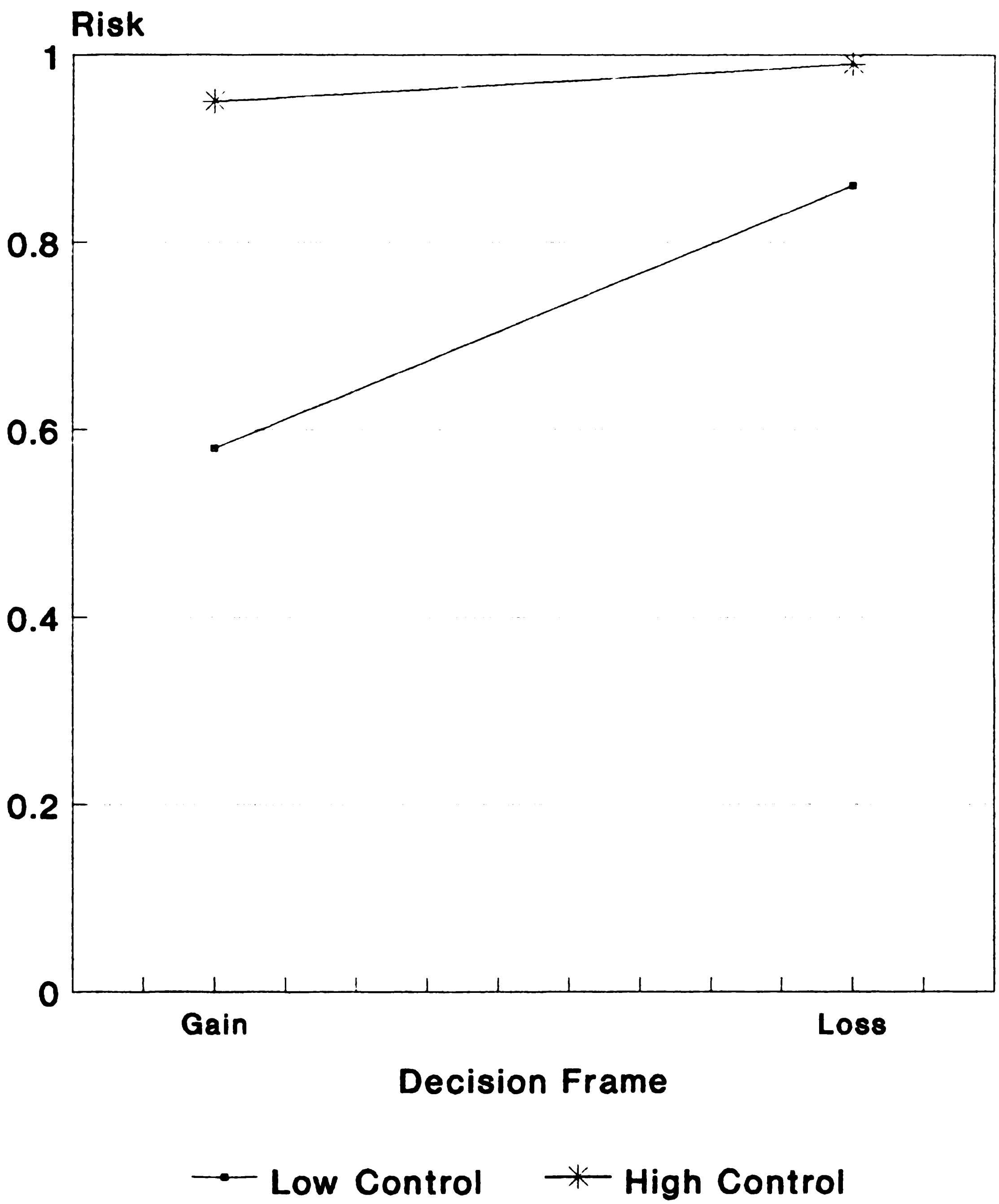


Figure 11: Moderating effect of perceived control

total amount of variance in decision riskiness explained by the three variables was 20 percent.[1]

Hypothesis 3 addressed potential predictors of perceived control. The hypothesis is restated below:

H3: Across decisions, individuals with a more internal locus of control, greater task knowledge, and a more positive performance history will have higher perceptions of control than individuals with a more external locus of control, less task knowledge, and a more negative performance history. For specific decisions, individuals with less informational cue ambiguity will have higher perceived control than individuals with greater informational cue ambiguity.

Two separate analyses were conducted for this hypothesis. The first tested the relationship between performance history and perceived control. The second tested the relationships between all the other predictors and perceived control. Two analyses were required because the criterion for the analysis involving performance history was only based on the last 10 games. The last 10 games were used, as opposed to the entire 20, in order to examine the effects of previous performance (i.e., in games 11-20) on subsequent perceived control (i.e., in games 21-30). Since only two variables were involved, a simple correlation between performance history and later perceived

[1] At first glance, the fact that 20 percent of the total variance was predicted when it was reported that the decision frame accounted for 29 percent of the unique variance may seem confusing. The fact that both results are possible is apparent form Figure 10. The denominator for the total variance is the area of the entire circle (Y), whereas the denominator for the decision frame effect is only the portion dealing with between factors and thus, always less than (Y).

control was computed. As shown in Table 7, the correlation, $r=.513$, was significant at $p < .05$, supporting the predicted relationship.

The remaining components of Hypothesis 3 were tested using the repeated measures regression for between and within subjects effects. Partitioning the total variance in perceived control showed that 15 percent was due to between subjects factors and 85 percent was due to within subjects factors. Cue ambiguity was the within subjects variable in this analysis. There were two between subjects variables, task knowledge and locus of control. Since Hypothesis 3 was designed to be exploratory, all the two-way interactions among the potential predictors of perceived control were also tested. The results of the repeated measures regression for Hypothesis 3 are shown in Table 9. As predicted, task knowledge and locus of control were both positively related to perceptions of control. That is, individuals with higher task knowledge and individuals with a more internal locus of control tended to perceive greater control. Cue ambiguity was not a significant predictor of perceived control. None of the interactions involving cue ambiguity were significantly related to perceived control either. However, the interaction between task knowledge and locus of control was significantly related to perceived control [$F=7.34$, $df=(1,68)$]. The interaction between locus of control and task knowledge in predicting perceived control is plotted in Figure 12. The graph shows that for individuals with an internal locus of control, perceived control increased as task knowledge increased. On the other hand, for individuals with an external locus of control, perceived control tended to remain relatively constant across various levels of

Table 9

Repeated Measures Regression Results for Hypothesis 3

Dependent Variable = Perceived Control

Independent Variables	Unique R^2	F-Value	df	Total R^2
(1) Cue Ambiguity	.026[w]	2.38	(1,68)	.022
(2) Task Knowledge	.297[b]	28.70*	(1,68)	.067*
(3) Locus of Control	.076[b]	5.59*	(1,68)	.079*
(4) (1) * (2)	.034[w]	3.16	(1,68)	.108*
(5) (1) * (3)	.007[w]	.69	(1,68)	.114*
(6) (2) * (3)	.097[b]	7.34*	(1,68)	.129*

*p. < .05

[w]Within subjects effect

[b]Between subjects effect

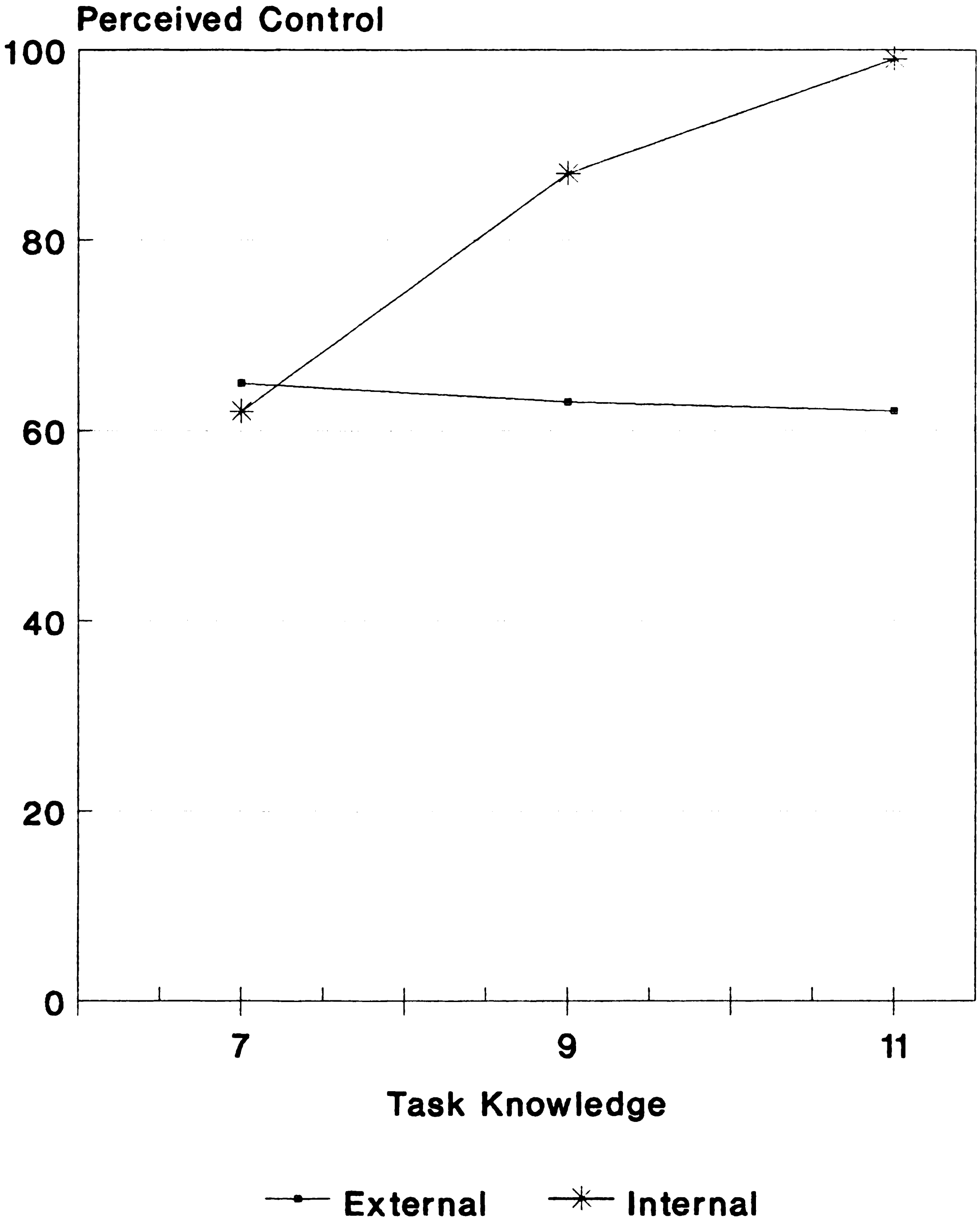


Figure 12: Interaction between task knowledge and locus of control

task knowledge. The total amount of variance in perceived control accounted for by all main effects and all interactions was 13 percent. Hypothesis 3 was partially supported.

