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# EFFECTS OF GROUP PROCESSES UPON INDIVIDUAL AND GROUP DECISIONS INVOLVING RISK

by
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A dissertation submitted in partial fulfillment
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ABSTRACT

EFFECTS OF GROUP PROCESSES UPON INDIVIDUAL AND GROUP DECISIONS INVOLVING RISK

by

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This study focused on the cognitive and affective processes that were thought to produce shifts toward greater risk and caution in decision-making following group discussion.

In order to test specific hypotheses derived from these processes an SEU model for individual choice behavior was applied to the Choice Dilemmas task. Three experiments demonstrated that individuals' decisions regarding risk (i.e., minimum probability of success which an individual would accept, p) could be accounted for by a rational decision rule which is maximization of subjective expected utility (SEU). When minimum acceptable probabilities were predicted from the relative utilities of the possible outcomes (i.e., utilities' ratio, $\hat{p}$) these estimated values were quite close to the actual risk level chosen, p. The function $p = \hat{p}$ described the obtained relationship fairly well, before as well as after group discussion and decision.

Two hypotheses that accounted for the shifts in terms of cognitive processes were tested. The first hypothesis, informational influence, suggests that new information raised during the group discussion influences the person's view of the situation (i.e., his assessment of the utilities of the potential outcomes) and this in

turn influences his decision regarding risk. Shifts in risk, therefore, may be considered an epiphenomenon, the inevitable result of changes in utilities produced during group discussion. This hypothesis was supported in four experiments. First, it was shown that group discussion is responsible for the shifts in risk as well as for changes (i.e., shifts) in the utilities' ratio. Consistent shifts in either risk preference or utilities' ratio did not occur in the absence of group discussion. Second, significant shifts in utilities' ratio were found in all the experiments. Furthermore, these shifts in utilities' ratio closely correspond to the shifts in risk preference. In the last experiment where the groups decided about utilities, the same shifts in utilities' ratio were found as in the earlier experiments where the groups decided about risk preference.

The second cognitive hypothesis, the rationality hypothesis, suggests that the shifts in risk are the result of increasing rationality. More specifically, it asserts that better use of the SEU Maximization rule is made during the group discussion than when the individual decides alone (i.e., discussion enhances rationality). This enhanced rationality then influences the person's decisions regarding risk. In contrast, a third hypothesis suggests that the shifts in risk are the result of an affective process. It argues that there are significant rewards and punishments, available in group situation, e.g., approval and disapproval, and these influence the person's decisions regarding risk. Neither the rationality hypothesis nor the affective hypothesis was supported by the results of the experiments In fact, the bulk of the evidence is against these hypotheses.

Implications are drawn for behavioral decision theory concerning risk and decision-making, and for future research in attitudes and behavior and group processes.

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# CHAPTER I

## INTRODUCTION AND REVIEW OF THE LITERATURE

Over the past several years individual and group decisions involving risk have been subject to very intensive research. The interest in group risk-taking seems to have arisen from a serendipitous finding, first reported by Stoner (1961), that groups are willing to take greater risks than the individuals composing them. This phenomenon has been called the 'risky-shift'. The following review organizes the various explanations for the risky-shift according to the processes which they assume produce the effect. In an attempt to unravel and illuminate these processes, related questions concerning individual and group-decision making are also discussed.

### The Risky-Shift Phenomenon

Reading the literature up to 1961, one gets the solid impression that in groups individuals become more moderate, reserved and conservative. They conform to the judgments of others (Asch, 1956; Sherif, 1936); their judgments are less extreme when done in the presence of others (Allport, 1924); and their opinions about risk-taking when expressed in a group are more conservative (Whyte,

1956). Moreover, it was clearly demonstrated that group pressures are exerted on deviants to bring them into line with group norms (Festinger, 1950; Schachter, 1951). Thus many were surprised and intrigued when in 1961 Stoner found that group members are willing to take risks which are more extreme than those they were willing to accept as individuals. Stoner used the Choice Dilemmas Questionnaire (CDQ), a risk-taking instrument that was developed by Wallach and Kogan (1959) to measure individual risk-taking tendencies. The instrument and data on its reliability and validity are presented in Kogan and Wallach (1964).

The CDQ includes a series of twelve problems covering a wide range of topics. Each problem consists of a description of an hypothetical life situation where a person is confronted with a choice between two alternative courses of action. One alternative, if chosen, guarantees a safe outcome. The other alternative involves risk. If successful, its outcome is the most desirable but, if unsuccessful, its outcome is most undesirable. An illustrative example is Item 1:

Mr. A, an electrical engineer, who is married and has one child, has been working for a large electronics corporation since graduating from college five years ago, He is assured of a lifetime job with a modest, though adequate, salary, and liberal pension benefits upon retirement. On the other hand, it is very unlikely that his salary will increase much before he retires. While attending a convention, Mr. A is offered a job with a small, newly

founded company which has a highly uncertain future. The new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms.

Imagine that you are advising Mr. A. Listed below are several probabilities or odds of the new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A to take the new job.

The subject indicates this probability by checking one of the following odds: 1, 3, 5, 7, or 9 in ten that the company will prove financially sound. He may indicate, instead, that Mr. A should not take the new job no matter what the odds. The lower the checked odds, the riskier the decision is considered to be.

In a standard procedure, subjects are first asked to make individual decisions on all the twelve problems while working alone. Then groups are formed and instructed to discuss each problem and to arrive at a unanimous group decision regarding the acceptable level of risk. The difference between the mean level of risk taken initially by the subjects and the subsequent level of risk endorsed by the group is termed a 'shift'.

It is important to note here that in these studies risk is defined only in terms of the odds of success (i.e., probability) of an alternative course of action. The smaller the odds of success, the riskier the decision is considered to be. Hence, the risky-

shift phenomenon refers to an apparent change in preference for smaller odds of success. This, however, is not the only viable definition of risk-taking behavior. In some studies risk-taking has also been defined as a choice of an alternative with greater variance of probabilities and values (Coombs and Pruitt, 1960 and 1961), or as a choice of alternative with greater uncertainty about these probabilities and values (Marquis and Reitz, 1969). For reviews concerning the definition and assessment of risk-taking behavior see Slovic (1964) and Coombs and Huang (1968).

The importance of a phenomenon rests on its generality. Using the CDQ the same effect of group shift toward greater risk was reproduced across a wide variety of populations. Stoner (1961) found the phenomenon using male students in industrial management as subjects. Wallach, Kogan and Bem (1962) replicated the results with liberal art students; males and females. Marquis (1962) used senior executives as subjects and replicated the phenomenon as well. Using the CDQ as well as hypothetical choice dilemmas based on real case studies the effect was demonstrated with psychiatric clinic teams (Siegal and Zajonc, 1967). Replications have also been made in other countries, including England (Bateson, 1966) and Israel (Rim, 1963 and 1964) with samples of impressive heterogeneity.

The risky-shift phenomenon has also been reproduced with a variety of decision tasks. Thus, the effect is by no means limited to hypothetical choice dilemmas with merely imaginary outcomes. It has been produced in a task involving choices among

College Board examination items of varying levels of difficulty and with monetary payoffs (Clausen, 1965; Wallach, Kogan and Bem, 1964). As another instance, when groups were to choose to receive different stimuli varying in the probabilities of occurrence of painful side-effects, they were willing to accept greater probabilities (i.e., greater risk of receiving the side-effect) than the individuals composing these groups (Bem, Wallach and Kogan, 1965). In a tactical radar simulation game, where subjects could postpone their decisions until additional information became available, they ventured more judgments after group discussion thereby risking incorrect judgments (Lamm, 1966).

Limits on the generality, however, should also be noted. Among the twelve hypothetical choice dilemmas of the CDQ there are two items (5 and 12) that consistently yield group shifts toward greater caution (conservatism), though the magnitudes of these shifts are at best moderate (i.e., a third to a half of the mean risky-shift). Other hypothetical choice dilemma items that yield cautious shifts have been constructed by various researchers (Burns, 1967; Myers, 1967; Nordhøy, 1962; Rabow et al., 1966; Stoner, 1968; Vidmar, 1969). But again, the magnitude of these shifts is usually moderate in comparison to that of the mean risky-shift.

Another important limitation on the generality of the risky-shift phenomenon is its failure to show up in studies of betting behavior (Collins and Guetzkow, 1964; Hunt and Rowe, 1960; Lonergan and McClintock, 1961). There are, however, two recent studies that did produce the risky-shift in betting. In one study longer group

discussion to consensus was encouraged (Pruitt and Teger, 1969)[1] In the other study discussion was not allowed but subjects were exposed to other group members' decisions (Blank, 1968).[2] Similarly, the risky-shift has not appeared consistently in Estes-type gambling situations where subjects "bet" which of two lights would appear. Two such studies found cautious shifts (Smith and Radinsky, 1969; Zajonc et al., 1968); a third obtained both cautious and risky-shifts under different conditions (Zajonc et al., 1969).

At present it seems reasonable to conclude that, while the generality of the risky-shift has been demonstrated, its limits have not been clearly outlined. More important, there is no good explanation of the phenomenon.

The various explanations that have been offered to account for the risky-shift are sometimes called "theories", but more often "hypotheses". These hypotheses can be divided into four types according to the processes assumed to underlie the effect: affective, cognitive, interactive and statistical.

## Affective Hypotheses

Making a decision in a group can produce positive or negative consequences for the individual. If he takes these consequences into

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[1] In this study the risk-taking scale was biased toward riskiness, as subjects could not choose alternative with odds of success greater than 1 in 2 except for one alternative with sure success i.e., odds of 1 in 1.

[2] In this study, unlike any other, the expected value of alternatives increased with their riskiness.

account, and they influence his decision, an affective process is said to be operative. In other words, if what the individual may lose or gain by virtue of the fact that he is making his decision in a particular context (e.g., under group pressure, in the presence of others, under pressure to reach a quick decision) influences his decision, the process of influence is assumed to be an affective one. Borrowing from the terminology of behavioral decision theory (Edwards et al., 1965) it can be stated that affective processes involve a shift from one pay-off probability decision matrix to another, where the consequences to the individual of making the decision in a group enter into consideration.

It has been argued (Goodman, 1967) that a change in a decision about risk level resulting from an affective proccess is temporary, and therefore should disappear as the individual leaves the group. The permanency of a change is not, however, sufficient evidence that affective processes were not operative. Once a change has occurred, intervening factors may work to stabilize it. Commitment to the decision is just one case in point. Similarly, the interaction among group members cannot be taken as either a necessary or a sufficient condition that an affective process was operative. The individual may be affected by anticipated consequences that are not mediated by the interaction as much as he may recognize these consequences but not let them influence his decision, or he may fail to be aware of them altogether.

Diffusion of Responsibility. This hypothesis was advanced by Wallach, Kogan and Bem (1962) and maintained by these researchers in later studeis (Wallach and Kogan, 1965; Kogan and Wallach, 1967a; 1967b; 1967c; and Wallach, Kogan and Bem, 1964). In its most recent formulation the hypothesis asserts that:

> It is the affective bonds formed in discussion that may enable the individual to feel less than proportionally to blame when he entertains the possible failure of risky decision. (Wallach and Kogan, 1965, p. 18)

As the felt responsibility of each group member is reduced, the individuals and the group as a whole are able to take greater risks.

The hypothesis received indirect support in several studies. One study showed that highly anxious individuals, who are assumed to be more motivated to avoid blame for failure, produced greater shift toward risk (Kogan and Wallach, 1967a). However, one recent study employing the Marlowe-Crowne Need for Social Approval Scale (Crowne and Marlowe, 1964), Alpert and Haber Achievement Anxiety Test (1960), and Taylor's Manifest Anxiety Scale (1953) failed to replicate this result (Myers, Murdoch and Smith, 1969). Another study demonstrated that group discussion is a necessary and sufficient condition for producing the group shift, while a group consensus without discussion is not sufficient to produce the shift (Wallach and Kogan, 1965). The authors maintained that this finding is compatible with the diffusion of responsibility hypothesis, and that group discussion is the mechanism that enables the group members to diffuse their responsibility through the creation of affective bonds. Two studies cast some doubt on the role of discussion in producing the shift. With instructions deemphasizing the requirement to reach consensus, Teger and Pruitt

(1967) found shifts toward greater risk when subjects merely revealed their risk-level choices but did not discuss them. Shifts toward greater risk-taking were also found by Lamm (1967) and by Kogan and Wallach (1967c), both of whom allowed individual subjects to listen to real group discussion of the CDQ without discussing the issues themselves. It is important to note, however, that in the latter two studies the magnitude of the shifts toward risk was not nearly as great as in the condition where discussion among group members was allowed.

It is evident that a direct test of the diffusion of responsibility hypothesis requires one to manipulate subjects' felt responsibility and the extent to which other group members can share it. In an experiment purported to be a direct test of the hypothesis and employing a problem solving task, it was found that subjects who were told to make a decision for the group without discussion, where the consequences of the decision would fall on everybody in the group, shifted to more cautious risk-levels. Subjects in groups where discussion was allowed shifted to greater risk-levels. The discussions concerned risk-level and which group member would attempt to solve a given problem for the group. Moreover, greater shifts toward risk occurred in groups where subjects shared equally in the consequences of a decision than in groups where each member was responsible for his own wins and losses (Wallach, Kogan and Bem, 1964).