Tests of Team Context Hypotheses

Hypotheses 4, 5, 6, and 7 all dealt with the risky decision making of leaders in a team context. Results related to those four hypotheses are presented in this section. Table 10 provides the means, standard deviations, and meaningful correlations among the variables relevant to the team context. As noted in the table, the n for correlations between variables measured between subjects was 41 (i.e., the number of subjects) and the n for correlations between within subjects variables was 840 (i.e., 41 multiplied by the 20 decision trials).

Hypotheses 4, 5, and 6 were all concerned with predicting the decision riskiness of team leaders. Each hypothesis is restated below:

H4: Decision frames will have a direct effect on team leader decision riskiness. Under conditions where alternatives are equal in subjective expected utility and unequal in risk, team leaders presented with a gain frame will be more likely to select a less risky alternative than those presented with a loss frame. Under the same conditions, team leaders presented with a loss frame will be more likely to select a riskier alternative than those presented with a gain frame.

H5: Perceptions of control will moderate the relationship between decision frame and decision riskiness for team leaders' decisions. Specifically, risk seeking will be greater under loss frames than under gain frames when perceptions of

Table 10

Team Context Correlation Table

Between Subject Correlations

Variable	Mean	sd	1	2	3	4	5	6	7
(1) Frame									
(2) Risk	.86	.14	-.465*						
(3) Perceived Control	79.72	7.17	.102	.070					
(4) Need for Affiliation	3.22	.42	.061	-.013	.221				
(5) Cohesiveness	3.59	.63	-.244	.096	-.009	.077			
(6) Task Knowledge	6.93	2.94	-.109	.052	.319*	-.060	.346*		
(7) Locus of Control	1.43	.19	-.056	.240	-.179	.050	.053	-.062	
(7) Performance History	.715	.115							
(8) Late Perceived Control	81.52	8.49							-.201

Within Subject Correlations

Variable	Mean	sd	1	2	3	4	5	6
(1) Frame								
(2) Risk	.86	.34	-.196*					
(3) Perceived Control	79.69	18.89	.038	.323*				
(4) Cue Ambiguity				-.376*	-.537*			
(5) Recommend. Ambiguity	2.02	.83	.071*	-.134*	-.327*		.402*	
(6) Centralization	.31	.15	-.149*	.027	.026	-.084*	.003	
(7) Coordination	.97	.98	.011	-.006	.014	-.019	-.036	.421*

Note. Between subjects correlations are based on $n = 41$. Within subjects correlations are based on $n = 820$. $^*p < .05$

control are lower. When perceptions of control are higher, there are no predicted differences for decision riskiness between gain and loss frames.

H6: Across decisions, the leader's need for affiliation and the team's cohesiveness will moderate the relationship between decision frame and decision riskiness for a team leader's decisions. Specifically, risk seeking will be greater under loss frames than under gain frames when the need for affiliation and team cohesiveness are higher than when the need for affiliation and team cohesiveness are lower. When the need for affiliation and team cohesiveness are lower, there are no predicted differences for decision riskiness between gain and loss frames.

These three hypotheses were tested together using the repeated measures regression procedure. The results of that analysis are shown in Table 11. Overall, the main effects and interactions involved in Hypotheses 4, 5, and 6 accounted for almost 17 percent of the variance in the decision riskiness of team leaders. Partitioning the variance in decision riskiness showed that 7 percent of the variance was due to between subjects factors and 93 percent was due to within subjects factors.

Hypothesis 4 predicted a main effect for decision frame on decision riskiness. Table 11 shows that decision frame accounted for 63 percent of the unique between subjects variance in decision riskiness. Examining the beta weight associated with decision frame also shows that the relationship was in the predicted direction (i.e., leaders were more risk taking under loss frames). Thus, Hypothesis 4 was supported.

Table 11

Repeated Measures Regression Results for Hypotheses 4, 5, & 6

Dependent Variable = Decision Riskiness

Independent Variables	Unique R^2	F-Value	df	Total R^2
(1) Perceived Control	.110[w]	5.30*	(19,741)	.103*
(2) Decision Frame	.630[b]	66.34*	(1,39)	.146*
(3) (1) * (2)	.009[w]	.45	(19,741)	.154*
(4) Need for Affiliation	.021[b]	.82	(1,39)	.155*
(5) Team Cohesiveness	.007[b]	.29	(1,39)	.156*
(6) (2) * (4)	.000[b]	.00	(1,39)	.156*
(7) (2) * (5)	.142[b]	6.43*	(1,39)	.166*

*$p < .05$

[w]Within subjects effect

[b]Between subjects effect

Hypothesis 5 predicted an interaction between decision frame and perceived control in predicting decision riskiness. As shown in Table 11, perceived control did have a main effect on decision riskiness, accounting for 11 percent of the unique within subjects variance, but the hypothesized interaction with decision frame was not significant. Thus, Hypothesis 5 was not supported.

Finally, Hypothesis 6 predicted that the team leader's need for affiliation and the team's cohesiveness would each interact with decision frame in predicting decision riskiness. Only the interaction between decision frame and team cohesiveness was significant, accounting for 14 percent of the unique between subjects variance. To determine if the nature of the interaction was as predicted, the interaction between decision frame and team cohesiveness was plotted in Figure 13. It was expected that the greatest differences between risk taking under gain and loss frames would be exhibited when team cohesiveness was high. As shown in Figure 13, the opposite result was obtained. The greatest differences in risk taking under loss and gain frames occurred under conditions of low team cohesiveness. More specifically, risk seeking was greater under loss frames than under gain frames when team cohesiveness was low. When team cohesiveness was high, risk taking was more comparable under gain and loss frames. It is interesting to note that under loss frames, decision riskiness decreased as team cohesiveness increased, while under gain frames riskiness increased as team cohesiveness increases. Hypothesis 6 was not supported.

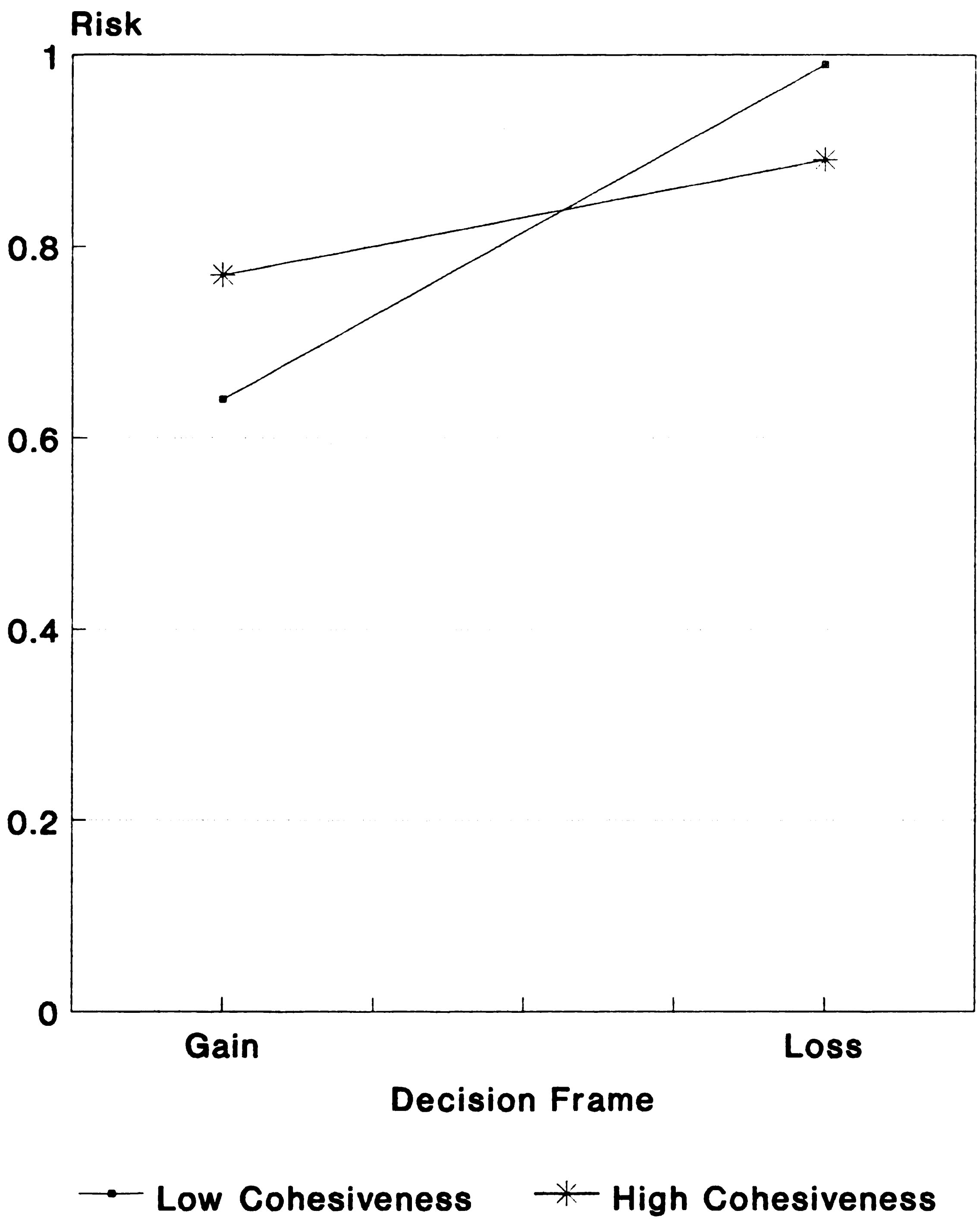


Figure 13: Moderating effect of team cohesiveness

Predictors of team leaders' perceived control were considered in Hypothesis 7. That Hypothesis is presented below:

H7: Across decisions, team leaders with a more internal locus of control, greater task knowledge, and a more positive performance history will have higher perceptions of control than team leaders with a more external locus of control, less task knowledge, and a more negative performance history. For specific decisions, team leaders with less informational cue ambiguity, less recommendation cue ambiguity, greater centralization, and greater coordination will have higher perceived control than team leaders with greater informational cue ambiguity, greater recommendation cue ambiguity, less centralization, and less coordination.

Two separate analyses were conducted for this hypothesis. The first tested the relationship between the team's performance history and leader's perceived control. The second tested the relationships between all the other predictors and the leader's perceived control. Two analyses were necessary because the criterion for the analysis involving the team's performance history was only based on the last 10 games. The last 10 games were used, as opposed to the entire 20, in order to examine the effects of previous performance (i.e., in games 11-20) on subsequent perceived control (i.e., in games 21-30). (Recall that the same procedure was used at the individual level.) Since only two variables were involved, a simple correlation between performance history and later perceived control was computed. As shown in Table 10, the correlation, r=-.201, was not significant. Thus, the predicted relationship was not supported.

The remaining components of Hypothesis 7 were tested using the repeated measures regression for between and within subjects effects. Partitioning the total variance in team leaders' perceived control showed that 14 percent was due to between subjects factors and 86 percent was due to within subjects factors. In this analysis, there were four within subjects variables: cue ambiguity, recommendation ambiguity, coordination, and centralization. Task knowledge and locus of control were the between subjects variables. The more exploratory two-way interactions among the potential predictors of perceived control were excluded because there was not sufficient power to test them. The results of the repeated measures regression for Hypothesis 7 are shown in Table 12. Overall, the six predictors accounted for 37 percent of the total variance in perceived control. However, cue ambiguity was by far the largest contributor, accounting for almost 40 percent of the within subjects variance. In fact, cue ambiguity was the only significant predictor of perceived control in the analysis. Thus, only one of the hypothesized relationships in H7 was supported.

<u>The Process of Risky Decision Making</u>

Hypothesis 8 was concerned with the risky decision making processes of team leaders. In particular, H8 dealt with use of informational cues and recommendation cues under loss and gain frames. The specific hypothesis is restated below:

Table 12
Repeated Measures Regression Results for Hypothesis 7
Dependent Variable = Perceived Control

Independent Variables	Unique R^2	F-Value	df	Total R^2
(1) Cue Ambiguity	.395[w]	34.46*	(15,585)	.340*
(2) Recom'd. Ambiguity	.012[w]	1.05	(15,585)	.350*
(3) Coord.	.000[w]	.00	(1,39)	.351*
(4) Centrality	.006[w]	.51	(1,39)	.356*
(5) Task Knowledge	.011[b]	.44	(1,39)	.365*
(6) Locus of Control	.006[b]	.22	(1,39)	.370*

*p. < .05

[w]Within subjects effect

[b]Between subjects effect

H8: Under loss frames, team leaders are more likely to base decisions on subordinate recommendations than under gain frames.

This hypothesis called for a comparison of R squares obtained under gain and loss frames. Since decision frame was a between subjects variable, this means that R squares obtained using two unique samples needed to be compared. Since there is currently no direct test for comparing R squares obtained from two different samples (Cohen & Cohen, 1983), an alternative approach was employed.

As a first step toward testing Hypothesis 8, two separate regression analyses were conducted, one for leaders under gain frames and one for leaders under loss frames. In each analysis, the three subordinate recommendations were entered as predictors of the team leader's decision. In order for H8 to be potentially supported, the R square obtained for loss frame leaders had to be larger than the R square obtained for gain frame leaders. Regression results showed that the R square for leaders under loss frames was .536 and the R square for leaders under gain frames was .431. Both R squares were significant.

Simply comparing the R squares and concluding that the one obtained under loss frame conditions was larger offered only weak support for Hypothesis 8, especially since both R squares were significant. Even though there is no direct test for determining whether or not two R squares obtained from unique samples are significantly different (Cohen and Cohen, 1983), additional steps were taken to determine if the two R squares were substantially different. The first step involved obtaining the confidence interval for the gain frame R square. The second step was to ascertain whether or not the R square for the loss frame R square fell within that interval.

The confidence interval for the gain frame R square (.431) ranged from .337 to .525. Thus, the loss frame R square of .536 fell outside this interval. This finding further supported Hypothesis 8, showing that team leaders under loss frames are considerably more likely to rely on subordinate recommendations in making team decisions than team leaders under gain frames.

Comparing Framing Effects in the Individual and Team Contexts

Hypothesis 9 dealt with a comparison of the effects of decision frames on decision riskiness in the individual and team contexts. The specific prediction is restated below:

H9: The effects of decision frame on decision riskiness are likely to be stronger for team leaders than for individuals.

A hierarchical regression analysis with dummy coding was used to test this hypothesis. All of the variables involved were between subjects factors. In the analysis individuals were dummy coded zero and team leaders were dummy coded one. The results of the hierarchical regression are presented in Table 13. Only the first step in the regression analysis was significant, essentially demonstrating a main effect for decision frame that was already established in tests of Hypotheses 1 and 4. Since framing effects obtained for individual decision makers did not differ significantly from framing effects evidenced for team leaders, Hypothesis 9 was not supported.

Table 13
Hierarchical Regression Results for Hypothesis 9
Dependent Variable = Decision Riskiness

Independent Variables	Unique R^2	F-Value	df	Total R^2
(1) Decision Frame	.276	41.62*	(1,109)	.276*
(2) Individual/ Leader	.009	1.42	(1,109)	.286*
(3) (1) * (2)	.000	.04	(1,109)	.286*

*$p < .05$

DISCUSSION

The primary goal of this research was to explore the effects of cognitive frames on risky decision making in the individual and team contexts. More specifically, the research was designed to study potential moderators of the relationship between cognitive decision frames (i.e., loss and gain frames) and decision risk purported by prospect theory. Nine formal hypotheses were developed, three that dealt with individual level issues, five concerned with a leader in a team context, and one involving a comparison of the individual and team contexts. The empirical tests of these hypotheses were presented in the previous section. To understand more fully the findings obtained in this study, this section begins with a summary and interpretation of the results. The chapter concludes with a discussion of the primary contributions and limitations of the research.

Summary and Interpretation of Results

Individual decision makers. At the individual level, results showed that cognitive decision frames had the expected effects on decision risk. Findings supported Hypothesis 1 which predicted greater risk seeking under loss frames and greater risk aversion under gain frames. These results are consistent with prospect theory propositions and the empirical results of the original empirical research conducted in developing prospect theory (Kahneman & Tversky, 1979, 1984; Tversky & Kahneman, 1981). The framing effects detected in this study can be thought of as an extension of previous research given the substantial differences between the decision task employed in the present research and the types of tasks typically used in prospect theory research. Paper and pencil hypothetical choice problems have been the most usual type of decision task employed in cognitive framing research prompted by prospect theory. By comparison, it seems likely that the information processing task employed in the present research (i.e., the TIDE^2 simulation) represented a more complex and engaging decision scenario. Previous research by Schurr (1987) obtained results consistent with prospect theory for individuals working on a complex bargaining task. However, that work was attempting to study team level phenomena.

A complex decision task was employed in the present research in an attempt to create some variability in perceived control. A key theme in the present research was that cognitive framing effects (i.e., risk seeking under loss frames and risk aversion under gain frames) were likely to be a function of the low perceived control generated by the lottery-type tasks typical of prospect theory research. It was argued here that perceived control is a critical boundary condition of the effects of cognitive decision frames on decision riskiness. In particular, it was argued in Hypothesis 2 that under gain frames, individuals with high perceived control would be more risk seeking than individuals with low perceived control. Individuals under loss frames were expected to be more consistently risk seeking, regardless of the level of perceived control. Results showed the expected effect for perceived control. Thus, it was concluded that framing effects are more pronounced under conditions in which individuals perceive low control and are less likely to be evidenced under conditions of high perceived control.

In Hypothesis 3, an attempt was made to identify some of the predictors of individual decision makers' perceived control. Across decisions, cue ambiguity, task knowledge, and locus of control were considered. Since the hypothesis was considered more speculative, the two-way interactions among the predictors were also considered. Results showed that task knowledge and locus of control were both significant predictors of perceived control in decision making settings. Individuals with greater task knowledge and individuals with a more internal locus of control perceived greater control than individuals with less task knowledge and individuals with a more external locus of control.

In addition, the interaction between task knowledge and locus of control was significant. Results showed that the effects of task knowledge on perceived control were greatest for individuals with an internal locus of control. In other words, internals with low task knowledge perceived less control than internals with high task knowledge, and slightly less than externals with low task knowledge. Internals with high task knowledge perceived the greatest control. Individuals with an external locus of control had a similar level of perceived control across levels of task knowledge. This finding is not surprising given the definition of the locus of control construct. By definition, those with a more internal locus of control are more likely to view outcomes and events as contingent on the self, while those with a more external locus of control attribute causality to external forces (Rotter, 1966). Since one's level of task knowledge is a personal characteristic, it seems reasonable that task knowledge would have a greater impact on perceived control for internals. According to the theory, externals do not believe they have much control regardless of personal abilities like task knowledge.

An individual's performance history on the decision task was expected to be positively related to perceived control. The results supported this hypothesis with a significant correlation between early task performance (i.e., trials 11-20) and later perceived control (i.e., trials 21-30). Individuals who made more accurate decisions early in the simulation had greater perceived control toward the end of the session. A positive performance history was expected to be interpreted as reinforcing feedback thereby increasing perceptions of control.

In general, the individual level hypotheses were supported by the empirical results. The effects of cognitive frames on decision riskiness were demonstrated using a complex decision task. In addition, results showed that perceived control moderated the relationship between framing and decision risk in the expected fashion. Three of the four hypothesized predictors of perceived control, performance history, task knowledge, and locus of control, were substantiated. An interpretable interaction between task knowledge and locus of control in the prediction of perceived control was also detected.

Team leaders. Prospect theory framing effects were predicted for leaders of decision making teams in Hypothesis 4. As expected, results showed that leaders under gain frames tended to make risk averse decisions while leaders under loss frames made more risk seeking decisions. As at the individual level, perceived control was expected to moderate the relationship between decision frame and decision riskiness for team leaders. However, for team leaders, the interaction was not significant. Hypothesis 5 was not supported. Nonetheless, perceived control did have a significant main effect on decision riskiness. Leaders with greater perceived control tended to make riskier decisions than leaders with lower perceived control.

In Hypothesis 6, two additional moderators of the relationship between decision frame and decision riskiness were proposed in the team context: the team leader's need for affiliation and the team's cohesiveness. In this sample, there was very little variance in the need for affiliation of team leaders. Thus, the results did not support the need for affiliation moderator prediction. Furthermore, the interaction between decision frame and need for affiliation was not significant. The interaction between decision frame and team cohesiveness was significant. However, the nature of the interaction was not as predicted. Leaders of highly cohesive teams were expected to make more risk seeking decisions under loss frames and more risk averse decisions under gain frames. Leaders of less cohesive teams, on the other hand, were predicted to make more consistently risk seeking decisions. The obtained interaction is depicted in Figure 13. (The predicted interaction is shown in Figure 6.)

Leaders of highly cohesive teams were more risk seeking under loss frames than under gain frames. However, compared to leaders of less cohesive teams, leaders of highly cohesive teams were relatively <u>more</u> risk seeking under gain frames. Examining the interaction, it seems that the cognitive framing effect was simply more pronounced for leaders of teams low in cohesiveness. These leaders tended to be more risk seeking under loss frames and more risk averse under gain frames. The leaders of more highly cohesive teams tended to be more consistent in the riskiness of their decisions across loss and gain frames. Rather that exacerbating the effects of framing on decision riskiness, cohesiveness appeared to temper the effects of cognitive decision frames. If the typical effects of cognitive frames on decision risk represent nonrational decision making, then cohesiveness would appear to urge team leaders toward greater rationality in risky decision making. It was assumed that team leaders in highly cohesive teams would be more influenced by decision frames because they would perceive greater social costs for failing to gain (i.e., under gain frames) and losing (i.e., under loss frames). Previous research has shown that cohesiveness fosters an atmosphere of greater social support (e.g., Griffith, 1989). The present results seem to indicate that instead of focusing on the potential social costs, leaders may have perceived greater "social license" to disregard the decision frames as the result of team cohesiveness.