The results of this experiment are not unequivocal and lend themselves to different interpretations. The risk-taking instrument used in the study consisted of items from the College Board Entrance

Examination. Risk-level was measured by the difficulty of the item, determined by the percentage of students in the population who answered the item correctly. Subjects' own perception of the difficulty of the item was not measured. It can be argued that group discussion increases subjects' confidence about their ability to answer the item correctly, and influences them to take what objectively is a more difficult item. Alternatively, since the group can select its ablest member to tackle a problem it could also choose a more difficult item (i.e., one with lower odds of success). Clausen (1965) utilized the same instrument in her experiment and indeed found a positive correlation between subject's riskiness, i.e., choice of a difficult item, and his confidence. It seems likely, therefore, that what was manipulated in Wallach, Kogan and Bem's experiment was confidence and subjective perception of the difficulty of the items rather than shared responsibility.

Diffusion and concentration of responsibility were also manipulated in an experiment using a two-choice gambling task. No significant shifts were found in either of these two conditions, nor was there any difference in shifts between the conditions (Smith and Radinsky, 1969).

Pruitt and Teger (1969) noted that in its original formulation the hypothesis focused on participation in a group decision as the mechanism that diffuse the responsibility. Once it was found that shifts occur merely by discussion without working for any group decision (Wallach and Kogan, 1965) the hypothesis was reformulated and focused on the creation of affective bonds that enable the

diffusion of responsibility to occur (Kogan and Wallach, 1967a; 1967b; 1967c; Wallach and Kogan, 1965; Wallach, Kogan and Burt, 1967). In order to test this version of the hypothesis Pruitt and Teger (1969) conducted an experiment using betting as the risk-taking situation. To create affective bonds they allowed groups in the experimental condition to discuss filler items but prohibited it on experimental items. The intensity of the affective bonds was also measured using a sociometric index of group cohesiveness. Group cohesiveness was found to be of the same magnitude as in a control experiment where discussion on all items was allowed. However, while the usual shift toward risk occurred in the control condition, it did not in the experimental condition. Two earlier studies that used the CDQ with a similar experimental design (discussion only on filler items) yielded the same results, i.e., no shifts occurred on items that were not discussed (Johnston, 1968; Madaras and Bem, 1968). This suggests that creation of affective bonds is not a sufficient condition for diffusion of responsibility and certainly not for the occurrence of shifts, and it strengthens the conclusions drawn in the two earlier studies cited above (Madaras and Bem, 1968; Pruitt and Teger, 1969) that exchange of information relevant to the issue being decided upon is necessary in order to produce the risky-shift. We shall return to the issue of information later.

Thus, so far the hypothesis has not received any <u>direct</u> unequivocal evidence in its support. Moreover, the cautious shifts on items 5 and 12 of the CDQ is strong evidence against the hypothesis. These cautious shifts have been found in several studies and they are

statistically significant. Moreover, they are no longer limited to these two items; other items that produced cautious shifts have been written (see Burns, 1967; Myers, 1967; Nordhøy, 1962; Rabow et al., 1966; Stoner, 1968; Vidmar, 1969). Cautious shifts were also found in studies that used two-choice risk-taking task (Smith and Radinsky, 1969; Zajonc et al., 1968; Zajonc et al., 1969).

Finally, it is interesting to note that all the evidence generated by the diffusion of responsibility hypothesis is equally compatible with a symmetrical opposing hypothesis. It can be argued that subjects are willing to take greater risks in groups because of the potential prestige that will befall them if their choice lead to success. In other words, the emphasis here is on rewards for success rather than blame for failure. This might be called the "assuming of responsibility hypothesis". According to this hypothesis, individuals in groups will tend to take greater risks in order (1) to demonstrate their willingness to assume responsibility because assuming responsibility is culturally valued, and (2) to take credit for potential success. Intuitively the two hypotheses are equally plausible and from the research conducted so far it is impossible to distinguish between them. However, in view of the mounting evidence against the diffusion of responsibility hypothesis, it seems that there is very little ground for maintaining it or its opposite, the assuming of responsibility hypothesis.

Familiarization. In 1966, Bateson, using part of the CDQ, found that subjects who familiarized themselves with the items by writing briefs

of arguments for and against the uncertain risky alternative shifted their decisions and endorsed greater risks. The same results were also reported by Flanders and Thistlethwaite (1967) using a more complete experimental design. The strength of the risky-shift effect produced through familiarization was as great as that produced through group discussion in the control condition of their experiment.

Bateson argued that increased familiarity with the issue results in increased willingness to take greater risk. Familiarization can take place during group discussion as well as during private study of the problem. This implies that the risky-shift is a pseudo group effect as defined by Secord and Backman (1964, p. 377). The mechanism that leads subjects to take greater risks after familiarization was spelled out. It was suggested that a person would not commit himself to a decision until he had had enough time to think about it. He may feel he wants to weigh all the evidence, particularly when the problem is important and complex. If he is pressed to make a decision he will rather take a cautious position. Upon further familiarization, his initial cautiousness will evaporate, allowing him to endorse a decision involving greater risk. Thus it is assumed that the process responsible for the risky-shift occurs before the individual is even exposed to the group or engaged in familiarization with the problem; that is, when he takes an initially rather cautious decision. Since the subject's decision is influenced by the circumstances under which the decision is being made, the underlying process is affective, although it also has some cognitive overtone.

Obviously, the hypothesis cannot handle cautious shifts. But more important, the empirical evidence against it is overwhelming. Greater familiarization with the items did not produce shifts toward greater risk in studies conducted by Johnston (1968), Marston (1968) and Miller and Dion (1970). Pruitt and Teger (1967) and Teger et al., (in press), performed a series of replications and failed to reproduce the Bateson and the Flanders and Thistlethwaite results. Their suggestion, that a judgment of "not proven" be recorded against the hypothesis, seems appropriate.

Risk-as-a-Value Hypothesis: Information about Others' Choices (IOC). This hypothesis has undergone several modifications since first being advanced by Brown in 1965. In its general form the hypothesis maintains that risk is valued in American culture. Hence, risk-taking is socially desirable and those who take risks conform to a cultural norm emanating from the cultural value of risk. Brown (1965) maintains that the consequences of the cultural value of risk in a group situation are twofold. First, the cultural value of risk biases the discussion and leads group members to generate more information and raise more arguments favoring the risky alternative. This biased flow of information was first noticed and reported by Nordhøy(1962). Second, the cultural value of risk leads subjects to believe that they are somewhat riskier than others and thus closer than the average person to their cultural ideal. This was initially observed and reported by Hinds (1962). Each of these two consequences served as a basis for a different version of the value hypothesis.

The first version maintains that the biased flow of information and arguments favoring the risky alternative influence subjects to take greater risks. They are assumed to be convinced on the basis of the arguments that a more risky decision is what is called for in those situations. The second version, often referred to as information exchange or information about others' choices (IOC), argues that during the discussion subjects who believe themselves to be more risky than others are exposed to the choices of others. They soon learn that, relative to the others, they are in fact less risky than they thought they were. In view of this discovery, to measure up to what the cultural value of risk demands, they change their prior decision and take a greater risk. Whereas the first hypothesis implies the operation of a cognitive process, that is, subjects are convinced by virtue of information contained in the arguments, the second hypothesis implies the operation of an affective proces, that is, subjects are influenced by the circumstances under which the decision is being made. In the latter case, risk is socially desirable and by social comparison (Festinger, 1954) cautious individuals discover that they have not been risky enough. Brown committed himself to the affective hypothesis (IOC), believing that information about others' choices is the primary cause of the risky-shift.

> The content of the discussion, the arguments pro and con are of no importance by this theory. It is the information about other people's answers that makes individuals move toward greater risk after group discussion.(Brown, 1965, p. 702)

In order to account for the cautious shifts found on items 5 and 12 of the CDQ and on other items written by Nordhøy, Brown revised

the hypothesis. Thus it was hypothesized that any given problem involving risk elicits widely held cultural values that favor either the risky or the cautious alternative. On problems for which the cultural values favor a risky decision, the individuals will tend to be rather risky right from the beginning and consider themselves to be more risky than most others. In the discussion they will find out that others are in fact riskier than they are, and this will lead them to change and endorse greater risk. The converse will be true for problems for which the widely held cultural values favor the cautious decision.

The first evidence that was cited to support both versions of the hypothesis is the product moment correlation between the initial overall mean risk-level, and the mean shift toward risk across the twelve items of the CDQ. High correlations were reported by Wallach, Kogan and Bem (1962), Teger and Pruitt (1967) and Pruitt and Teger (1967) to be $r = .83; .78; .81$, respectively. Another correlation was reported by Stoner (1968) to be $r = .89$ ($p < .001$). Stoner used a different set of twelve items, including four items that yielded cautious shifts. These correlations are seen as support for the hypothesis because they are supposed to indicate that on items yielding large shifts toward risk the initial risk-level mean is on the risky side of the continuum (i.e., low odds) and on items yielding conservative-shifts the mean is on the conservative side of the continuum (i.e., high odds).

Unfortunately, what the correlations have been taken to indicate is not quite what one finds upon closer examination of the

data. For the items that yielded cautious shifts the initial mean risk-level is indeed on the conservative side of the continuum. For the two conservative items of the CDQ (5, 12) (i.e., those that yielded cautious shifts) the average probability is .75 [see Pruitt and Teger (1967) for pooled results based on six earlier studies producing the risky-shift]. For the four conservative items used by Stoner the average in .76 (Stoner, 1968). But, for the ten risky items of the CDQ (i.e., those that yielded risky-shifts) the average probability is .54 (Pruitt and Teger, 1967). Even if only the four most risky items are considered (i.e., those that produced the greatest shift toward risk) this average is still .49. Only in Stoner's (1968) study is the mean of the initial risk-level choices on the risky items somewhat on the risky side of the continuum, with an average of .42. These results provide little support for the hypothesis. They make sense only with respect to the conservative shifts but certainly not for the more robust risky-shift on the CDQ.

The second kind of evidence in support of this hypothesis illuminates the social comparison mechanism. Before being exposed to the choices of others during the discussion, it has been found that subjects considered themselves to be somewhat more risky than most others on items yielding risky-shifts and more conservative on items yielding cautious shifts (Hinds, 1962; Levinger and Schnieder, 1969; Stoner, 1968; Wallach and Wing, 1968; Willems, 1969). Presumably, during the group discussion the discovery of their inaccurate assessment of how they stand with respect to others influences them to take greater risk on risky items and smaller risk on cautious ones. There

is, however, an entirely different explanation for these results that will be considered later.

The third kind of evidence advanced to support the hypothesis comes from Madaras and Bem (1968) who compared subjects' ratings of hypothetical risk-acceptors and risk-rejectors on semantic differential scales. These hypothetical figures were faced with dilemmas from the CDQ and other sources, which included five items that have been shown to yield conservative shifts. They discovered as predicted that for the risky items the risk-acceptor was indeed viewed more favorably than the risk-rejector. The risk-acceptor was rated as more strong, active, successful, fast, hard and masculine, and somewhat more good and sociable than the risk-rejector. However, on the cautious items the risk-rejector was not rated more favorably than the risk acceptor. In fact, contrary to predictions, the risk-acceptor was still rated more favorably than the risk-rejector although the difference was much smaller on most dimensions and nonexistent on some. Similar evidence was produced by Levinger and Schneider (1969). They found that subjects reported they admired choices riskier than their own, both on the ten risky items of the CDQ (statistically significant) and on two conservative ones (not statistically significant). These results provide some direct evidence for Brown's risk as-a-value hypothesis, i.e., that on risky items risk-taking is socially desirable. However, they only <u>suggest</u> that the desirability of being perceived as a risk-taker by others, or even by oneself, is what leads subjects to take greater risks in a

group situation. Moreover, these results failed to support the part of the hypothesis designed to account for conservative shifts, namely, the contention that on the conservative items caution is prescribed by the cultural values and thus socially desirable.

Most of the findings cited so far regarding the cultural value hypothesis are compatible with other hypotheses as well. A critical test of the former would indicate whether information about others' choices is a sufficient condition for shifts to occur. A study conducted by Blank (1968) approached such a test. Subjects made choices among gambling bets on tossing dice alone, and in the presence of others also working on the same task. In the latter condition subjects made their choices in turn but did not discuss them. The results supported the hypothesis showing greater preference for low probability (i.e., risky) bets when choices of others were known. Unfortunately, the expected value of the low probability bets was about three to four times greater than that of the high probability bets, thus casting doubt on the comparability of Blank's results to those of other studies in which expected values were constant.