Hypothesis 7 was considered more exploratory, dealing with predictors of team leaders' perceived control. As at the individual level, performance history, cue ambiguity, task knowledge, and locus of control were considered. In addition, the relationships between perceived control and recommendation ambiguity, coordination, and centrality were also studied. Only the relationship between cue ambiguity and perceived control was significant. The more ambiguous the informational cues, the less control leaders perceived. The effect was quite large, accounting for nearly 40 percent of the within subjects variance and approximately 34 percent of the total variance. Since cue ambiguity and recommendation ambiguity were highly correlated

($r=.40$, $p < .01$), it seems reasonable that only the first predictor entered into the repeated measures regression for perceived control (i.e., cue ambiguity) was significant.

Task knowledge and locus of control, both significant predictors of perceived control for individual decision makers, were not predictive of team leaders' perceived control. It may be that in a team context, individual difference variables related to the team leader or any one individual have less of an impact than at the individual level. It was argued that risky decision making in the team context would be qualitatively different from individual risky decision making, in that perceived control would be a more complex issue in the team context. It appears that, in this case, the individual model for predicting perceived control was not very useful when applied to the team context.

However, even the more team-specific predictors of perceived control were not significant in the repeated measures regression analysis. Neither coordination or centrality were predictive of team leaders' perceived control. Examining the zero-order correlations, we find that coordination and centralization were significantly related to each other ($r=.42$, p. $< .01$), but not to perceived control. It also seems that the stability of the coordination measure was questionable in that the standard deviation (.98) was comparable to the mean (.97).

Measurement problems aside, one potential reason that perceived control was not predicted by coordination and centralization is that team leaders did not have a sense of the extent to which their teams were coordinated and centralized. Both centralization and coordination were objective measures derived from the simulation itself by assessing relevant communication patterns. It may have been difficult for team leader's to obtain an accurate picture of the communication patterns in their own teams and interpret them in a meaningful way. The TIDE^2 simulation was configured such that team leaders could only track communication involving themselves. Thus, while they may have been able to track communication patterns in which they were included, leaders could not readily evaluate the extent of communication among subordinates. So, for instance, a team leader may not have had a clear idea of the amount of communication directed toward him or her, relative to the amount of communication among subordinate stations (i.e., centralization). Likewise, leaders in the simulation could not directly ascertain the efficiency of communication patterns among subordinates, one aspect of coordination. These difficulties in assessing communication patterns may have been exacerbated by the fact that each decision trial only lasted 3 minutes. In addition, even if leaders were aware of the levels of coordination and centralization in their own teams, those levels may not have been meaningful in the absence of some comparative standard. That is, without knowing the levels of coordination and centralization in other teams, it seems that the levels in a leader's own team may have been more difficult to interpret.

Although there was a significant and positive relationship between performance history and perceived control at the individual level, the same relationship predicted for team leaders was not substantiated. The correlation between performance on trials 11-20 and perceived control on trials 21-30 was not significant and in the wrong direction (i.e., team leaders with a more positive performance history perceived less control). It may be that, compared to individual decision makers acting alone, team leaders perceived less of a linkage between themselves personally and decision performance. Thus, while individual decision makers who performed well reported greater perceived control over subsequent performance, the lack of correlation in the team context suggests that leaders did not to make as strong a connection between previous performance and subsequent control.

The final team leader hypothesis addressed the manner in which leaders make risky decisions under gain and loss frames. It was expected that leaders would rely more on recommendation cues under loss frames than under gain frames. The reasoning being that leaders would be more likely to attempt to diffuse responsibility for potential losses than for potential gains. The results supported this prediction. The R square for recommendation cues in predicting risky decisions under the loss frame was outside the confidence interval for the R square obtained under the gain frame. This test was somewhat indirect, but offered some initial support for Hypothesis 8, nonetheless.

Comparison of the individual and team contexts. Hypothesis 9 predicted that the effects of cognitive decision frames on decision riskiness would be stronger for team leaders than for individual decision makers. This hypothesis was not supported. The hierarchical regression results showed only a main effect for framing, the effect that was obtained in both the individual and team contexts in tests of Hypotheses 2 and 5, respectively. The results obtained here indicate that framing effects were not substantially stronger for team leaders in a team context. The contention most commonly expressed in the literature is that the effect of cognitive frames on risky decision making are likely to be exacerbated for teams relative to individuals (e.g. Whyte, 1989). Although the literature is not clear on this point, the prediction may be more relevant for different types of decision making teams, such as teams that reach decisions by consensus. In the teams used for the present research, individual team leaders were ultimately responsible for making the team decision. Thus, it appears that the team context does not dramatically alter the effects of cognitive frames on decision riskiness for individual decision makers.

Summary. Results were generally supportive of the study's central hypotheses. Cognitive decision frames had the predicted effects on decision riskiness for individual decision makers and leaders of decision making teams. In addition, certain factors were found to moderate the relationship between decision frames and decision riskiness. For individual decision makers that moderator was perceived control. Individuals under gain frames tended to make more risk averse decisions when perceived control was low and more risk seeking decisions when perceived control was high. Individuals under loss frames made more consistently risk seeking decisions regardless of perceived control. For team leaders, team cohesiveness moderated the relationship between decision frame and decision riskiness. However, the nature of that relationship was not as expected. Instead of exacerbating the effects of cognitive frames, high cohesiveness tended to diminish the effects of cognitive decision frames. Overall, then, the study was successful in demonstrating cognitive framing effects for individuals and team leaders and in defining boundary conditions for those effects.

Contributions and Limitations

In this section, the major contributions and limitations of the present research are considered. The discussion centers primarily around three themes: control, risky decision making in the team context, and decision accuracy.

Issues of control. Considerable attention has been devoted to understanding risky decision making processes. In an attempt to explain the departures from rationality often evidenced in decision making under conditions of risk, Kahneman and Tversky (1979) developed prospect theory. Empirical research to date has largely supported the frame dependent shifts in risk preference predicted by prospect theory (Kahneman & Tversky, 1979; 1984; Tversky & Kahneman, 1981). Essentially, previous work has shown that individuals tend to be risk seeking when a risky decision is framed as a loss and risk averse when the decision is framed as a gain.

The present research sought to explore the boundary conditions of prospect theory's framing effects. Although Kahneman and Tversky (1984) have contended that cognitive framing effects are both "robust" and "pervasive," previous research has demonstrated predicted effects in only limited contexts, for certain types of decision problems. Framing effects have typically been examined using hypothetical choice problems (e.g., Fagley & Miller, 1987; 1990; Kahneman & Tversky, 1979; 1984) or gambling tasks (e.g., Tversky & Kahneman, 1981). Both types of decision making scenarios involve lottery-type tasks characterized by low control.

The issue of context is critical because it may have a direct bearing on perceived control. Clearly, not all risky decision making occurs in a gambling or lottery-type context. In particular, risky decisions within the organizational environment are likely to differ substantially from the gambling scenario. For instance, organizational decision makers have expertise, knowledge, and a variety of other criteria on which to base their risky decisions. Presumably in this type of context, decision makers can assess their own probabilities of making a correct decision. In other words, the decision maker can figure his or her own "odds" and respond accordingly. In a lottery context, the probabilities of making a correct decision are given. Since a lottery is a purely chance event, there is little reason for a decision maker to believe that the applicable probabilities of making a correct decision are different from those that are given. This type of scenario can be contrasted with a situation in which the outcome for an accurate risky decision is based on something other than chance. When the probability of making a correct decision is dependent on some personal or situational factors, individuals may assess their own personal probabilities.

The present study demonstrated the predicted moderating effect for perceived control. Individuals and team leaders who reported lower perceived control made decisions in accordance with prospect theory predictions. In contrast, those reporting higher perceived control made more risk seeking decisions regardless of the cognitive decision frame. The complex decision making simulation allowed for the manipulation of certainty through varying the ambiguity of informational decision cues. The use of the TIDE[2] simulation represents an extension of previous research which primarily used paper and pencil hypothetical choice problems. Even though the simulation was an artificial task in which study's participants would not normally be engaged, participants' outcomes were real, not hypothetical. Rewards were actually contingent upon the decisions made by the individuals and team leaders.

This study's findings may be interpreted in terms of their implications for the role of subjective expected utility (SEU) in risky decision making. One might argue that under conditions of low control, SEU does not affect a decision maker's choice. However, under conditions of high control SEU may be the determinant of risk taking. In other words, a decision maker is simply more likely to take a risk when SEU is greater. This interpretation would be consistent with the study's results since perceived control was operationalized as the probability of making a correct decision.

In any case, the present findings suggest that "nonrationality" in risky decision making may not be as pervasive or as problematic as suggested in the literature (e.g., Kahneman & Tversky, 1984). Although the present research is preliminary, it does seem to suggest that outside a lottery context, decision makers base risky decisions on personal perceptions of control instead of relying exclusively on frame in which the decision problem is presented.

Previous research has demonstrated that perceived control is positively related to a number of desirable organizational outcomes. The results of Spector's (1986) meta-analysis indicated that perceived control is positively related to job satisfaction, organizational commitment, job involvement, performance, and motivation. The results also demonstrated that perceived control is negatively related to stress, absenteeism, intentions to turnover, and turnover. The decision making literature has theorized that perceived control would be positively related to risk taking (Baird & Thomas, 1985; Vlek & Stallen, 1980). It has also been argued that risk taking would be greater for skill-dependent decision tasks than for chance-dependent tasks (Vlek & Stallen, 1980). The results of the present research seem to support these theoretical contentions.

Future research should focus on the further development of the control construct in the risky decision making context. If perceived control is to have solid implications beyond the SEU interpretation, then it is important to demonstrate that "probability of success" is only one aspect of the perceived control construct. For example, one could apply Averill's (1973) typology of control to the decision making context, defining and exploring the effects of behavioral, cognitive, and informational control on risk taking.

Future research should also devote further attention to the predictors of perceptions of control. In the present research, task knowledge and locus of control were predictive of perceptions of control. Decision task familiarity or experience may also be predictive of perceptions of control. This potential predictor of control seems particularly relevant in an organizational context. Organizational decision makers will vary in terms of their experience making risky decisions. More experienced decision makers should have enhanced perceived control.

Risky decision making in teams. Although little scholarly research has addressed risky decision making in the context of teams, the topic is a significant one. In organizations, a great deal of risky decision making occurs in a team context. Hackman (1990) provided several examples of decision making teams in organizational settings, noting both their criticality and their shortcomings. Ilgen et al. (in press) have commented on the importance of decision making teams in organizations, noting the paucity of relevant empirical research currently in existence. Since organizations are likely to continue to rely on teams to make important decisions, the topic is one that needs additional theoretical and empirical attention.

In terms of the team context, research concerning the effects of cognitive frames on decision risk is at the embryonic stage. This study attempted to extend and apply what is known at the individual level to the team context. Simply demonstrating the effects of cognitive frames on decision risk in a team context represents a reasonable contribution to the literature at this point. The present study showed that cognitive frames affect the decision riskiness of leaders operating in the context of a hierarchical team with distributed expertise. A reasonable next step in the development of team research might be an attempt to replicate these findings using different types of teams (e.g., democratic and consensus seeking). A successful replication would extend our knowledge of the team phenomenon, while failure to replicate would help further define the boundaries of the team context effects. Regardless of the results, a meaningful contribution to the literature could be gleaned from research involving teams of varying structures.

Additional team research may also continue to explore the boundary conditions of framing effects by considering potential moderators of the relationship between cognitive frames and decision riskiness. The present study found that team cohesiveness vitiated the effects of cognitive frames. Cohesiveness is an indicator of the quality of the relationships within the team in terms of how attracted team members are to the team. Other indicators of team quality may similarly moderate framing effects. For instance, teams that rate high on collectivism (i.e., the tendency to be group oriented) and/or team member exchange (i.e., effective relationships among team members) may be less subject to the effects of cognitive decision frames.

Decision accuracy. Studying the effects of cognitive decision frames using information processing tasks provides a unique opportunity to consider the issue of decision accuracy. Part of the difficulty with lottery tasks and gambling scenarios is that there are no objectively "right" or "wrong" decisions. An information processing task has an objectively correct decision that is established a priori. Thus, future research may examine not only the effects of decision frames on risk taking, but also their effects on decision accuracy.

This study's findings provide some basis for speculating that perceived control may have an impact on the relationship between decision frame and decision accuracy, similar to its effect on the relationship between frame and risk. This study demonstrated that risk is consistently high under loss frames, regardless of the level of perceived control. This implies that not much "differential" decision making occurs under loss frames; risky options are consistently preferred. In contrast, under gain frames individuals make differential decisions on the basis of perceived control. They discriminate by taking less risk under conditions of low control and more risk under conditions of high control. One could hypothesize that decision accuracy is consistent across levels of perceived control under loss frames, but that decision accuracy is greater when perceived control is greater under gain frames. Given the significant theoretical and practical implications of decision accuracy, this hypothesis, or at least this issue, warrants attention in future research.

Concluding Remarks

Decision making under conditions of risk is an important theoretical and applied topic. The study of the effects of cognitive decision frames on risk appears to be a particularly interesting area of research in which the potential for progress related to both individuals and teams is great. The present research demonstrated framing effects for individuals working on a complex decision task. The study also made some important preliminary steps toward defining the boundaries of framing effects. Perceived control seems to be a critical determinant of risky decision making at the individual level, particularly as a moderator of the cognitive framing effects predicted by prospect theory. This research has also made some initial steps toward identifying predictors of perceived control in the risky decision making context.

The present study has extended the individual literature by demonstrating cognitive framing effects for leaders in a team context. Results showed that individual difference variables did not have significant effects in the team context, neither as moderators of the relationship between cognitive frames and decision risk, nor as predictors of perceived control. However, team characteristics may be important in defining the boundaries of framing effects in the team context. In the present research, team cohesiveness moderated prospect theory framing effects.

Although the effects of cognitive frames may not be as pervasive and all encompassing as previously indicated in the literature (e.g., Kahneman & Tversky, 1984), that does not mean the topic is any less important as an area of research. On the contrary, defining the boundaries of prospect theory's framing effects and considering the implications for decision accuracy, especially within an organizational context, may be a particularly interesting and important area of research. Given the prevalence of teams in organizational settings (e.g., Hackman, 1990; Ilgen et al., in press), extending individual level findings and determining their applicability to the teams may be an equally worthwhile endeavor.

APPENDICES

APPENDIX A

APPENDIX A

GENERAL INSTRUCTIONS

NAVAL COMMAND AND CONTROL TEAM SIMULATION

INTRODUCTION

The year is 1994 and you are a part of a U.S. naval carrier group's command and control team, stationed in the Middle East. A regional conflict between two nations in this area has recently broken out. Your mission is to protect sea-going commercial traffic in the area from accidental or intentional attacks. As history indicates, this is a highly sensitive task. For example, in 1987, an Iraqi jet accidentally fired two Exocet missiles into the Frigate U.S.S. Stark, killing 37 American servicemen and crippling the vessel. One year later, the U.S.S. Cruiser Vincennes accidentally shot down an Iranian passenger plane killing 290 innocent civilians. Any repeat of mistakes of this kind will probably lead to a withdrawal of American forces from the area. Such a withdrawal would have disastrous economic and political ramifications that would spread well beyond this region.

THE TASK FORCE

A naval carrier battle team is an awesome array of ships and support units. It consists of a concentric ring of missile firing warships which protect the aircraft carrier at its center. The aircraft carrier, in return provides an overall umbrella of air protection for the entire task force. The carrier's 90 planes can unleash air strikes against targets at land, sea and even under water. A carrier group can dominate up to 196,000 square miles of Ocean. Your carrier group consists of the Carrier itself, a Ticonderoga class Aegis Cruiser, AWACs reconnaissance planes and a land based Coastal Air Defense (CAD) unit. Although the Carrier itself is equipped with some air patrol capacities, the Cruisers, AWACs and CAD units provide the bulk of air traffic patrol. Taken together, the air patrol groups on the Carrier, the Cruiser, the AWACs and the CAD unit make up the command and control team.

TEAM MISSION

The team of which you are a part, will role play the Commanding Officers of various units in the carrier group. Your mission is to monitor the air space surrounding the carrier group, making sure that neutral ships are not attacked. In performing this role, you must make certain that you do not allow loss of life resulting from accidental or intentional attacks on ships in the task force. At the same time, it is also of paramount importance that you do not inadvertently shoot down friendly military aircraft or any civilian aircraft. Many passenger aircraft fly through the region, and friendly military aircraft from nations not involved in the conflict also patrol the area. The navy can ill-afford any mistakes of either the Stark or Vincennes variety.

OVERVIEW OF ROLES

There are four roles in this simulation. The leader is the Commanding Officer (CO) of the Aircraft Carrier. The other team members include the CO of the AWACs air reconnaissance planes; the CO of the Aegis Cruisers, and the CO of the Coastal Air Defense (CAD) unit. The team's task is to decide what response the carrier group should make toward incoming aircraft. Aircraft that are being tracked on radar are called targets. Teams base their decisions on data they collect by measuring characteristics of the air targets. These measures are obtained from sophisticated radar equipment. The team must make a critical choice regarding each target. There are three potential responses, IGNORE, WARN, and DEFEND. These are described below:

IGNORE: This means that the carrier group should devote no further attention to the target and instead focus on other possible targets in the area. The group should never ignore a target that might possibly attack. This would most assuredly lead to loss of lives on the ship attacked.

WARN: This means that the carrier group sends a message to the target identifying the group and alerting the target. Warn will NEVER BE THE ABSOLUTELY CORRECT RESPONSE. Since in reality all targets are either threatening or non-threatening, WARN will never be the most appropriate response. The decision to WARN, however, is not as bad as selecting DEFEND when the correct response is IGNORE or as bad as selecting IGNORE when the correct response is DEFEND.

DEFEND: This is "weapons away" and means to attack the target with Tomahawk cruise missiles. A defend decision cannot be aborted once initiated. Defend is an appropriate response when the team feels attack is imminent.

CHARACTERISTICS OF TARGETS

The incoming air targets can be measured on nine attributes. These are listed below along with the ranges of possible values on the attributes:

(1) **Speed:**	100 to 800 miles per hour (mph)
(2) **Altitude:**	5,000 to 35,000 feet
(3) **Size:**	size of the target ranging from 15 to 50 meters
(4) **Angle:**	-15 (rapid descent) to +15 degrees (rapid ascent)
(5) **IFF:**	"Identification Friend or Foe." This is a radio signal that identifies whether an aircraft is civilian, para-military, or military, ranging from .2 Mhz (an airliner) to 1.6 Mhz (a fighter).
(6) **Direction:**	from +40 degrees (passing far to the east or west of the Carrier) to 00 degrees (coming straight in to the Carrier)
(7) **Corridor Status:**	a corridor is a 20 mile lane open to commercial air traffic. Status is expressed in terms of miles from the center of the corridor, ranging from 1 mile (in the middle of it) to 50 miles (way out of it)
(8) **Radar Type:**	the kind of radar possessed by the aircraft ranging from Class 1 (weather radar only) to Class 9 (weapons radar)
(9) **Range:**	distance of the aircraft from the Carrier ranging anywhere from 20 to 200 miles

DETERMINING THE LEVEL OF THREAT

In general, the degree to which an incoming target is threatening depends on its standing on these nine attributes. There are five simple rules to remember in determining the danger associated with any target:

(a) All else equal, in terms of IFF, **military targets** are more threatening than civilian targets (see attribute **#5**)

(b) SPEED and DIRECTION go together, so that **fast targets coming straight in** are most threatening (see **#1--#6** above). Speed alone and direction alone mean nothing. There is nothing to fear if fast targets are not headed toward the group. There is nothing to fear from objects headed directly for the group that are moving slowly.

(c) ANGLE and RANGE go together, so that **descending targets that are close** are especially threatening (see **#4--#9**) above. Angle alone and range alone mean nothing. Descending targets that are far away, or close targets that are on the way up are not threatening.

(d) ALTITUDE and CORRIDOR STATUS go together, so that **low flying targets that are way outside the corridor** are especially threatening (see **#2--#7** above). Altitude alone and corridor status alone mean nothing. There is nothing to fear from high flying targets well outside the corridor or low flying targets in the middle of the corridor.

(e) SIZE and RADAR go together, so that **small objects with weapons radar** are especially threatening (see **#3--#8** above). There is nothing to fear from small targets with weather radar or from large targets with weapons radar.

HOW RULES COMBINE TO DETERMINE JUDGMENTS

The five rules combine to determine the overall threat represented by the target. So for example, if the team detected an (a) military aircraft that was (b) flying in straight and fast, (c) was close and descending, (d) was flying low and way outside the corridor, and (e) was small and had weapons radar; a hostile attack would be indicated and the team should DEFEND.

If the team detected (a) a civilian aircraft, that is (b) passing slow at an angle, (c) was far away and ascending, (d) was flying high and in the middle of the corridor and (e) was large and had weather radar; this would indicate a passenger plane that should be IGNORED.

Whether the appropriate response is DEFEND or IGNORE will not always be obvious. Sometimes, a target will appear threatening according to some of the rules but not all. The team will have to combine the rules in order to make a correct decision. Sometimes the team may just decide to WARN a target, rather than risk incorrectly choosing IGNORE or DEFEND. Remember that all the rules count equally in determining what judgment should be made. The team's expertise and experience will be important for handling the non-obvious targets.