Furthermore, there is accumulating evidence indicating that information about others' choices is not a sufficient condition for shifts to occur; at least not for shifts of the same magnitude as the risky-shift after group discusson on the CDQ. Wallach and Kogan (1965) asked subjects to reveal their choices to each other on cards, change them if necessary, and reach a unanimous decision on the CDQ. Subjects were not allowed to discuss the problems. No shift toward risk was found. Though shifts toward greater risk were produced in

another study using the same procedure--with the exception of deemphasizing the importance of reaching a unanimous decision--their magnitude was less than half of that found in the condtion of discussion to consensus (Teger and Pruitt, 1967). In another study, subjects made initial decisions on all twelve items of the CDQ and later discussed only half of them, thereby being forced to discover that in general, they were relatively less risky than they had thought. A risky-shift was found only on the items that had been discussed; there were no shifts on the other items. These results led the authors of the study to conclude that "the crucial information transmitted in group discussion is not the risk-level of others, but information relevant to the specific items discussed" (Madaras and Bem, 1968). A similar experimental design was used in a study by Pruitt and Teger (1969). In that study the risky-shift was produced only on items that had been discussed. The authors drew a conclusion similar to the former, saying that:

> . . . some sort of communication among group members about the issue of risk taking is necessary for a risky-shift to occur. This communication may even take the abbreviated form of exchanging information about preferences (Teger and Pruitt, 1967), though the effect is at its strongest when a full group discussion takes place (p.124).

In conclusion, in spite of some indirect supportive evidence Brown's hypothesis that information about others' choices (IOC) is sufficient to produce shifts must be rejected. The evidence suggests that the crucial factor responsible for both risky and conservative shifts is something in the flow of information relevant to the issues being decided upon, and not the mere knowledge of others' choices.

Cognitive Hypotheses

The cognitive hypotheses suggest that the overt change of decision (i.e., shifts toward greater risk or greater conservatism) is the result of a covert cognitive opinion change. These hypotheses are concerned with alterations in decisions resulting from changes in the person's view of the situation being evaluated, rather than alterations resulting from direct influence of the circumstances under which the decision is being made (e.g., group discussion, presence of others, etc.).

Borrowing again from the terminology of behavioral decision theory (Edwards et al., 1965), cognitive hypotheses are concerned with changes within the payoff-probability decision matrix that the individual initially considers relevant for the given issue. It is still the same decision matrix that the individual is weighing in the sense of containing the same factors: the relative desirabilities (utilities) of the potential outcomes and the likelihood (probability) that each course of action would lead to those outcomes. Thus, his decision may change as a result of a change in his judgment of the relative utilities of the outcomes and/or their probabilities.

Risk as-a-Value Hypothesis: Information Relevant to the Task (IRT). This hypothesis was considered in the previous section. Recall that the evidence for cautious shifts required that the hypothesis be reformulated. To wit: any given problem elicits widely held cultural values that favor either the risky or the cautious alternative, and thus information flow will be biased in that direction. However, the

crux of the matter is that shifts are produced because subjects change their view of the situation by virtue of the information and arguments being generated in the discussion, rather than by mere exposure to the choices of others. In other words, contrary to Brown's contention, the content of the discussion and the arguments pro and con do constitute the primary factor responsible for the shifts.

Because most of the research on risk as-a-value was geared to test the IOC hypothesis, the "information relevant to the task" (IRT) hypothesis gained only indirect support. This indirect support stems from findings leading to the rejection of the IOC hypothesis. There is evidence that some sort of communication in the form of information relevant to the task is necessary for the full strength shift to occur (Madaras and Bem, 1968; Pruitt and Teger, 1969). Also compatible with the IRT hypothesis is the evidence that subjects' decisions are strongly affected by changes of information provided in the task as well as by arguments brought up during the discussion. In one study by Rabow et al., (1966) changes introduced into the problems resulted in changes in the magnitude and directions of the shifts. Nordhøy, who originally noticed the biased flow of arguments in favor of riskiness, introduced two small changes on Item 12 of the CDQ that resulted in reversal from a cautious to a risky-shift (cited by Brown, 1965). This item involves an engaged couple who sought the advice of a marriage counselor about whether they should get married. A frequent argument in discussions of this item seemed to be persuasive: "If they sought the counselor's advice they are not really in love; therefore, they should not risk marriage unless the odds of successful married life in the future are high".

When additional facts were added--the couple were in love and met the counselor incidently at a party--a shift toward greater risk was observed. In discussion of Item 7 of the CDQ, where the magnitude of the risky-shift is greatest, the present author has noticed that a particular persuasive argument is often brought up. This item involves a low ranked chess player playing against a top favored player. The question arises whether he should attempt a risky maneuver that might bring him a quick victory. Groups were willing to make riskier decisions whenever someone suggested that the player attempt the risky maneuver even if the odds of success are low by arguing that "otherwise he would lose anyway, since as a low ranked player he is obviously not as good as the top favored player."

Another line of evidence favoring the hypothesis has already been mentioned. Subjects exhibited the risky-shift after listening to real discussions of the CDQ individually (Kogan and Wallach, 1967c; Lamm, 1967); the riskier group decisions are accepted by the subjects as their private decisions (Lamm, 1967; Wallach and Kogan, 1965) and this accepatance endures for at least six weeks (Johnston, 1968; Wallach et al., 1962) indicating the permanence of the change that led to the shift.

In summary, although all the evidence is at least consistent with the IRT hypothesis, the latter has not been subjected to direct test. For a rigorous direct test it would be necessary to point out the particular information that produces the shifts.

Rationality: Expected Value (EV) and Subjective Expected Utility (SEU) Hypotheses. The most elaborated formulation of the rationality hypothesis was offered by Kogan and Wallach (1967b), though it was initially discussed by Brown (1965). The hypothesis is based on "behavioral decision theory" (BDT). (For reviews of BDT see Edwards, 1961; Edwards et al., 1965; Becker and McClintock, 1967). Briefly, BDT is concerned with choices among alternative courses of action. The variables that are dealth with in the theory are the values (v) and utilities (personal subjective value, u) of outcomes resulting from alternative actions, and the probabilities (p) and subjective probabilities (sp) that each course of action will lead to a certain outcome. One useful strategy is to choose an alternative that maximizes average gain or minimizes average loss. The average gain or expected value (EV) of a given alternative action is a function of the probabilities ($p_i$) that certain outcomes will follow the particular action, multiplied by the respective values ($v_i$) attached to these outcomes, as follows:

$$EV = \sum_{i=1}^{n} p_i v_i, \; i = 1,2,\ldots,n \text{ outcomes}$$

Similarly, when subjective average gain is taken to be the criterion for choosing an alternative course of action, it is determined by the multiplication of the subjective probabilities and the respective utilities as follows:

$$SEU = \sum_{i=1}^{n} sp_i u_i, \; i = 1,2,\ldots,n \text{ outcomes}$$

Basic to the rationality (EV) hypothesis regarding the risky-shift is the equation of a rational decision with the choice of an alternative that maximizes expected value (EV) or subjective expected utility (SEU), and the assumption that risk-taking represents a more rational maximizing approach in the choice delimmas that yielded risky-shifts and vice versa for those that yielded conservative shifts. Once this assumption is made, the hypothesis can be stated as follows: a group is in a better position than an individual to unearth information that will aid in the accurate assessment of the probabilities and utilities associated with the choice alternatives. This will result in shifts in the direction required to maximize SEU. It remains to be shown that group decisions reflect better maximization of expected value or subjective expected utility than individual decisions. (Note that increased maximization of EV or SEU implies better utilization of the information already available to individual subjects before the group discussion; it does not require the introduction of new information during the discussion.) On the basis of two studies, Kogan and Wallach ($1967_b$) argue that this is not the case. In one study EV was increased for the more conservative alternatives (Bem et al., 1965). In the other study EV was the same for all alternatives (Wallach, Kogan and Bem, 1964; see also Clausen, 1965). In both cases a risky-shift was produced. In a more recent study by Pruitt and Teger (1969) the risky-shift was also produced in a gambling task involving alternatives with the same expected values. Consequently, the rationality hypothesis must be rejected if rationality is defined as maximization of expected value.

However, these results may still be consistent with the rationality hypothesis since it is possible that subjects were maximizing subjective expected utility rather than expected value. Close examination of the four studies that produced evidence against the EV hypothesis reveals that in each of these studies either the utilities could well have been different from the explicit values (Bem et al., 1965; Pruitt and Teger, 1969) or the subjective probabilities could have been different from the objective ones (Clausen, 1965; Wallach, Kogan and Bem, 1964). Therefore a rationality hypothesis that adopts maximization of SEU as a criterion of rational choice is still a viable explanation for risky as well as for conservative shifts and should be subjected to direct test.

A study by Stoner (1968) suggests a way of doing it. In his study subjects were presented with eighteen phrases describing possible outcomes involved in twelve choice dilemma items. Each phrase described one possible outcome. Subjects were asked to rank the eighteen phrases "in the order in which they are important to you". (Although in the study this instrument is called a "value ranking instrument" it is clearly a utility ranking instrument.) In addition, subjects were asked to make the usual decision on each item individually, and were subjected to the usual procedure of group discussion to consensus. The results show that for items producing a risky-shift, the successful outcome of the risky alternative was ranked higher in importance than the outcome of the cautious, more certain alternative. The converse held for the items that produced cautious shifts. The results of this experiment may be misleading because the "value ranking instrument" did not include

phrases for all possible outcomes. Consequently, the entire experiment is open to serious criticism concerning its immediate purpose, which was to test the value hypothesis. For a direct test of the SEU hypothesis the utilities of all outcomes should be adequately represented.

## Interactive Hypotheses

The affective and cognitive hypotheses do not consider the interaction among group members to be necessary or sufficient for shift; it is only a condition under which diffusion of responsibility or information exchange occurs. Other appropriate conditions may substitute for it. In contrast, interactive hypotheses conceive of the interaction as a necessary condition for shifts to occur. They are concerned more with identifying the social processes which produce the effect (e.g., disproportionate exercise of influence by some group members) than with the psychological mechanisms involved (e.g., affective or cognitive), and as such they constitute a class in themselves. At the same time the interactive hypotheses differ from each other. Each assumes that shifts occur because some members exert more influence in the group decision-making than others. But they disagree as to the reasons for this differential influence. In other words, their differences lie in what is assumed to be the basis of the influence (e.g., some personality characteristics, majority influence or greater confidence in certain positions). Of course since they make no explicit assumptions about psychological mechanisms, these theories are not necessarily incompatible with the affective or cognitive hypotheses.

Risk-Takers as Leaders. One point of view has it that high risk-takers possess greater leadership capabilities and therefore are more influential in a group setting. This hypothesis is based on the view that both leadership and risk-taking tendency are stable personality characteristics, and it claims that these characteristics go together. Being more influential in the group, high-risk-takers are able to move the group closer to their position, which results in a general shift toward greater risk.

The initial supportive evidence came from Marquis' (1962) study in which it was noticed that extreme members were more talkative in the discussions, and thus may have been more influential. Related correlational evidence has been accumulated indicating that high risk-takers are also more self-assured and confident about their decisions (Clausen, 1965), and are perceived by the group members to be more influential (Clausen, 1965; Flanders and Thistlethwaite, 1967; Wallach et al., 1962; Wallach et al., 1965). This kind of evidence raises the question of cause and effect since it can be argued that high risk-takers are perceived in retrospect to be more influential because the group has moved toward greater risk. Evidence casting serious doubts on the greater influence of high risk-takers is reported by Brown (1965) from research conducted by Nordhøy. Nordhøy found that on choice dilemma items which yielded conservative shifts, the conservative group members were perceived to be more influential. The very fact that significant conservative shifts are produced on certain items constitutes additional serious challenge for the leadership hypothesis.

Three studies attempted to test the leadership hypothesis directly and all displayed negative results. The first study employed a design aiming to differentiate cause and effect (Wallach, Kogan and Burt, 1968). The idea was that if high risk-takers are leaders, and leadership is a stable personality characteristic their greater influence should also hold for issues that are not related to risk-taking. Groups containing high and low risk-takers on the CDQ were formed to discuss non-risk related issues and issues containing alternatives balanced for riskiness. Following these discussions, group members ranked each other as to the degree of influence, contribution of best ideas and effective guidance in the group discussion. By none of these criteria were high risk-takers considered more persuasive and influential among the male groups and were only slightly so considered among the female groups. The risky-shift phenomenon has been found for groups of both sexes. The other two studies testing the leadership hypothesis manipulated group composition according to subjects' mean score on the CDQ (Hoyt and Stoner, 1968; Vidmar, 1970). If shifts occur because high risk-takers exert disproportionate influence, they should disappear in groups composed of subjects with the same mean risk score. However, significant shifts toward greater risk were found in the homogeneously composed groups in both studies. The magnitude of these shifts was about the same as found in heterogeneously composed control groups, and the same as that which is usually found in randomly composed groups.

On the theoretical level the leadership hypothesis assumed the existance of stable personality characteristics of leadership and

risk-taking tendency. Most of the evidence indicates that this assumption is invalid. The failure to find common and stable leadership characteristics (Gibbs, 1969) is as glaring as the repeated failure to find convergence among risk-taking measures (regarding the lack of stable generalized risk-taking tendency see Goodman, 1970; Slovic, 1962; Slovic, 1964; Kogan and Wallach, 1967b; Weinstein, 1969). Adding to this the negative results of studies that tested the hypothesis itself it appears that the leadership hypothesis may safely be discarded.