AREAS OF EXPERTISE

The Commanding Officer of the Carrier is the team leader and the person who ultimately decides what to do for each target. The other team members, however, also make decisions about how to handle the targets. These decisions are sent to the Carrier as recommendations. Each team member has expertise that is unique to his or her role. That expertise comes in the form of the person's (a) ability to **measure attributes** and **translate raw data** into judgments regarding threat, and (b) the person's **knowledge of the rules.**

For example, although all team members know that military aircraft are more threatening than non-military aircraft, only two people in the team can actually measure this characteristic of the target. In addition, only these two players will be trained to know exactly how raw data on IFF (i.e., radio signal Mhz.) can be translated into terms of "non-threatening" or "very threatening."

Similarly, each member of the team will have to memorize one of the four combination rules (e.g., memorize how speed and direction go together). Thus, at least one member of each team will be an expert on each of the four combination rules.

The CO of the Carrier also memorizes one rule, but he or she can only measure three attributes. The distinctive competency of the Carrier, however, is that its CO knows what all the other team members are experts in.

PATROL SESSIONS

Patrol sessions refer to the time that your team is responsible for monitoring air traffic in your designated area. While you are monitoring traffic, you will be stationed at a computer monitor. This monitor will have four icons on it. These are there to remind you that there are four members on the team: the Carrier (i.e., the team leader), the AWACS (i.e., plane), the Coastal Air Defense unit (i.e., the land mass) and the Aegis Cruiser (i.e., the ship). A red dot in the middle of the screen indicates the presence of a target in your airspace. A clock on the screen tells how long before the CO of the Carrier must render a decision. The target will begin to blink and beep at an increasing rate when there is less than 30 seconds left to respond. If the Leader fails to make any decision with respect to the target, this will be recorded as a **NO CALL** and treated as if the team decided to **IGNORE** it.

The bar at the top of the screen indicates what you can do while on patrol. There are basically five things that you can do when trying to make a decision about a target: Measure, Query, Receive, Transmit, and make a Judgment. Each of these functions will either be described in the videotape or in your training sessions.

<u>THE "FEEDBACK SCREEN"</u>

After every trial except the first, team members will receive a report telling them how well the team is performing. <u>Feedback is delayed by one trial</u>. This means that the results of Trial 1 will be provided after Trial 2 and the results of Trial 2 will be shown after Trial 3, etc. Each feedback screen informs the team of their decision, as well as the "correct decision." There are three possible outcomes from an encounter. The team's total effectiveness and monetary rewards will be expressed in terms of points associated with each outcome.

HIT:

A hit means that the team's decision was exactly correct. This means that a friendly or civilian aircraft was appropriately IGNORED or that your team correctly DEFENDED against a hostile military aircraft. <u>A hit is worth 10 points to the team's overall score</u>.

MISS:

Your team will incur a "miss" whenever WARN is chosen as the team's response. Remember that WARN is never the best response, but it is better than selecting IGNORE or DEFEND incorrectly. <u>A miss is worth 7 points.</u>

DISASTER:

A disaster means that the team's decision was incorrect. That is, the team decision was IGNORE when it should have been DEFEND or; the team's decision was DEFEND when the target should have been IGNORED. A disaster means that one of the ships in the group was struck by a missile (if overly passive), or that one of the ships shot down a friendly target (if overly aggressive). <u>The team receives no points for disasters</u>.

FRAMING MANIPULATIONS

MONETARY REWARDS

At the end of the simulation the team's POINTS GAINED will be totaled. Each point is worth 5 cents. So, a hit is worth 50 cents, a miss is worth 35 cents, and a disaster is worth nothing. Hits are worth 30 percent more money than misses because they are 30 percent more difficult to obtain. (The 30 percent estimate is based on the AVERAGE performance of previous teams across trials.)

The feedback screen provides information on the judgments rendered by each station and the team. (Remember that feedback is delayed by one trial.) The team's performance history is recorded in terms of the total number of Hits, Misses, and Disasters acquired. The team's total points are also recorded on the feedback screen. There is also a space for a goal, but no specific goal has been assigned to your team. The feedback screen also shows a projection of the team's total score based on what the final total will be at the end of the entire session if performance continues at the current level of proficiency. To figure out how much money each member of your team will receive, multiply the total points by .05. For example, if the number of total points at the end of the session is 200, each team member would receive $10.00.

You will be given more information about earning money before you begin the simulation.

MONETARY REWARDS

At the end of the simulation the team's POINTS LOST will be totaled. Each point means a 5 cent deduction from $15.00. So, for a hit the team loses nothing, a miss means a 35 cent loss, and a disaster means a 50 cent loss. The deduction for misses is 30 percent less than the deduction for disasters because disasters are 30 percent more difficult to avoid. (The 30 percent estimate is based on the AVERAGE performance of previous teams across trials.)
The feedback screen provides information on the judgments rendered by each station and the team. (Remember that feedback is delayed by one trial.) The team's performance history is recorded in terms of the total number of Hits, Misses, and Disasters acquired. The team's total points lost are also recorded on the feedback screen. There is also a space for a goal, but no specific goal has been assigned to your team. The feedback screen also shows a projection of the team's total score based on what the final total will be at the end of the entire session if performance continues at the current level of proficiency. To figure out how much money each member of your team will receive, multiply the total points by .05 and subtract that amount from $15.00. For example, assume that the number of total points at the end of the session is 100. You would multiply 100 by .05 for a product of $5.00. Subtract $5.00 from $15.00. Each team member would receive $10.00.

You will be given more information about earning money before you begin the simulation.

Your Specific Role

Role of Leader (Carrier). The Carrier is the leader who makes the team's final decision. The carrier can only measure and interpret three things (1) Speed, (2) Angle, and (3) Corridor Status. The range of values and degree of threat associated with each are shown below.

Degree of Threat

	Non-Threatening	Very Threatening
Speed	100 to 275 mph	525 to 800 mph
Angle	+15 to +8 degrees	-8 to -15 degrees
Corridor Status	0 to 8 miles out	22 to 50 miles out

The leader is unique in knowing the areas of expertise for all other areas. The table below shows which attributes each station can measure.

	Speed	Altit	Size	Angle	IFF	Direct	Corr.St	Radar	Range
CAD	X	X	X	X	X				
AWAC				X	X	X	X	X	
Cruiser	X	X					X	X	X

Summary of How to Determine Threat Levels

(a) All else equal, in terms of IFF, military targets are more threatening than civilian targets.

(b) SPEED and DIRECTION go together, so that fast targets coming straight in are most threatening. Speed alone and direction alone mean nothing. There is nothing to fear if fast targets are not headed toward the group. There is nothing to fear from objects headed directly for the group that are moving slowly.

(c) ANGLE and RANGE go together, so that descending targets that are close are especially threatening. Angle alone and range alone mean nothing. Descending targets that are far away, or close targets that are on the way up are not threatening.

(d) ALTITUDE and CORRIDOR STATUS go together, so that low flying targets that are way outside the corridor are especially threatening. Altitude alone and corridor status alone mean nothing. There is nothing to fear from high flying targets well outside the corridor or low flying targets in the middle of the corridor. *****

(e) SIZE and RADAR go together, so that small objects with weapons radar are especially threatening. There is nothing to fear from small targets with weather radar or from large targets with weapons radar. *****

***** Carrier must memorize this rule!!

Your Specific Role

Role of Land Platform (CAD). The Coastal Air Defense (CAD) unit is a specialist in the measurement and interpretation of five target attributes, (1) speed, (2) altitude, (3) size, (4) angle, and (5) IFF.

The range of values and degree of threat associated with each are shown below.

	Degree of Threat	
	Non-Threatening	Very Threatening
Speed	100 to 275 mph	525 to 800 mph
Altitude	35,000 to 27,000 ft	13,000 to 5,000 ft
Size	50 to 40 meters	20 to 10 meters
Angle	+15 to +8 degrees	-8 to -15 degrees
IFF	.2 to .6Mhz	1.4 to 1.8Mhz

Summary of How to Determine Threat Levels

(a) All else equal, in terms of IFF, military targets are more threatening than civilian targets.

(b) SPEED and DIRECTION go together, so that fast targets coming straight in are most threatening. Speed alone and direction alone mean nothing. There is nothing to fear if fast targets are not headed toward the group. There is nothing to fear from objects headed directly for the group that are moving slowly.*****

(c) ANGLE and RANGE go together, so that descending targets that are close are especially threatening. Angle alone and range alone mean nothing. Descending targets that are far away, or close targets that are on the way up are not threatening.

(d) ALTITUDE and CORRIDOR STATUS go together, so that low flying targets that are way outside the corridor are especially threatening. Altitude alone and corridor status alone mean nothing. There is nothing to fear from high flying targets well outside the corridor or low flying targets in the middle of the corridor.

(e) SIZE and RADAR go together, so that <u>small objects with weapons radar</u> are especially threatening. There is nothing to fear from small targets with weather radar or from large targets with weapons radar.

***** CAD must memorize this rule!!

Your Specific Role

Role of Air Platform (AWACs). The AWACs unit is a specialist in the measurement and interpretation of five target attributes, (1) angle, (2) IFF, (3) direction, (4) Corridor status, and (5) Radar Type.

The range of values and degree of threat associated with each are shown below.

	Degree of Threat	
	Non-Threatening	Very Threatening
Angle	+15 to +8 degrees	-8 to -15 degrees
IFF	.2 to .6Mhz	1.4 to 1.8Mhz
Direction	40 to 22 degrees	08 to 00 degrees
Corridor Status	0 to 8 miles out	22 to 50 miles out
Radar Type	Classes 1 & 2	Classes 8 & 9

Summary of How to Determine Threat Levels

(a) All else equal, in terms of IFF, military targets are more threatening than civilian targets.

(b) SPEED and DIRECTION go together, so that fast targets coming straight in are most threatening. Speed alone and direction alone mean nothing. There is nothing to fear if fast targets are not headed toward the group. There is nothing to fear from objects headed directly for the group that are moving slowly.

(c) ANGLE and RANGE go together, so that descending targets that are close are especially threatening. Angle alone and range alone mean nothing. Descending targets that are far away, or close targets that are on the way up are not threatening.*****

(d) ALTITUDE and CORRIDOR STATUS go together, so that low flying targets that are way outside the corridor are especially threatening. Altitude alone and corridor status alone mean nothing. There is nothing to fear from high flying targets well outside the corridor or low flying targets in the middle of the corridor.

(e) SIZE and RADAR go together, so that <u>small objects with weapons radar</u> are especially threatening. There is nothing to fear from small targets with weather radar or from large targets with weapons radar.

***** AWACs must memorize this rule!!

Your Specific Role

Role of Sea Platform (Cruiser). The Aegis Cruiser is a specialist in the measurement and interpretation of five target attributes, (1) Corridor status, (2) Radar Type, (3) Range, (4) Speed, and (5) Altitude.