Extremity and Influence. This hypothesis views the greater influence exerted by some group members, not as a function of some stable personality characteristic (such as assumed by the leadership hypothesis), but as a function of the extreme position they take with regard to an issue. The same person, according to this hypothesis, may take an extreme position on one issue and influence the moderate group members, but then take a moderate position on another issue and himself be influenced by the more extreme members of the group. Extreme position is not limited to the choice of high risk-levels--i.e., low probability of success--but includes low risk-levels (i.e., high probability of success) as well. It is, therefore, an hypothesis that could account for group shifts toward greater risk-taking as well as for shifts toward conservatism.

The extremity hypothesis was proposed by Burns (1967) as a model to predict group shifts toward greater risk and conservatism. He argues that subjects respond on the probability scale as a 'Likert

type' preference scale, so that choice of a very low probability of success indicates very intense and strong preference for the risky alternative; choice of a very high probability of success indicates very intense and strong preference for the more certain conservative alternative. He also argues that, as "intensity of attitude varies with attitude extremity is well documented by past research" (p. 38) it is the group members who endorsed extreme positions, i.e., either very high or very low probabilities, that are more confident and committed to their position. Thus the greater exercise of influence during the group interaction is attributed to the holder of these extreme positions. Two similar models were tested using choice dilemma items on 180 group decisions and predicted the exact group decisions on 49% and 53% of the cases, respectively. This is far better than any other model that has been proposed, including convergent averaging model that uses the mean of the initial risk-level choices as the predictor. The latter model could predict exactly only 36% of the group decisions. It was also shown that greater confidence was indeed associated with extreme positions.

Similar models focusing on extremity were also proposed by Myers, Murdock and Smith (1969). The basis for their prediction stems from the congruity model of attitude change (Osgood, Suci, and Tannenbaum, 1957), which assumes that the resistance to change of an attitude object is proportional to its extremity or polarity. Again, these models were tested using choice dilemma items, and they predicted group decisions significantly better than the averaging model. The inadequacy of these hypotheses will be discussed later with a critical evaluation of the interactive hypotheses.

Group Problem Solving Analogy: 'Commitment to Risk' and 'Influence Through Commitment' Hypotheses. These hypotheses make the same predictions as the extremity hypothesis. The difference lies in the exact nature of the mechanism proposed to account for disproportionate influence. They all agree that confidence and commitment constitute this mechanism. Yet, the extremity hypothesis argues that confidence is the natural concomitant of taking an extreme position on the scale, since it reflects intensity, whereas the hypotheses reviewed in the present section suggest different causes for the greater confidence. They are based on an analogy from group problem-solving studies and several ad hoc assumptions.

Burnstein (1969) points out the relevance to group decision-making involving risk of results coming from studies of individual versus group problem-solving. These studies are concerned with whether group decisions are more correct than the average individual decision, and if so, what accounts for this superiority. Early studies by Gurnee (1937a; 1937b) and by Thorndike (1938a; 1938b) demonstrated the superiority of the group and pinpointed that 'correct' members were more confident in their choices. The inference is made that by virtue of their greater confidence the 'correct' members were also more committed to their choice and were more influential throughout the group discussion. Burnstein offers the following speculation:

> . . . Perhaps increased commitment or confidence is an inherent consequence of choosing an alternative which is more likely to lead to failure. The conjecture would be, first, that the effort, in the form of extensive and anxious calculation, which precedes a decision is greater in the case of a risky choice than in the case of a conservative choice and, second, the unpleasant after-effect of choice,

> post-decision dissonance, is greater following a risky choice than following a conservative one. If either or both of these suppositions are correct, the risky decision is likely to take on added attraction which could well correspond to a feeling of commitment to the choice and a sense of confidence in its wisdom. Let us call this the "commitment to risk" hypothesis. At the same time, a conservative shift should occur when members who initially prefer an alternative with a high probability of success are highly confident in the wisdom of their choice (a relatively infrequent conjunction of traits according to this analysis) and engage in decision making with others who initially prefer a risky alternative but are not confident of their choice. This we will label the "influence through commitment" hypothesis. (Burnstein, 1969, p. 384)

These conjectures have been tested in research by Clausen (1965) using College Board problems as a risk-taking instrument. In general, her research generated supportive evidence for the 'commitment to risk' hypothesis. Greater confidence was found to be correlated with a choice of a more difficult (i.e., riskier) problem, particularly for problems in the areas of mathematics, spatial relations and sentence completion, where a risky-shift in Wallach et al., (1964) study was produced. In problems dealing with antonyms and analogies confidence was not correlated with the difficulty of the problem, and the risky-shift produced in Wallach et al., (1964) was relatively small. However, the influence through commitment hypothesis was not supported, because no conservative-shifts were observed--even when greater commitment and confidence were displayed by the more conservative group members. It must be noted that conclusions based on these results are limited to studies using College Board problems as a risk-taking instrument. Studies using choice dilemmas showed some differences: greater confidence

was correlated with extreme choices ($r = .29$; $p < .001$), both very risky and very conservative ones, and resulted in risky shifts as well as in conservative shifts (Burns, 1967).

In general, the evidence that supports the extremity hypothesis also supports the 'commitment to risk' and 'influence through commitment' hypotheses. There is not much that could be said about evidence differentiating these two hypotheses from the extremity hypothesis. Testing the assumption underlying the correlation between extremity and confidence would provide this evidence. There are, however, important results that are not explained by any of the interactive hypotheses. These results indicate that a risky-shift can be produced by individual subjects who merely listen to group discussion of the CDQ but do not interact in any way (Kogan and Wallach, 1967c; Lamm, 1967). Though the shift is not of the usual magnitude, it is nevertheless substantial and significant. Also unaccounted for are the results showing that group decisions are accepted by the subjects covertly as their private decisions (Lamm, 1967; Wallach and Kogan, 1965) and that this acceptance endures for a considerable time (Johnston, 1968; Wallach et al., 1962). Since all the interactive hypotheses assume that the exercise of disproportionate influence is critical, they cannot account for the risky-shift produced without interaction, unless they suppose that the influence during interaction is informational rather than normative (see Deutsch and Gerard, 1965). The basis for the last statement will be made clear in the discussion which follows.

## Statistical Hypotheses

According to the statistical models, a risky-shift as well as a conservative-shift is an artifactual phenomenon. It does not reflect a change of the individuals' risk-level preferences but appears as an inevitable outcome of an *a priori* rule of reconciling the differences in individual preferences. Consequently, no assumptions concerning the exercise of influence or other affective and cognitive processes are made. The important variables that account for group shifts are only the group decision rule and distribution of initial risk-level choices. The models differ in what they assume about these two variables.

Two decision-making models considered as alternative explanations of the risky-shift have been reviewed by Burnstein (1969). One model comes from test theory and is applicable when individuals' rank orders of preferences or judgments, are secured, and can be compared (correlated) with a "true" or criterion rank order. The other model requires that the rank order data be processed according to a majority rule decision scheme or, alternatively, the processing of the single most preferred judgments of the individuals according to the same scheme. In the latter case, the mode (or median) judgment is taken as the pooled group judgment. In brief, both models suggest that if there is an initial tendency toward accuracy--better than 50% chance of being correct, or a positive correlation between judgment and criterion--then the correlation between pooled group judgment (average rank order across subjects) and the criterion will

be greater than the average individual correlation. In other words, pooled group judgments will be better than the average individual judgements only if (1) the majority of the individual judgments tend to be correct (i.e., exhibit some positive correlation with the criterion), or (2) the majority of judgments are correct and the mode judgment is taken as the pooled group judgment. If riskiness (or conservatism) is substituted for correctness, then shift toward risk (and conservatism) follows directly from the model. When the average individual choice tends to be risky a risky-shift is predicted, and when it tends to be conservative a conservative-shift is predicted. Calculations were attempted on contrived data and yielded results in accordance with both models (see Zajonc, 1966; Burnstein, 1969).

What could the results of studies producing shifts tell us about the test-theory or majority-rule model as a valid explanation for group shifts? For one thing, to validate these models past studies would have to show that on items that produced a risky-shift the average individual tended to be risky (i.e., the majority of individuals made risky choices), and on items producing a conservative-shift the average individual tended to be conservative. In studies using College Board problems where a risky-shift was found, the average of the initial probabilities chosen was quite low (.30), indicating strong initial tendency for risk. (Clausen, 1965; Wallach et al., 1964). In two other studies one with real physical consequences for the subjects (Bem et al., 1965) and the other with monetary payoffs (Pruitt and Teger, 1969), the average initial probabilities were .34 and .10, respectively. In both studies a risky-shift

was produced. Thus, these results support the model as an explanation for the risky-shift.

Results from studies that used the CDQ are not quite consistent with the model. According to data of six studies reported by Pruitt and Teger (1967) the average initial probability for the ten items that produced a risky-shift is .54, for the four most risky items it is only .49 which is incongruent with the model, and for the two items that produced a conservative-shift the average is .75, congruent with the model. More supportive results can be found in Stoner's (1968) study using a different set of choice dilemma items. The average initial probability for six risky items is .42 and for four conservative items the average is .76.

While the results of the studies that used decision tasks involving real consequences and Stoner's (1968) study using a revised set of choice dilemma items are congruent with these statistical models, the bulk of the results with the more commonly used CDQ are not. Thus, the evidence with regard to the adequacy of the models as an explanation for the risky-shift is inconclusive. Additional analysis is needed to determine whether the model can be considered a valid explanation for the risky-shift.

If the majority-rule model has any validity in explaining shifts, positively skewed distributions of initial choices (i.e., with a risky majority) should yield a risky-shift, and negatively skewed distributions (i.e., with a rather cautious majority) should yield a conservative-shift, regardless of the means of these distributions. This could also be viewed as a simple conformity situation.

Vinokur (1969) manipulated initial distributions using the six most risky items of the CDQ. Though the positively skewed distributions yielded a significant risky-shift (-.86; $p < .001$), the negatively skewed distributions did not yield a conservative-shift, but instead yielded a small, nonsignificant risky-shift (-.33), even though the mean of the negatively skewed distributions was .52 (i.e., on the conservative side of the scale). Furthermore, it was shown--using reanalyzed raw data from three other studies that had yielded risky-shifts on the CDQ (Wallach et al., 1962; Wallach and Kogan, 1965; Wallach, Kogan and Burt, 1965)--that contrary to what would be expected the percentage of positively skewed groups was virtually the same as the percentage of negatively skewed groups (42.2% and 43.6% respectively; the rest were symmetrical). Additional analysis of the same raw data produced further evidence against the test-theory or majority-rule model. Both the positiviely and negatively skewed distributions on the three most risky items of the CDQ (4, 6, 7) with nearly the same means (.42; .45) yielded risky shifts with nearly the same magnitude (-1.58; -1.41). It was only on two non-risky items (2, 5) that the positively and negatively skewed distributions yielded diametrically opposed shifts (-.50, $p < .05$; +.53, $p < .01$) as predicted by these statistical models. Zajonc et al. (1968) examined data produced in their experiment comparing individual and group risk-taking in a two-choice situation in light of various group decision models. None of these, including the majority-rule model, could account for the group shifts toward conservatism produced in their experiment.

In view of all the evidence, the statistical models are untenable. Hence, group shifts cannot be considered as statistical artifacts of the way individual preferences are reconciled. Besides, as was already shown, there is a growing body of evidence indicating that the change in individuals' risk-level preferences is genuine. The individuals change their risk-level preferences following a discussion without being asked to make any group decision (Wallach and Kogan, 1965) or even after listening to real group discussions of the choice dilemma items (Kogan and Wallach, $1967_c$; Lamm, 1967). When they do reach group decisions they accept the group decisions as their private risk-level preferences (Wallace and Kogan, 1965) and maintain their new risk-level preferences for at least six weeks (Johnston, 1968; Wallach et al., 1962). Thus, the statistical models seem inadequate because they preclude assumptions about group processes which can be shown to be critical for a shift.

## Conclusions and Discussion

This review suggests that, of all the explanations for shifts toward greater risk or conservatism, only three are viable. These are the value (IRT) hypothesis, the extremity hypothesis, and the rationality (SEU) hypothesis. The first two hypotheses are supported by direct evidence and are not inconsistent with evidence from other studies. The third one, rationality (SEU), is consistent with the results of most studies reviewed here but has not yet been subjected to direct test.

The two cognitive hypotheses, rationality (SEU) and value (IRT) could complement each other. Both argue that the crucial factor responsible for individual as well as group shifts toward greater risk (or caution) is information relevant to the task that is produced during the group discussion. While the rationality hypothesis explains how the same information is processed and acted upon the value hypothsis focuses on how and why new information is produced.

The extremity hypothesis is clearly incompatible with the other two hypotheses. It differs in what it considers to constitute the crucial factor, the key mechanism, responsible for the shifts. Whereas the value and rationality hypotheses consider the information relevant to the issue to be the crucial factor, the extremity hypothesis considers the preference for a certain course of action, as reflected by the extreme position, to be the crucial one. That is to say, extreme preferences result in greater confidence and commitment which in turn leads to greater influence. To put it differently, the two cognitive hypotheses can be contrasted with the extremity hypothesis in respect to the kind of influence that induces the shifts. The value and rationality hypotheses assume some kind of informational influence; the extremity hypothesis assumes normative influence (see Deutsch and Garard, 1955). Most of the research evidence indicates it is informational influence that induces changes in risk-level preferences. We have already noted that shifts occur after discussion without group decision (Wallach and Kogan, 1965; Lamm, 1967; Clark and Willems, 1969; Kogan and Wallach, 1967c), as well as by mere exposure

(listening) to group discussions (Kogan and Wallach, 1967c; Lamm, 1967), and that the acceptance of the new risk-level endorsed by the group is covert as well as overt (Lamm, 1967; Wallach and Kogan, 1965) and relatively long lasting (Johnston, 1968; Wallach et al., 1962). Shifts on non-risky (neutral) choice dilemmas were shown to be the result of majority influence--a risky-shift resulted from a risky-majority and a conservative-shift resulted from a conservative-majority. However, the risky-shifts on the risky choice dilemma items were shown to be unaffected by the existence of either a risky or a conservative-majority; consequently they can only be interpreted as the outcome of informational influence (Vinokur, 1969).

However, the extremity hypothesis--in fact, all the interactive hypotheses--demonstrated correlations between greater confidence and extreme position, and these results were marshalled as supportive evidence. It seems that these results can be viewed as equally compatible with the value and rationality hypotheses. We only have to assume that the more information and persuasive arguments favoring a certain alternative a subject may have, the more extreme his position (i.e., risk-level preference) will be. In other words, the extreme position taken by a subject already reflects the level and quality of the information he holds; the better that information, the more confident he will be in holding his position. It is analogous to the common finding in group problem-solving studies mentioned earlier, that the correct group member is also more confident. Thus, the greater confidence is not something inherent in

holding an extreme position as the extremity hypothesis holds. Both confidence and extreme position are more often the result of the availability of better information and more persuasive arguments. The correlation between them may indeed drop to zero in ambiguous situations where good information is difficult to obtain, and persuasive arguments are harder to generate. Clausen's (1965) study illustrates this point cogently. In her male groups, she found positive correlations between confidence and preferred risk-level (i.e., item difficulty), for items dealing with mathematics, spatial relations and sentence construction that produced large risky-shifts in Wallach et al., (1964) study. She obtained zero-order correlations for items dealing with antonyms and analogies where virtually no shifts were found. Obviously, it is easier to demonstrate to others the correctness of one's solution to a mathematical problem than the appropriateness of one's choice of an antonym or certain analogy.

Because it is an interactive hypothesis, the extremity hypothesis cannot account for shifts that are produced by mere exposure to group discussion through listening. The cognitive value and rationality hypotheses, although explaining shifts in these circumstances, would predict a shift of the same magnitude when subjects participate in the group discussion themselves. However, the results show that the magnitude of these shifts is not nearly as great as that produced in interaction groups (Kogan and Wallach, 1967c; Lamm, 1967). It would seem that neither a cognitive nor an

interactive process can, by itself, constitute a sufficient condition for the appearance of the phenomenon in its full strength. Therefore, it would be worthwhile to consider an explanation that includes both processes. The one we propose here is based on two related models: the "Partially Shared Information" model and the group problem-solving model. The first model was originally proposed by Steiner (1966) to account for the relationship between group size and potential group productivity. The implications of the partially shared information model are consistent with results from studies concerned with group problem-solving models (Lorge and Solomon, 1955; Restle and Davis, 1962) and more general studies comparing individual and group performances (Barnlund, 1959; Hall et al., 1963; Thorndike, 1938a; Thorndike, 1938b). (For comprehensive reviews see Lorge et al., 1958; Collins and Guetzkow, 1964; Kelly and Thibaut, 1969). These studies demonstrated the superiority of groups over the average individual on a variety of tasks, particularly when full interaction was allowed.

For any choice dilemma problem there exists a pool of persuasive arguments for each alternative course of action. A persuasive argument can be equated with a correct solution in a group problem-solving situation. Once it has been brought up it is likely to be accepted by the subjects as valid. The pool of persuasive arguments related to a given choice dilemma item can reliably be obtained from a large population of subjects; thus, predictions concerning individual and group shifts could be made in advance. It is assumed that a subject reading a choice dilemma item attends to the information

contained in the item, makes some inferences and organizes the information into arguments for and against the risky and the cautious alternative. Then, he reaches a decision concerning his preferred risk-level on the basis of these arguments. If he comes up with many persuasive arguments favoring a particular alternative (i.e., the risky or the cautious one) he is likely to take an extreme position (i.e., either very high or very low risk-level, depending on which alternative the arguments favor), and to be very confident and committed to his decision. His extreme position and greater confidence are both consequences of the quality and number of arguments he possesses. Furthermore, he may think his risk-level is somewhat more extreme (i.e., either more risky or more conservative) than that taken by most others, because he feels that he possesses arguments that others may not be aware of.

If for a given choice dilemma there is a preponderance of persuasive arguments for one alternative, then individual and group shifts in risk-level are predicted to occur in the direction of the alternative favored by the arguments. The strength of the shift depends first on the probability that an average subject will possess all or most of the persuasive arguments. If this probability is either very high or very low, strong shifts will not occur. If the probability is high, the individuals have already made their initial decision on the basis of the persuasive arguments. Thus, prior to discussion the group members are already extreme. If the probability is very low, it is unlikely that individuals will come up with those persuasive arguments, even after considerable thought. Therefore it

is also unlikely that a group will contain individuals who possess these persuasive arguments and use them in discussion. For these reasons, the strongest shifts are predicted on choice items with a preponderance of persuasive arguments for one alternative but with a moderate probability that an average individual will possess them. If group shift toward greater risk (or conservatism) following persuasive arguments is substituted for group movement toward better problem-solving, then the analogy between the risky-shift and the group problem-solving model becomes apparent.

Given an item with a preponderance of persuasive arguments in one direction, the strength of the shift then depends on a number of other conditions, a few of which have already been studied. Let us consider a few examples. First, very small shifts are predicted when the subject familiarizes himself with an item. He is likely to hit upon some but not all of the persuasive arguments during the process of familiarization. These shifts may be difficult to detect experimentally, which may explain the failures to replicate Bateson's (1966) and Flanders and Thistlethwaite's (1967) results. Moderate shifts are predicted for a situation where subjects merely listen to group discussion. Here the likelihood that persuasive arguments will be brought up during the group discussion is considerably increased. This will influence listeners who did not possess these arguments to change their decision. The strongest shifts are predicted for a situation where the subjects actually engage in group discussion. Here, the less extreme members can ask the more extreme members direct questions and clarify moot points.

Second, there should be no difference in the magnitude of the shift between groups forced to reach a unanimous group decision and groups in which individuals are asked merely to reach private decisions following discussion. Indeed, equally strong shifts were found in the two conditions by Wallach and Kogan (1965) and Lamm (1967). Furthermore, the strength of the shifts should increase with group size. The more members in the group, the more likely it is that the group will contain at least one person with the persuasive arguments; consequently, the more likely it is that the persuasive arguments will be brought up during discussion. A study by Teger and Pruitt (1967) demonstrated a considerable increase in the magnitude of the risky-shift with increases in group size from three members, (shift of -.14) to four (-.59) to five (-.97) for the ten risky items of the CDQ; and, likewise, an increase in conservative-shift in groups of size three (-.05), four (.12), five (.38) for the two conservative items of the CDQ. Equivalent results are reported by Vidmar et al., (1969), using a different set of choice items, for an increase of both the risky-shift on risky items and conservative-shift on conservative items with groups of size two, three, four and five members. Similarly, the strength of the shift is predicted to increase with the heterogeneity (variance) of group members' initial choices. Again, a study by Vidmar (1970) showed significantly greater risky-shifts in heterogeneously composed groups than in homogeneously composed groups.

So far nothing has been assumed about the nature of the persuasive arguments. It remains to be seen whether the persuasive arguments appeal to cultural values of riskiness and caution (i.e., to

the utility for risk) as Brown's value hypothesis implies, or merely contain information concerning the desirabilities (utilities) of the various possible outcomes.

It has recently been argued that individual and group shifts toward greater risk or conservatism are not content-bound exceptions to the averaging tendency of the group, but represent a more general phenonmenon: the polarization effect due to normative commitment (Moscovici and Zavalloni, 1969).. It was demonstrated that following group discussion on opinion and judgmental items that were not risk-related, individuals and groups shifted and endorsed more extreme positions. It is important to note that the explanation for risky and conservative shifts offered above was based on a general model which describes this effect of partially shared information on group productivity and does not view these shifts as content-bound exceptions. However, contrary to Moscovici and Zavalloni's view that these shifts are due mainly to normative or, in our terms, affective processes, the explanation presented here suggests that shifts are due to a cognitive or informational influence.

# CHAPTER II

## THE PROBLEM: A THEORETICAL MODEL FOR INDIVIDUAL AND GROUP DECISION-MAKING

From the review of the literature in Chapter I it is clear that a systematic approach to the risky-shift has not been attempted. Consequently, even if some limited ad hoc explanation of the phenomenon has been provided, theoretically meaningful new questions about group processes have not been generated. Furthermore, the conceptual difficulties concerning the definition of risk (Coombs and Huang, 1968), as well as the lack of convergent validity in the assessment of risk-taking (Goodman, 1970; Slovic, 1962; Slovic 1964), raise serious doubts about whether studying group risk-taking will increase our understanding of group processes. Instead of focusing on risk-taking, it might be more fruitful if future studies concentrate on the decision-making process itself, including the decision-making process of individuals as well as that of groups.

An adequate theory of individual and group decisions involving uncertainty, should include an explanation of the decision-making process and should account for both risky and conservative-shifts. Construction of such a theory constitutes the objective of this dissertation.

When seeking an understanding of how individual choices are processed and combined into a group decision, knowledge of these individual choices is essential. In particular, it may be helpful to know how such choices are generated in the first place.[1] Otherwise, it would be impossible to separate the contribution of the group process to the group product (e.g., group decision) from the contributions of the individual group members. Thus, it would be helpful to start with a good theory of decision-making. Behavioral decision theory (BDT) seems to be such a theory. It spells out relevant variables in any decision-making situation involving uncertainty, and suggests various relationships among them. The relevant variables in BDT can be classified into the following three categories: (1) objective and subjective probabilities that certain events will occur and their outcomes follow; (2) values and utilities (i.e., subjective values) attached to those outcomes; (3) decision rules; ways of combining probabilities, values and utilities to decide on one of several alternative courses of action. The formulations of BDT are rigorous and this has made it appealing to experimentalists. Unfortunately, with very few exceptions (e.g., Brim et al., 1962) experimental tests of the theory have been limited to a small range of experimental tasks and situations. It has usually consisted of outcomes with the same single value dimension--usually money--and subjects working for

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[1] Zajonc has suggested that this be a requirement for any standard group task (Zajonc, 1965).

either real but small monetary payoffs or imaginary ones (cf. Becker and McClintock, 1967). More complex situations are those where the values of the various potential outcomes belong to different dimensions (e.g., money, prestige, power, health ). According to BDT, in order to make a decision in a complex sitution, the subject must reconcile these different values and project their outcomes onto a single utility dimension. He must be able to compare the utilities of the potential outcomes.

The Choice Dilemmas task seems to provide such a complex situation for testing BDT. In turn, BDT may be helpful in discovering the nature of the group decision-making process, which is the major purpose of our research. How could this be successfully accomplished? First, it should be determined to what extent subjects attempt to maximize subjective expected ability. In terms of the risky-shift paradigm, it means that a subject's risk-level preference must reflect his estimation of the differences among the utilities associated with the potential outcomes in the choice dilemma situation. An SEU model for predicting risk-level preferences for a typical choice dilemma item can be constructed as follows:

Let $U_c$, $U_s$, $U_f$ designate the utilities of the outcomes of the certain (cautious) alternative ($U_c$), of the risky alternative when successful ($U_s$) and when it fails ($U_f$); and p, q designate the subjective probabilities that the risky alternative will be successful (p) or unsuccessful (q). Assume (a) $U_s > U_c > U_f$, (b) $p + q = 1$ (i.e., $q = 1 - p$) for every subject. Then:

$$SEU = \sum_{i=1}^{n} p_i U_i \quad \text{where } i = 1,2,\ldots,n \text{ outcomes} \qquad [1]$$

Subjective expected utility for the risky alternative:

$$SEU_{(R)} = pU_s + (1 - p)U_f \qquad [2]$$

and subjective expected utility of the certain alternative:

$$SEU_{(C)} = 1 \cdot U_c \qquad [3]$$

If maximization of SEU provides the decision rule, then the choice of the risky alternative should follow only when its SEU is equal to or greater than the SEU of the certain cautious alternative: that is, when

$$SEU_{(R)} \geq SEU_{(C)} \qquad [4]$$

or

$$pU_s + (1 - p)U_f \geq 1 \cdot U_c \qquad [5]$$

Consequently, the risky alternative should be chosen if and only if

$$p \geq \frac{U_c - U_f}{U_s - U_f} \qquad [6]$$

In other words, the <u>lowest</u> probability of success that a subject is predicted to consider acceptable (i.e., his risk-level preference)

in order to attempt the risky alternative if he uses maximization of SEU as a decision rule is

$$\hat{p} = \frac{U_c - U_f}{U_s - U_f} \qquad [7]$$

($\hat{p}$ : the ratio of the utilities of the outcomes, as judged by the subject, which also serves as a predictor of the subject's risk-level preference, p.)