	Degree of Threat	
	Non-Threatening	Very Threatening
Corridor Status	0 to 8 miles out	22 to 50 miles out
Radar Type	Classes 1 & 2	Classes 8 & 9
Range	200 to 110 miles	60 to 20 miles
Speed	100 to 275 mph	525 to 800 mph
Altitude	35,000 to 27,000 ft	13,000 to 5,000 ft

Summary of How to Determine Threat Levels

(a) All else equal, in terms of IFF, **military targets** are more threatening than civilian targets.

(b) SPEED and DIRECTION go together, so that **fast targets coming straight in** are most threatening. Speed alone and direction alone mean nothing. There is nothing to fear if fast targets are not headed toward the group. There is nothing to fear from objects headed directly for the group that are moving slowly.

(c) ANGLE and RANGE go together, so that **descending targets that are close** are especially threatening. Angle alone and range alone mean nothing. Descending targets that are far away, or close targets that are on the way up are not threatening.

(d) ALTITUDE and CORRIDOR STATUS go together, so that **low flying targets that are way outside the corridor** are especially threatening. Altitude alone and corridor status alone mean nothing. There is nothing to fear from high flying targets well outside the corridor or low flying targets in the middle of the corridor.

(e) SIZE and RADAR go together, so that <u>small objects with weapons radar</u> are especially threatening. There is nothing to fear from small targets with weather radar or from large targets with weapons radar. *****

***** Cruiser must memorize this rule!!

APPENDIX B

APPENDIX B

PERCEIVED CONTROL

Probability of the Correct Decision

At chance levels, the probability of being correct if you select Ignore or Defend is .50 (i.e., a 50 percent chance of getting a HIT). Based on the performance of previous teams, the average team working on average targets has a .70 probability of being correct if Ignore or Defend is selected (i.e., a 70 percent chance of getting a HIT).

If you were 100 percent certain of being correct, the probability of getting a HIT would be 1.0.

Beginning with trial 11, please indicate the probability that you would have received a HIT for choosing Ignore or Defend. Even if you selected WARN, please make the rating based on what you believe your probability of being correct would have been had you selected Ignore or Defend.
Your rating can range from .50 to 1.0.

.50------------------------------------	.70------------------------------------	1.0
PROBABILITY AT CHANCE LEVELS	PROBABILITY FOR AVERAGE TEAM WORKING ON AN AVERAGE TARGET	PROBABILITY AT CERTAINTY

During the feedback screen following each of the listed trials, record the probability that you would have been correct had either Ignore or Defend been your response.

Trial 11:	____________ probability	Trial 21:	____________ probability
Trial 12:	____________ probability	Trial 22:	____________ probability
Trial 13:	____________ probability	Trial 23:	____________ probability
Trial 14:	____________ probability	Trial 24:	____________ probability
Trial 15:	____________ probability	Trial 25:	____________ probability
Trial 16:	____________ probability	Trial 26:	____________ probability

Trial 17:	____________	probability	Trial 27:	____________	probability
Trial 18:	____________	probability	Trial 28:	____________	probability
Trial 19:	____________	probability	Trial 29:	____________	probability
Trial 20:	____________	probability	Trial 30:	____________	probability

APPENDIX C

APPENDIX C

TASK KNOWLEDGE TESTS

Individual

1 1.5 Mhz represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

2 +20 degrees of angle represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

3 5 miles out side the corridor represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

4 35 degrees of direction represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

5 30,000 foot altitude represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- d A target on the border between two threat levels.
- e A target that is out of the possible range.

6 20 meters represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

7 850 miles per hour represents which of the following?

a A non-threatening target.
b A very threatening target.
c A target on the border between two threat levels.
d A target that is out of the possible range.

8 Class 1 radar represents which of the following?

a A non-threatening target.
b A very threatening target.
c A target on the border between two threat levels.
d A target that is out of the possible range.

9 80 miles for range represents which of the following?

a A non-threatening target.
b A very threatening target.
c A target on the border between two threat levels.
d A target that is out of the possible range.

10 Which of the following combinations represents a more threatening target?

a Slow and land radar targets.
b High flying and fast targets.
c Descending and inside the traffic corridor targets.
d Outside the traffic corridor and high flying targets.
e Close and descending targets.

11 Which of the following combinations represents a more threatening target?

a Slow targets with weather radar.
b High flying and fast targets.
c Descending and inside the traffic corridor targets.
d Small targets with weapons radar.
e Close and ascending targets.

12 Which of the following combinations represents a more threatening target?

a Slow and land radar targets.
b High flying and fast targets.
c Descending and inside the traffic corridor targets.
d Fast targets headed toward the group.
e Close and ascending targets.

13 Which of the following combinations represent a more threatening target?

a Slow and land radar targets.
b High flying and fast targets.
c Descending and inside the traffic corridor targets.
d Outside the traffic corridor and low flying targets.
e Close and ascending targets.

<u>Carrier</u>

1 200 miles per hour represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

2 25 miles outside the corridor represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

3 20 miles outside the corridor represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

4 850 miles per hour represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

5 Class 10 radar type represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

6 +20 degrees of angle represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

7 +10 degrees of angle represents which of the following?
- a A non-threatening target.
- b A very threatening target.
- c A target on the border between two threat levels.
- d A target that is out of the possible range.

Recall that these are the nine target attributes:

Speed Alit Size Angle IFF Direct Corr.St. Radar Range

8 Who can measure speed?
- a CAD
- b AWAC
- c Cruiser
- d CAD and Cruiser
- e AWAC and Cruiser

9 Who can measure altitude?
- a CAD
- b AWAC
- c Cruiser
- d CAD and Cruiser
- e CAD and AWAC

10 Who can measure range?
- a CAD
- b AWAC
- c Cruiser
- d CAD and Cruiser
- e AWAC and Cruiser

11 Who can measure IFF?
- a CAD
- b AWAC
- c Cruiser
- d CAD and AWAC
- e AWAC and Cruiser

12 Who can measure size?
- a CAD
- b AWAC
- c Cruiser
- d CAD and Cruiser
- e AWAC and Cruiser

13 Which of the following combinations represent a more threatening target?
- a Slow and land radar targets.
- b High flying and fast targets.
- c Descending and inside the traffic corridor targets.
- d Outside the traffic corridor and low flying targets.
- e Close and ascending targets.

LIST OF REFERENCES

LIST OF REFERENCES

Andrisani, P. J., & Nestel, G. (1976). Internal-external control as a contributor to and outcome of work experience. Journal of Applied Psychology, 61, 30-34.

Armelius, K. (1979). Task predictability and performance as determinants of confidence in multiple-cue judgments. Scandinavian Journal of Psychology, 20, 19-25.

Averill, J. R. (1973). Personal control over aversive stimuli and its relationship to stress. Psychological Bulletin, 80, 286-303.

Baird, I. S., & Thomas, H. (1985). Toward a contingency model of strategic risk taking. Academy of Management Review, 10, 230-243.

Bakeman,R., & Helmreich, R. (1975). Cohesiveness and performance: Covariation and causality in an undersea environment. Journal of Experimental Social Psychology, 11, 478-489.

Bateson, N. (1966). Familiarization, group discussion, and risk-taking. Journal of Experimental Social Psychology, 2, 119-129.

Bazerman, M. H. (1982). Impact of personal control on performance: Is added control always beneficial? Journal of Applied Psychology, 67, 472-479.

Bazerman, M. H. (1984). The relevance of Kahneman and Tversky's concept of framing to organizational behavior. Journal of Management, 10, 333-343.

Bernoulli, D. (1738). Specimen theoriae novae de mensura sortis. Commentarri Academiae Scientiarum Imperialis Petropolitanae, 5, 175-192. Translated by L. Sommer (1954) as Expositions of a new theory on the measurement of risk. Econometrica, 22, 23-26.

Bird, A. M. (1977). Team structure and success as related to cohesiveness and leadership. Journal of Social Psychology, 103, 217-223.

Brehmer, B., & Hagafors, R. (1986). Use of experts in complex decision making: A paradigm for the study of staff work. Organizational Behavior and Human Decision Processes, 38, 181-195.

Burnstein, E. (1969). An analysis of group decisions involving risk ("the risky shift"). Human Relations, 22, 381-395.

Clark, R. D. III. (1971). Group induced shift toward risk: A critical appraisal. Psychological Bulletin, 76, 251-270.

Collins, B. E., & Guetzkow, H. (1964). A social psychology of group processes for decision-making. New York: Wiley.

Curley, S. P., Yates, J. F., & Abrams, R. A. (1986). Psychological sources of ambiguity avoidance. Organizational Behavior and Human Decision Processes, 38, 230-256.

Dailey, R. C. (1978). Relationship between locus of control, perceived group cohesiveness, and satisfaction with coworkers. Psychological Reports, 42, 311-316.

Davidson, D., Suppes, P., & Siegel, S. (1957). Decision making: An experimental approach. Stanford, CA: Stanford University Press.

deCharms, R. (1968). Personal causations: The internal affective determinants of behavior. New York: Academic Press.

Dobbins, G. H., & Zaccaro, S. J. (1986). The effects of group cohesion and leader behavior on subordinate satisfaction. Group and Organization Studies, 11, 203-219.

Dorfman, P. W., & Stephan, W. G. (1984). The effects of group performance on cognitions, satisfaction, and behavior: A process model. Journal of Management, 10, 173-192.

Dutton, J. E., & Jackson, S. E. (1987). Categorizing strategic issues: Links to organizational action. Academy of Management Review, 12, 76-90.

Dyer, J. L. (1984). Team research and team training: A state-of-the-art review. In F. A. Muckler (Ed.) Human factors review, (pp. 285-323). Santa Monica, CA: Human Factors Society.

Einhorn, H. J., & Hogarth, R. M. (1981). Behavioral decision theory: Processes of judgment and choice. Annual Review of Psychology, 32, 53-88.

Ellsberg, D. (1961). Risk, ambiguity, and the Savage axioms. Quarterly Journal of Economics, 75, 643-669.

Ericsson, K. A., & Simon, H. A. (1980). Verbal reports as data. Psychological Review, 87, 215-251.

Ericsson, K. A., & Simon, H. A. (1984). Protocol analysis: Verbal reports as data. Cambridge, MA: MIT Press.

Evans, C. R., & Dion, K. L. (1991). Group cohesion and performance: A meta-analysis. Small Group Research, 22, 175-186.

Fagley, N. S., & Miller, P. M. (1987). The effects of decision framing on choice of risky vs. certain options. Organizational Behavior and Human Decision Processes, 39, 264-277.

Fagley, N. S., & Miller, P. M. (1990). The effects of framing on choice: Interaction with risk-taking propensity, cognitive style, and sex. Personality and Social Psychology Bulletin, 16, 496-510.

Field, R. H. G. (1982). A test of the Vroom-Yetton normative model of leadership. Journal of Applied Psychology, 67, 523-532.

Field, R. H. G., & House, R. J. (1990). A test of the Vroom-Yetton model using manager and subordinate reports. Journal of Applied Psychology, 75, 362-366.

Fleishman, E. A., & Zaccaro, S. J. (1992). Toward a taxonomic classification of team performance functions: Initial considerations, subsequent evaluations and current formulations. In R. W. Swezey & E. Salas (Eds.) Teams: Their training and performance. New Jersey: ABLEX.