Several important consequences of the SEU model are indicated by equation [6]. First note that the p which maximizes SEU is not determined by the aboslute utility of any single outcome alone, but by the relative differences between all the utilities.

Second, in order to reach a group decision concerning the lowest p, it is not necessary for the subjects to reconcile their aboslute utilities directly, as is often assumed, but merely to agree on their relative magnitudes, i.e., on the ratio among those utilities.

Third, for the occurrence of a shift toward risk "risk-oriented instructions" (i.e., the standard instructions requesting subjects to choose the lowest probability that is acceptable) are necessary. Without the word lowest the meaning of the task becomes vague since invariably any higher probability is preferred to a lower one--a point that may be raised in a group discussion inhibiting the shift toward risk. When "neutral" instructions, that omit the word lowest, are presented to subjects the model would predict that the usual

significant risky-shift will not occur. Indeed this was found by Clark (1969). The model would also predict that "neutral instructions" will not reduce the conservative-shift on conservative choice dilemmas and would possibly increase it--a matter for future research.

In order to validate the SEU model positive correlations between p and $\hat{p}$ (i.e., $\hat{p}$ as in equation [7]) should be obtained for each subject across several choice dilemmas. However, before proceeding with the analysis of the group process let us define some new terms. Let $p_1$, $p_2$, $\hat{p}_1$, and $\hat{p}_2$ designate the risk-level choice before ($p_1$) and after ($p_2$) group discussion, and the predicted probabilities based on the utilities' ratio also before ($\hat{p}_1$) and after ($\hat{p}_2$) group discussion.

Given data regarding $p_1$, $p_2$, $\hat{p}_1$ and $\hat{p}_2$, it is possible to test whether a cognitive or an affective process is responsible for the shifts. The hypothesis derived from the shared information model contends that the shifts are produced by the introduction of new information (i.e., persuasive arguments) during the group discussion. This explanation will be referred to as the informational influence hypothesis. In contrast, the other explanation suggests that the shifts toward risk and conservatism are due not to the influence of <u>new</u> information but to a process of rationalization in which better use is made of the same information in order to maximize SEU. This explanation will be referred to as the rationality (SEU) hypothesis.

According to the informational influence hypothesis there has to be a change in p (i.e., risk preference) in the direction of the

change in $\hat{p}$ (i.e., utilities' ratio) as a result of the additional information relevant to the utilities on which $\hat{p}$ is based. However, there need not be any increase in the goodness of fit between p and $\hat{p}$ following group discussion (i.e., the absolute difference between p and $\hat{p}$ need not decrease), since it is not assumed that increased rationality results from group discussion.

On the other hand, the rationality hypothesis implies that, there should not be a change in the $\hat{p}$ subsequent to the group discussion, since no new information on the utilities has been added. The shifts in p are in the direction of the initial $\hat{p}$ because by changing their risk preference to fit their utilities' ratio, subjects are trying to maximize SEU. Consequently, the goodness of fit between p and $\hat{p}$ should increase considerably after group discussion (i.e., the absolute difference between p and $\hat{p}$ should decrease).

If both informational influence and rationalization processes are operative, there will be both a change in $\hat{p}$ in the direction of the change in p and an increase in the goodness of fit between the two.

There remains of course the possibility that netiher of these two cognitive hypotheses is responsible for the risky and conservative-shifts. In this case there should not be a change in $\hat{p}$ after group discussion; instead the goodness of fit betwen p and $\hat{p}$ should decrease. Evidence of this kind would suggest that an affective process is responsible for the shifts--that new utilities [e.g., utility for risk, or for

appearing risky, as the risk as-a-value (IOC) hypothesis suggests] that are not represented in the outcomes of the choice dilemma (i.e., Equation [6]) are influencing the risk-level choices. (Or, it may be that group members abandon SEU maximization and apply a different decision rule.) A summary of this analysis is presented in Table 1 (p. 56).

## Summary of the Purpose of the Study

This dissertation focuses on two processes, cognitive and affective, that may account for the widely replicated shifts toward greater risk and conservatism following group discussion.

Two hypotheses, both based on a cognitive process, are suggested as possible explanations for the shifts in risk. The first hypothesis, informational influence, suggests that new information raised during the group discussion influences the person's view of the situation (i.e., his assessment of the utilities of the potential outcomes) and this in turn influences his decision regarding risk. The second hypothesis, the rationality hypothesis, suggests that the shifts are the result of increasing rationality. More specifically, it asserts that better use of the SEU maximization rule is made during the group discussion than when the individual decides alone (i.e., discussion enhances rationality). This enhanced rationality then influences the person's decisions regarding risk.

In contrast to these two hypotheses, a third hypothesis suggests that the shifts in risk are the result of an affective process. It is argued that some potential rewards and punishments, inherent in the circumstances under which the decision is made (i.e., in a group), influences the person's decision regarding risk.

TABLE 1

SEU ANALYSIS OF THE EFFECTS OF GROUP PROCESSES ON INDIVIDUAL AND GROUP DECISIONS INVOLVING RISK

| Choice Dilemma Type | Change in p, risk preference | Analysis and Results: Change in $\hat{p}$, Utilities' ratio | Analysis and Results: Fit between p and $\hat{p}$ | Evidence in support of |
|---|---|---|---|---|
| Risky: | $p_2 - p_1 < 0$ | $\hat{p}_2 - \hat{p}_1 < 0$ | $\lvert p_1-\hat{p}_1\rvert = \lvert p_2-\hat{p}_2\rvert$ | Informational influence hypothesis |
| Conservative: | $p_2 - p_1 > 0$ | $\hat{p}_2 - \hat{p}_1 > 0$ | $\lvert p_1-\hat{p}_1\rvert = \lvert p_2-\hat{p}_2\rvert$ | |
| Risky: | $p_2 - p_1 < 0$ | $\hat{p}_2 = \hat{p}_1$ | $\lvert p_1-\hat{p}_1\rvert > \lvert p_2-\hat{p}_2\rvert$ | Rationality (SEU) hypothesis |
| Conservative: | $p_2 - p_1 > 0$ | $\hat{p}_2 = \hat{p}_1$ | $\lvert p_1-\hat{p}_1\rvert > \lvert p_2-\hat{p}_2\rvert$ | |
| Risky: | $p_2 - p_1 < 0$ | $\hat{p}_2 - \hat{p}_1 < 0$ | $\lvert p_1-\hat{p}_1\rvert > \lvert p_2-\hat{p}_2\rvert$* | Informational influence and rationality (SEU) hypotheses |
| Conservative: | $p_2 - p_1 > 0$ | $\hat{p}_2 - \hat{p}_1 > 0$ | $\lvert p_1-\hat{p}_1\rvert > \lvert p_2-\hat{p}_2\rvert$* | |
| Risky: | $p_2 - p_1 < 0$ | $\hat{p}_2 = \hat{p}_1$ | $\lvert p_1-\hat{p}_1\rvert < \lvert p_2-\hat{p}_2\rvert$ | Affective hypothesis (or change in decision rule) |
| Conservative: | $p_2 - p_1 > 0$ | $\hat{p}_2 = \hat{p}_1$ | $\lvert p_1-\hat{p}_1\rvert < \lvert p_2-\hat{p}_2\rvert$ | |

*Note that the increase in goodness of fit can result from either changes in p or $\hat{p}$ or both. According to the rationality hypothesis, which purports to account for the shifts in p, the goodness of fit should increase as a result of the changes in p rather than in $\hat{p}$. Consequently, the results that satisfy the above-mentioned equations constitute evidence for the rationality hypothesis only if the mean change in p is greater than the mean change in $\hat{p}$ (i.e., $\lvert p_2-p_1\rvert > \lvert\hat{p}_2-\hat{p}_2\rvert$).

It is suggested that an SEU model of individual choice behavior can be employed in testing these three hypohteses. The methods used in four experiments designed to do this will be discussed in the following chapter.

# CHAPTER III

# METHOD

Four experiments were conducted in order to obtain data for testing the SEU model and the three major hypotheses. This chapter is concerned with the general design and data-collection material used in these experiments. The specific procedures and results of each experiment will be the topic of Chapters IV, V and VI.

## Overview of the General Design

The basic data required for the analysis outlined above are as follows:

1. Individual risk-taking preferences (i.e., minimum acceptable probabilities of success) before and after group discussion, which will be designated as $p_1$ and $p_2$, respectively.
2. Individual assessments of the utilities' ratio (as in Equation [7], p. 52) before and after group discussion, which will be designated as $\hat{p}_1$ and $\hat{p}_2$, respectively.
3. Group decisions concerning risk-taking preferences and group decisions concerning the utilities' ratio, which will be designated as $p_G$ and $\hat{p}_G$, respectively.

The present research consists of a set of four experiments employing the choice dilemma paradigm in order to obtain the required data. In particular, the design of this set of experiments is mainly concerned with two methodological problems.

First, if changes in risk preferences (p) and in assessment of the utilities' ratio ($\hat{p}$) do occur after group discussion, it must be shown that these changes are indeed due to the group discussion rather than other factors (e.g., greater familiarity with the task). For this reason, a control condition was provided in the first experiment in which group discussion does not occur. Instead, subjects (Ss) were instructed merely to repeat their risk preferences and utilities' ratio assessments.

Second, if changes in risk preferences are found to be correlated with changes in utilities' ratio assessments, it must be ascertained that this relationship is not due to Ss attempt to give consistent responses with regard to the two measurements, but rather to the causal relationship between the two. In other words, according to our theory, the risk preference is determined by the S on the basis of his assessment of the utilities' ratio. If he changes his assessment of that ratio, then he will change his risk preference. However, when both measurements of p and $\hat{p}$ are obtained before and after group discussion, there is the possibility that concomitant changes will occur not because of the causal relationship between utilities' ratio and risk preferences as our theory (SEU) suggests, but because the Ss are adapting one measure to the other for reasons unrelated to the

theory. An obvious possibility is that the Ss are trying to appear consistent. We shall term this possible effect resulting from the adaptation of one measure to the other for reasons unrelated to SEU the 'consistency effect'.

There are two principal ways to deal with the potential consistency effect. First, we can minimize this possibility by employing measures of p and $\hat{p}$ that make it difficult for Ss to see the relationship between the measures. Under these conditions consistent responses are unlikely to be the result of an artifact. This method was used in Experiment 2 and more stringently in Experiment 3. Generally speaking, in these two experiments the utilities' ratio $\hat{p}$ was not measured directly as in Experiment 1, but instead, Ss made separate assessments of the utilitiy of each outcome of a choice dilemma (for each choice dilemma) in Experiment 2, and also made independent assessments (i.e., using different set of scales for the utility of each outcome) in Experiment 3. The utilities' ratio for each choice dilemma was then computed on the basis of these three different assessments according to formula [7] (see page 52) rather than on the basis of one assessment as in Experiment 1. This method also provides more detailed information on changes in utilities of specific outcomes $U_s$, $U_f$ and $U_c$, in addition to the information on changes in the utilities' ratio. This information may make it possible to determine which of the outcomes are reassessed before there is a change in Ss' risk preference.

The second way to confront the problem of the consistency effect is by eliminating the possibility of its appearance

altogether. This can be arranged by simply eliminating one measure in one experiment and the other measure in a second experiment. Since all the research on the risky-shift produced shifts in risk preference using only measure of risk preference (p), our design includes an experiment (Experiment 4) that involves only the assessment of the utilities' ratio ($\hat{p}$). These assessments were made before and after group discussion for reaching unanimous group assessment of that ratio. Consequently, any changes in $\hat{p}$ in Experiment 4 that may be found to be correlated with changes in p in other experiments cannot be interpreted as a consistency effect since no measure of p was obtained throughout this experiment. The design of each of the four experiments in outlined in Table 2.

Table 2

EXPERIMENTAL DESIGN FOR SEU ANALYSIS OF THE EFFECTS OF GROUP PROCESSES ON INDIVIDUAL AND GROUP DECISIONS INVOLVING RISK

| Experiment | Individual Choice and Assessment | Group Decision | Individual Choice and Assessment |
|---|---|---|---|
| Experiment 1: | | | |
| Experimental condition: | $p_1$ $\hat{p}_1$ | $p_G$ | $p_2$ $\hat{p}_2$ |
| Control condition: | $p_1$ $\hat{p}_1$ | None | $p_2$ $\hat{p}_2$ |
| Experiment 2: | $p_1$ $\hat{p}_1^*(U_s,U_c,U_f)$ | $p_G$ | $p_2$ $\hat{p}_2^*(U_s,U_c,U_f)$ |
| Experiment 3: | $p_1$ $\hat{p}_1^{**}(U_s,U_c,U_f)$ | $p_G$ | $p_2$ $\hat{p}_2^{**}(U_s,U_c,U_f)$ |
| Experiment 4: | $\hat{p}_1$ | $\hat{p}_G$ | $\hat{p}_2$ |

* $\hat{p}$ based on <u>separate</u> assessment of $U_s$, $U_c$ and $U_f$.

** $\hat{p}$ based on <u>separate</u> and <u>independent</u> assessments of $U_s$, $U_c$ and $U_f$.

Material

(a) Risk-taking measure: the same risk-taking instrument was used for all the experiments that required measurements of risk preferences (i.e., Experiments 1, 2 and 3). The instrument consisted of a questionnaire containing instructions and several choice dilemma items. Eight items were used in Experiment 1; out of these eight items seven were used in Experiment 2, and six items were used in Experiment 3.

The eight items were chosen to include three risky items (i.e., items that have been found to yield risky shifts), three conservative items (i.e., items that have been found to yield conservative shifts) and two neutral items (i.e., items that have been found to yield no consistent significant shifts). The three risky items were taken from the original CDQ fully reproduced in Kogan and Wallach (1964; Appendix E). These items (numbers 4, 6 and 11 in the CDQ) begin with Mr. A, Mr. B and Mr. C, respectively, in our Opinion Questionnaire. From the three conservative items only one was taken from the CDQ (number 12) and it begins with Mr. D in our questionnaire (Q). The other two conservative items Mr. E and Mr. F, were taken from a Q used by Stoner (1968). The two neutral items were also taken from the CDQ (numbers 2 and 5). They begin with Mr. G and Mr. H in our Q. All eight items are presented in Appendix A. The risky, conservative and neutral items were dispersed in the Q given to the Ss so that no two items of the same type appeared adjacently.

Each choice dilemma was accompanied by the standard instructions to choose--between odds of 1, 2, 3, 4, 5, 6, 7, 8, or 9 chances

in 10--the lowest odds of success acceptable in order to recommend trying the uncertain (i.e., risky) alternative; or, instead, to indicate that this alternative should not be attempted, no matter what the odds. In the latter case, the response was scored as 10. Risk was measured in the standard manner as the odds that were chosen by the subject. The questionnaires and their instructions that were used in Experiments 1, 2 and 3 are shown in Table 3.

Table 3

RISK-TAKING INSTRUMENT: QUESTIONNAIRES MEASURING RISK-TAKING PREFERENCES (p)

| Questionnaire: Name | Measure | Instructions in Appendix |
|---|---|---|
| Opinion Questionnaire | $p_1$ | A |
| Opinion Questionnaire (group discussion and group decision) | $p_G$ | B |
| Opinion Questionnaire (final personal decision) | $p_2$ | C |
| Opinion Questionnaire* (final opinions) | $p_2$ | D |

*Note: Used only for control condition in Experiment 1.

(b) Direct assessment of utilities' ratio (Experiments 1 and 4): the same instrument for assessing subjective utilities' ratio was used in Experiments 1 and 4. The instrument consists of a questionnaire containing instructions followed by the same eight

choice dilemmas as they appeared in the Opinion Questionnaire; however, they do not include the risk-taking scale of odds and the lines instructing Ss how to respond on the scale. Instead, at the bottom of each page presenting a choice dilemma a 15-point scale was provided. From left to right respectively, the endpoints of the scale were described as the "low desirability"and the "high desirability" poles representing the outcomes of the uncertain alternative when it failed and when it succeeded. The subject was instructed to try and place himself in the position of the central figure(s) of the situation and place an 'X' on the desirability scale to indicate the relative desirability of the outcome of the certain (cautious) alternative. Ss responses are scored from 1 (the extreme category on the left, low desirability) to 15 (the extreme category on the right, high desirability). The score indicated subject's estimation of the utility of the certain alternative relative to the utilities of the outcomes of the uncertain alternative. From this score the utilities' ratio $\hat{p}$ was obtained directly (according to formula [7], p. 52) by dividing the score by 15. This score of the utilities' ratio, or predicted probability, is multiplied by 10 to make it comparable to the risk-taking measurement that was scored in terms of odds to 10 rather than in terms of probability. The eight choice dilemmas with their respective scales appear in Appendix E. The questionnaires and their instructions that were used as the instrument for the assessment of the utilities' ratio in Experiments 1 and 4 are shown in Table 4.

Table 4

UTILITIES' RATIO ASSESSMENT INSTRUMENT: QUESTIONNAIRES MEASURING UTILITIES' RATIO ($\hat{p}$)

| Questionnaire: Name | Measure | Instructions in Appendix |
|---|---|---|
| Desirability Estimation Questionnaire | $\hat{p}_1$ | E |
| Opinion Questionnaire (group discussion and group decision) | $\hat{p}_G$ | B |
| Desirability Estimation Questionnaire (final personal estimation) | $\hat{p}_2$ | F |

The instruments that were used for indirect assessments of the utilities' ratio in Experiments 2 and 3 will be described later, each with its respective experiment.

In addition, a post experimental questionnaire was administered at the end of each experiment. This questionnaire is presented in Appendix G.

# CHAPTER IV

## DIRECT MEASURES OF RISK AND UTILITIES' RATIO: EXPERIMENT 1

In addition to testing the hypotheses outlined above with SEU model, this experiment is also concerned with the first question; the extent to which group discussion rather than other factors (e.g., repeated experience with the task) is responsible for the shifts in risk and for the concomitant shifts in utilities' ratio predicted by the informational influence hypothesis. Therefore, the basic design of this experiment consists of an experimental condition with group discussion and a control condition without discussion.

### Subjects

A total of 152 male students from the introductory courses in psychology at The University of Michigan participated as subjects in this experiment. The students participated during the winter semester of 1970 as part of their course requirements.

### Procedure

Ss were randomly assigned to two conditions. In the first condition, the experimental condition, 90 Ss were run in 18 five-man

groups. In the second, control control condition, 62[1] Ss were run in groups ranging in size from three to seven.

Briefly, the procedure involved the administration of five questionnaires, measuring $p_1$, $\hat{p}_1$, $p_G$, $p_2$, $\hat{p}_2$, in succession in the experimental condition, and four questionnaires measuring $p_1$, $\hat{p}_1$, $p_2$, $\hat{p}_2$ in the control condition. Except for the questionnaire measuring $p_G$ in the experimental condition, the other four were filled out by the Ss privately with no discussion among Ss. Thus the administration of the third Q measuring $p_G$ constitutes the experimental manipulation of group discussion to consensus.

The procedure for the two conditions was identical for the first two Qs. Ss arriving to the laboratory were welcomed by the experimenter (E) and were seated at small tables. Each S was given the first "Opinion Questionnaire". After all Ss read the instructions, questions were answered by E. Then, Ss were told to fill out the Q at their own rate. Upon completion the Qs were collected and the "Desirability Estimation Questionnaire" was then given to each S. The same procedure was repeated with this Q as well as with the last two Qs, "Opinion Questionnaire (final personal decisions)" and "Desirability Estimation Questionnaire (final personal estimation)". In each case Ss worked on these Qs privately.

---

[1]Although the control condition includes fewer Ss than the experimental condition, it allows for statistical tests of the same or even better power than those done with the experimental condition. This is because the tests using the data of the experimental condition were based on groups (18), (i.e., means of the group members' scores), whereas those using the control condition data were based on Ss' individual decisions (62).

The procedure in the administration of the third Q, "Opinion Questionnaire (group discussion and group decision)", requires some elaboration. Before this Q was distributed, Ss were asked to arrange their small tables in a circle so that they were facing each other. Then the Qs were distributed and Ss were asked to read the instructions:

> In front of you is the same opinion questionnaire that you filled out before. You have taken it in order to familiarize yourself with all the situations, and to give you some idea where you might stand on each one.
>
> What we are really interested in now is having the group discuss each situation in turn and arrive at a unanimous decision on each. You will recognize that a unanimous decision is different from a majority vote.
>
> When the group reaches its decision, each of you should mark it in his own booklet so that you have a record of the group's decision. You may not return to a situation; discuss each one until the group decision is reached and then go to the next.
>
> Most groups are able to come to some decision if those who disagree will restate their reasons, and if the problem is reread carefully. Differences of opinion can be bridged by discussion.
>
> I am not going to participate in the discussion although I will be here to answer any procedural questions which may arise.

After Ss read these instructions they were allowed to ask questions. They were then asked to proceed with the task. Ordinarily it took Ss less than five minutes to reach a unanimous decision on an item. However, in those cases (less than 15%) where no consensus was reached within seven minutes of discussion, the E interrupted the discussion and asked the Ss to mark their present personal opinion at the moment each in his own Q. Ss were then asked to start the discussion on the following item. The mean of

these personal opinions (i.e., risk preferences) was taken in the analysis in place of a unanimous group decision. Thus the instructions as well as the procedure were almost identical to those used in other research demonstrating shifts toward risk and conservatism (e.g., Wallach, Kogan and Bem, 1962).

After the procedure was completed for all items, the Qs were collected and the Ss were asked to rearrange their seating arrangement as before, being seated separately behind the tables. Then the last two Qs were administered as mentioned above, followed by a "Final Questionnaire": a post experimental questionnaire (Appendix G). From this Q, questions Numbers 1, 2, and 4 were omitted for the control condition as irrelevant. Ss were also asked to write their cumulative grade point average on this Q. After these Qs were completed and collected, the purpose of the study was explained to the Ss and they were dismissed.

## Results

SEU model for individual choice behavior. The first question that should be answered before we can turn to the analysis of the group process is whether the SEU model of BDT proves to be a valid model for individual choice behavior. In other words, do subjects' initial choices (i.e., risk-level preferences) reflect the relationship among utilities as required by SEU theory. It was already mentioned that in order to validate the SEU model, positive correlations between p and $\hat{p}$ (i.e., $\hat{p}$ as in Equation [7], p. 52) should

be obtained for each choice dilemma across Ss, as well as within Ss, across several choice dilemmas. Some of the results pertinent to this question are presented in Table 5.

TABLE 5

MEANS OF UTILITIES' RATIO ($\hat{p}$) AND RISK PREFERENCES (p) AND PRODUCT MOMENT CORRELATIONS BETWEEN UTILITIES'RATIO AND RISK PREFERENCE

| Choice Dilemma | Experimental Condition (n=90) | | | Control Condition (n=62) | | |
|---|---|---|---|---|---|---|
| | $\hat{p}_1$ | $p_1$ | r | $\hat{p}_1$ | $p_1$ | r |
| A | 4.12 | 4.17 | .51** | 4.23 | 3.85 | .57** |
| B | 4.71 | 4.73 | .42** | 4.83 | 4.89 | .58** |
| C | 4.21 | 4.09 | .38** | 4.19 | 4.10 | .55** |
| D | 5.66 | 7.01 | .44** | 6.16 | 7.06 | .33* |
| E | 6.86 | 7.72 | .50** | 6.60 | 7.61 | .54** |
| F | 6.57 | 8.26 | .37** | 6.67 | 7.60 | .25* |
| G | 6.80 | 7.81 | .53** | 6.61 | 7.71 | .49** |
| H | 6.04 | 7.40 | .40** | 6.02 | 6.92 | .59** |

Note: All tests are two tailed.
For SD of values of $\hat{p}_1$ and $p_1$ in this table see Appendix L

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

The values of $p_1$ are given in odds in 10 (i.e., the probability multiplied by 10). The values of $\hat{p}$ were calculated according to Equation [7] and multiplied by 10 to make easier the comparison to the values of p. Thus $\hat{p} = 10 \frac{U_c - U_f}{U_s - U_f}$. More specifically, $\hat{p}$ was computed as follows:

$$\hat{p} = 10 \frac{U_c}{15}$$

$U_c$ = S's score on the desirability scale.

$U_s$ = Highest possible desirability (i.e., score of 15).

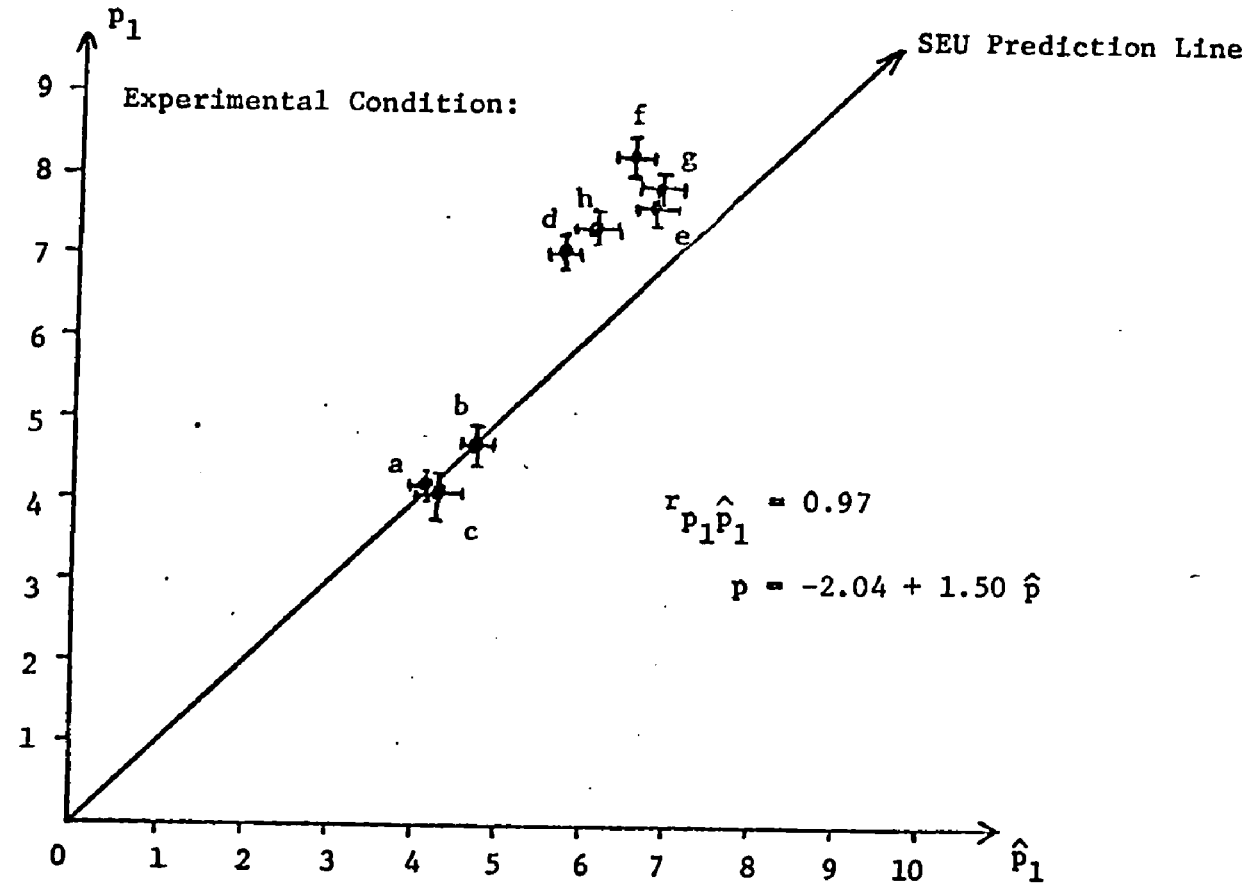
$U_f$ = Lowest possible desirability (0).