Glass, D. C., & Singer, J. E. (1972). Urban stress: Experiments on voice and social stressors. New York: Academic Press.

Greenberger, D. B., & Strasser, S. (1986). Development in application of a model of personal control in organizations. Academy of Management Review, 11, 164-177.

Greenberger, D. B., Strasser, S., Cummings, L. L., & Dunham, R. B. (1989). The impact of personal control on performance and satisfaction. Organizational Behavior and Human Decision Processes, 43, 29-51.

Griffith, J. (1989). The Army's new unit personnel replacement and its relationship to unit cohesion and social support. Military Psychology, 1, 17-34.

Gross, K. (1901). The play of man. New York: Appleton.

Hackman, J. R. (1990). Groups that work (and those that don't). San Francisco, CA: Jossey-Bass.

Hagen, O. (1979). Toward a positive theory of preferences under risk. In M. Allais & O. Hagen (Eds.) Expected utility hypotheses and the Allais paradox, (pp. 271-302). Dordrecht, Holland: D. Reidel.

Hartnett, J. J., & Barber, R. M. (1974). Fear of failure in group risk taking. British Journal of Social and Clinical Psychology, 13, 125-129.

Heilman, M. E., Hornstein, H. A., Cage, J. H., & Herschlag, J. K. (1984). Reactions to prescribed leader behavior as a function of role perspective: The case of the Vroom-Yetton model. Journal of Applied Psychology, 69, 50-60.

Hoogstraten, J., & Vorst, H. C. M. (1978). Group cohesion, task performance, and the experimenter expectancy effect. Human Relations, 31, 939-956.

Hollenbeck, J. R., Sego, D. J., Ilgen, D. R., Major, D. A. (1991). Team interactive decision exercise for teams incorporating distributed expertise ($TIDE^2$): A program and paradigm for team research (Tech. Rep. No. 91-1). East Lansing: Michigan State University, Departments of Management and Psychology.

Ilgen, D. R., Major, D. A., Hollenbeck, J. R., Sego, D. J. (in press). Decision making in teams: Raising and individual level decision model to the team level. In R. Guzzo and E. Salas (Eds.) Team decision making in organizations. San Francisco: Jossey Bass.

Jackson, S. E., & Dutton, J. E. (1988). Discerning threats and opportunities. Administrative Science Quarterly, 33, 370-387.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47, 263-291.

Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. American Psychologist, 39, 341-350.

Kameda, T., & Davis, J. H. (1990). The function of the reference point in individual and group risk decision making. Organizational Behavior and Human Decision Processes, 46, 55-76.

Lamm, H., & Meyers, D. (1978). Group induced polarization of attitudes and behaviors. In L. Berkowitz (Ed.) Advances in Experimental Social Psychology, 11. New York: Academic Press.

Langer, E. J., & Roth, J. (1975). Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task. Journal of Personality and Social Psychology, 32, 951-955.

Langer, E. J., & Rodin, J. (1976). The effects of choice and enhanced personal responsibility: A field experiment in an institutional setting. Journal of Personality and Social Psychology, 34, 191-198.

Levin, I. P., Johnson, R. D., & Davis. M. L. (1987). How information frame influences risky decisions: Between-subjects and within-subjects comparisons. Journal of Economic Psychology, 8, 43-54.

Levinger, G., & Schneider, D. J. (1969). A test of the risk as a value hypothesis. Journal of Personality and Social Psychology, 2, 165-169.

Libo, L. M. (1953). Measuring group cohesiveness. Ann Arbor: University of Michigan, Institute for Social Research.

Lichtenstein, S., Fischhoff, B., & Phillips, L. D. (1982). Calibration of probabilities: The state of the art to 1980. In D. Kahneman, P. Slovic, & A. Tversky (Eds.) Judgement under uncertainty: Heuristics and biases, (pp. 306-334). Cambridge: Cambridge University Press.

Loke, W. H. (1989). The effects of framing and incomplete information on judgments. Journal of Economic Psychology, 10, 329-341.

MacCrimmon, K. R., & Larsson, S. (1979). Utility theory: Axioms versus "paradoxes." In M. Allais & O. Hagen (Eds.) Expected utility hypotheses and the Allais paradox, (pp. 333-410). Dordrecht, Holland: D. Reidel.

Marquis, D. G. (1962). Individual responsibility and group decisions involving risk. Industrial Management Review, 3, 8-23.

McClelland, D. C. (1961). The achieving society. New York: Van Nostrand.

McClelland, D. C. (1975). Power: The inner experience. New York: Irvington.

McClelland, D. C., (1982). Leadership motive pattern and long-term success in management. Journal of Applied Psychology, 67, 737-743.

McClelland, D. C., & Winter, D. (1969). Motivating economic achievement. New York: Free Press.

McCord, M., & de Neufville, R. (1983). Empirical demonstration the expected utility decision analysis is not operational. In B. P. Stigum & F. Wenstop (Eds.) Foundations of utility and risk theory with applications, (pp. 181-200). Dordrecht, Holland: D. Reidel.

McGrath, J. E. (1984). Groups: Interaction and performance. Englewood Cliffs, NJ: Prentice-Hall.

McGuire, T. W., Kiesler, S., & Siegel, J. (1987). Group and computer-mediated discussion effects in risk decision making. Journal of Personality and Social Psychology, 52, 917-930.

Meyers, D., & Lamm, H. (1975). The polarizing effect of group discussion. American Scientist, 63, 297-303.

Miller, D. T., & Ross, M. (1975). Self-serving bias in the attribution of causality: Fact or fiction? Psychological Bulletin, 82, 213-225.

Miller, S. M. (1977). Controllability and human stress: Method, evidence, and theory. Behavior Research and Therapy, 171, 287-304.

Morgan, B. B., Glickman, A. S., Woodward, E. A., Blaiwes, A. S., & Salas, E. (1986). Measurement of team behaviors in a Navy environment (Tech. Rep. No. NTCS TR-86-014). Orlando, FL: Navy Training Systems Center.

Mosteller, F., & Nogee, P. (1951). An experimental measurement of utility. Journal of Political Economy, 59, 371-404.

Mudrack, P. E. (1989). Defining group cohesiveness: A legacy of confusion? Small Group Behavior, 20, 37-49.

Neale, M. A., Bazerman, M. H., Northcraft, G. B., & Alperson, C. (1986). "Choice shift effects" in group decisions: A decision bias perspective. International Journal of Small Group Research, 2, 33-42.

Pepitone, A., & Kleiner, R. (1957). The effects of threat and frustration on group cohesiveness. Journal of Abnormal and Social Psychology, 54, 192-19.

Platt, J. R. (1964). Strong inference. Science, 146, 347-353.

Pruitt, D. G. (1971). Choice shifts in group discussion: An introductory review. Journal of Personality and Social Psychology, 20, 339-360.

Rothbaum, F., Weisz, J. R., & Snyder, S. S. (1982). Changing the world and changing the self: A two-process model of perceived control. Journal of Personality and Social Psychology, 42, 5-37.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs: General and Applied, 80, 1-28.

Savage, L. J. (1954). The foundations of statistics. New York: Wiley.

Schoemaker, P. J. H. (1980). Experiments on decisions under risk: The expected utility hypothesis. Boston: Martinus Nijhoff.

Schurr, P. H. (1987). Effects of gain and loss decision frames on risky purchase negotiations. Journal of Applied Psychology, 71, 351-358.

Sitkin, S. B., & Pablo, A. L. (1992). Reconceputalizing the determinants of risk behavior. Academy of Management Review, 17, 9-38.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1982). Facts versus fear: Understanding perceived risk. In D. Kahneman, P. Slovic, & A. Tversky (Eds.) Judgement under uncertainty: Heuristics and biases, (pp. 463-489). Cambridge: Cambridge University Press.

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. Journal of Personality and Social Psychology, 48, 1467-1478.

Stoner, J. A. F. (1961). A comparison of individual and group decisions involving risk. Unpublished master's thesis, School of Industrial Management, Massachusetts Institute of Technology.

Sutton, R. I., & Kahn, R. L. (1986). Prediction, understanding and control as anecdotes to organizational stress. In J. Lorsch (Ed.) Handbook of organizational behavior, 272-285. Englewood Cliffs, NJ: Prentice-Hall.

Tetrick, L. E., & LaRocco, J. M. (1987). Understanding, prediction, and control as moderators of the relationships between perceived stress, satisfaction, and psychological well-being. Journal of Applied Psychology, 72, 538-543.

Thaler, R. H., & Johnson, E. J. (1981). Gambling with the house money and try to break even: The effects of prior outcomes on risky choice. Management Science, 36, 643-660.

Thompson, S. C. (1981). Will it hurt less if I can control it? A complex answer to a simple question. Psychological Bulletin, 90, 89-101.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. Science, 211, 453-458.

Van Bergen, A., & Koekebakker, J. (1959). Group cohesiveness in laboratory experiments. Acta Psychologica, 16, 81-98.

Vinokur, A. (1971a). Cognitive and affective processes influencing risky taking in groups: An expected utility approach. Journal of Personality and Social Psychology, 20, 472-486.

Vinokur, A. (1971b). Review and theoretical analysis of the effects of group processes upon individual and group decisions involving risk. Psychological Bulletin, 76, 231-250.

Vlek, C., & Stallen, P. J. (1980). Rational and personal aspects of risk. Acta Psychologica, 45, 273-300.

von Neumann, J., & Morgenstern, O. (1944). Theory of games and economic behavior. Princeton, NJ: Princeton University Press.

von Neumann, J., & Morgenstern, O. (1947). Theory of games and economic behavior, 2nd edition. Princeton, NJ: Princeton University Press.

Vroom, V. H., & Jago, A. G. (1978). On the validity of the Vroom-Yetton Model. Journal of Applied Psychology, 63, 151-162.

Vroom, V. H., & Yetton, P. W. (1973). Leadership and decision-making. Pittsburgh: University of Pittsburgh Press.

Wallach, M. A., Kogan, N., & Bem, D. J. (1964). Diffusion of responsibility and level of risk taking in groups. Journal of Abnormal and Social Psychology, 68, 263-274.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. Journal of Personality and Social Psychology, 39, 806-820.

White, R. (1959). Motivation reconsidered: The concept of competence. Psychological Review, 66, 297-333.

Whyte, G. (1989). Groupthink reconsidered. Academy of Management Journal, 14, 40-56.

Yinon, Y., & Bizman, A. (1974). The nature of affective bonds and the degree of personal responsibility as determinants of risk taking for "self and others." Bulletin of the Psychonomic Society, 4, 80-82.

Zaccaro, S. J., & McCoy, M. C. (1988). The effects of task and interpersonal cohesiveness on performance of a disjunctive group task. Journal of Applied Social Psychology, 18, 837-851.

Zuckerman, M. (1979). Attribution of success and failure revisited, or: The motivational bias is alive and well in attribution theory. Journal of Personality, 47, 245-287.