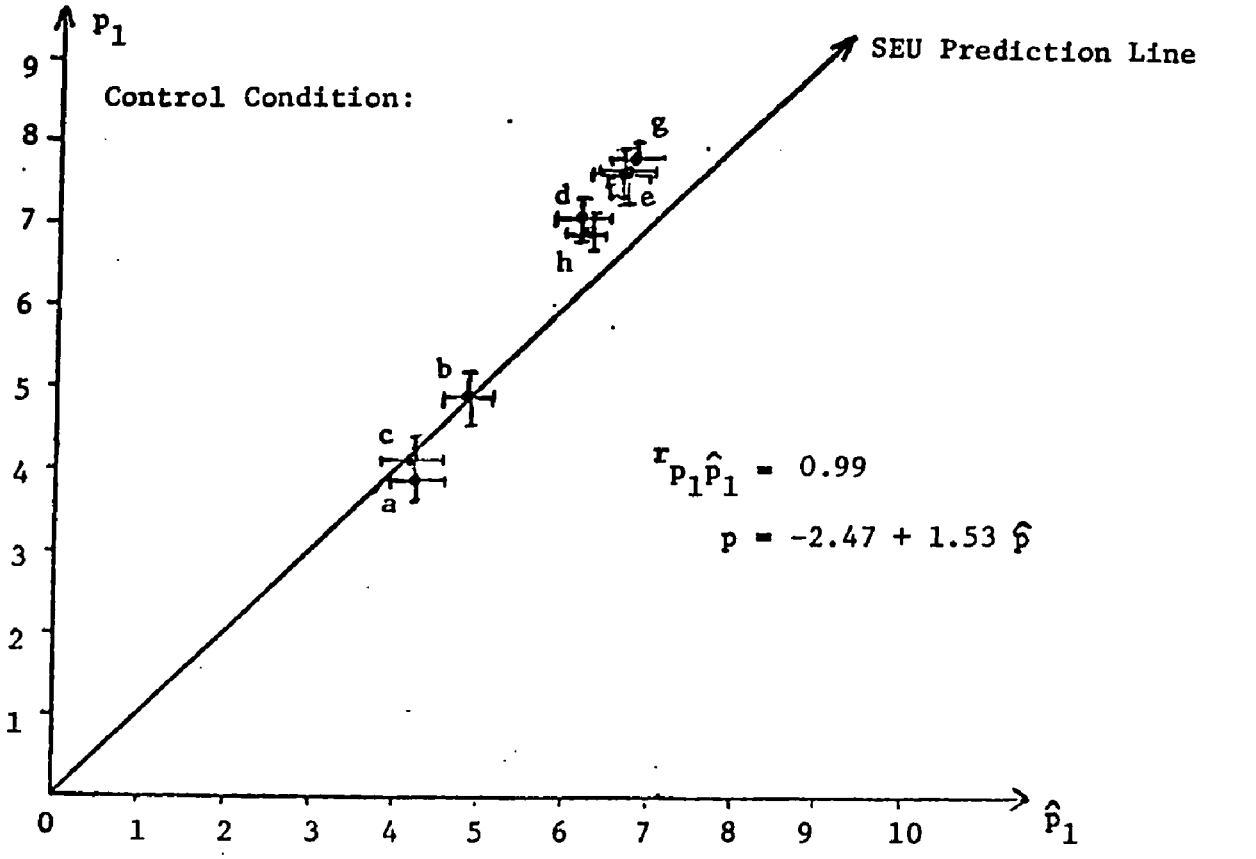
The results indicate moderate correlations between $\hat{p}_1$ and $p_1$ for the choice dilemmas across Ss. All correlations are significant beyond the .05 level. The results of both conditions are virtually the same. This was expected since these results were computed on the basis of data that was collected in identical Qs with the same procedure.

The means of $\hat{p}_1$ and $p_1$ of both conditions were plotted against a prediction line prescribed by the SEU model and are presented in Figure 1 (p. 72).

The results of the correlations across Ss for the choice dilemmas support the SEU model. However, since the SEU is a model for individual choice behavior its crucial test should be based on correlations between p and $\hat{p}$ across items within Ss. For this test a product moment correlation between p and $\hat{p}$ across the eight choice dilemmas was computed for each individual S. Each correlation was then transformed to Z score (i.e., $Z = 1/2 \log_e \frac{1+r}{1-r}$). These scores were summed and averaged. The transformation of the mean Z scores to r yielded r = .74 and r = .72 for experimental condition and control condition respectively. Each correlation was significant beyond the .001 level. Thus crucial support for the SEU model was obtained.

Fig. 1. MEANS OF UTILITIES' RATIO ($\hat{p}$) AND RISK PREFERENCE (p) OF EIGHT CHOICE DILEMMAS PLOTTED AGAINST SEU MODEL PREDICTION LINE




Note: Each data point is surrounded by two standard errors (i.e., one in each direction) of $p_1$ and $\hat{p}_1$.

The Ss' correlations were in turn correlated with their grade point average as reported in the post experimental questionnaire and yielded negligible nonsignificant correlations of .07 and .10 for the experimental and the control conditions, respectively. It therefore seems that the strong correlations within Ss are not simply a matter of the ability to see some connection between the scales measuring p and $\hat{p}$, but more likely, due to real processes which occur when the person must think about choosing between alternative courses of action with different outcomes, as suggested by the SEU model.

How the utilities' ratio changes: analysis of the informational influence hypothesis. The next analysis is concerned with the question of whether informational influence is the process responsible for the shifts in risk preferences. The results pertinent for this analysis are presented in Table 6 (p. 74).

First it should be noted that in the experimental condition, risky-shifts were produced on the risky items A, B and C; conservative-shifts on the conservative items D, E and F; no shifts were found on the neutral items G and H (Column $p_G - p_1$). These shifts in risk preference hold up for individual decisions following the group discussion as shown in Column $p_2 - p_1$. Moreover, no such consistent and significant shifts appear in the control condition.

Second, for the experimental condition the changes in $\hat{p}$ are perfectly consistent with the shifts in p. There is a decrease in $\hat{p}$ for the risky items A, B, C ($p < .01$), an increase in $\hat{p}$ for the conservative items D, E, F ($p < .05$), and only negligible changes in

TABLE 6: MEAN SHIFTS IN RISK PREFERENCE (p) AND IN UTILITIES' RATIO ($\hat{p}$)

| Choice Dilemma Type | Experimental Condition | | | | | Control Condition | | |
|---|---|---|---|---|---|---|---|---|
| | Shifts in Risk | | | Shifts in Utilities' Ratio | No. of Groups | Shifts in Risk | Shifts in Utilities' Ratio | No. of Ss |
| | $p_G-p_1$ | $p_2-p_G$ | $p_2-p_1$ | $\hat{p}_2-\hat{p}_1$ | N | $p_2-p_1$ | $\hat{p}_2-\hat{p}_1$ | N |
| Risky | | | | | | | | |
| A | -1.39*** | 0.06 | -1.33*** | -1.18*** | 18 | -0.16 | -0.62* | 62 |
| B | -0.95*** | 0.02 | -0.93*** | -0.92*** | 18 | 0.30 | 0.01 | 62 |
| C | -0.76** | 0.14 | -0.62* | -0.66** | 18 | 0.30 | -0.19 | 62 |
| Mean | -1.03*** | 0.07 | -0.96*** | -0.92*** | 54 | 0.14 | -0.26 | 186 |
| Conservative | | | | | | | | |
| D | 0.22 | 0.05 | 0.27 | 0.66* | 18 | -0.33* | 0.42* | 62 |
| E | 0.86** | -0.08 | 0.78** | 0.87*** | 18 | 0.07 | 0.22 | 62 |
| F | 0.61** | -0.07 | 0.54** | 0.69** | 18 | 0.45 | 0.41 | 62 |
| Mean | 0.56*** | -0.03 | 0.53*** | 0.74*** | 54 | 0.06 | 0.35* | 186 |
| Neutral | | | | | | | | |
| G | 0.08 | -0.05 | 0.03 | 0.15 | 18 | -0.32 | 0.12 | 62 |
| H | 0.11 | -0.07 | 0.04 | 0.12 | 18 | 0.06 | 0.22 | 62 |
| Mean | 0.09 | -0.06 | 0.04 | 0.13 | 36 | -0.13 | 0.17 | 124 |

Note: All tests are two-tailed correlated t-tests.

SD of the values in this table are provided in Appendix L.

*$p < .05$
**$p < .01$
***$p < .001$

$\hat{p}$ on the neutral items G and H. The product moment correlation between mean shifts in risk preference ($p_2-p_1$) and mean shifts in utilities' ratio ($\hat{p}_2-\hat{p}_1$) across the eight items is $r = .98$ ($p < .001$). Though there are some shifts in $\hat{p}$ in the control condition, they are small and only two of them are statistically significant. More importantly, these small shifts in $\hat{p}$ did not appear consistently in each dilemma type nor corresonding to the changes in p. The correlation between $p_2-p_1$ and $\hat{p}_2-\hat{p}_1$ is negligible, .08, and not significant.

A more stringent test of the informational influence hypothesis should be based on the correlation between changes in p and changes in $\hat{p}$ within Ss across the eight items. For each S a product moment correlation between shift in risk preference (i.e., $p_2-p_1$) and shift in utilities' ratio, (i.e., $\hat{p}_2-\hat{p}_1$) was computed across the eight items. These correlations were transformed to Z scores and averaged. The means Z scores of the experimental and control conditions were transformed to r again yielding $r = .51$ ($p < .001$) and $r = .14$ ($p < .05$), respectively. It then seems clear that for the average S in the experimental condition a shift in risk preference is associated with a change in the way he assesses the relative utilities of the outcomes (i.e., utilities' ratio). Consequently, the informational influence hypothesis gain additional support.

Shifts in risk: analysis of the rationality and the affective hypotheses. The next analysis has to do with whether the shifts can in part be accounted for by increased rationality (i.e., better miximization of SEU) or by an affective process due to the group discussion.

According to the SEU model for individual choice behavior, a S determines his risk preference on the basis of his assessment of the utilities' ratio. If choices are made on this basis, then p should be equal to $\hat{p}$. Furthermore, if choices on that basis are considered rational, then any difference between p and $\hat{p}$ indicates deviation from rationality. If Ss change their risk preference (p) so as to make it more closely correspond to their evaluation of the outcomes (i.e., to the utilities' ratio $\hat{p}$), the difference between p and $\hat{p}$ will decrease i.e., the goodness of fit between p and $\hat{p}$ will increase as follows: $|p_1-\hat{p}_1|-|p_2-\hat{p}_2| > 0$ (see also Table 1). If the increased goodness of fit is due to changes in p but not in $\hat{p}$, enhanced rationality has occurred. If goodness of fit decreases due to changes in p, this would be evidence for an affective process. Suppose the increase in goodness of fit occurs only in the experimental condition and not in the control condition. It clearly must be produced by group discussion. The results relevant to this analysis are presented in Table 7 (p. 77) From these data it can be concluded that (a) there was not even the slightest evidence for an affective process and in turn it seems that a process of rationality has taken place; (b) this process is due to the group discussion; and (c) this process may account for the shifts toward greater risk and conservatism.

There are negligible nonsignificant increases in the correlation between p and $\hat{p}$ in the experimental and the control condition. In every case the difference is tiny and not significant. There were however small but statistically significant increases in these

TABLE 7: PRODUCT MOMENT CORRELATIONS AND MEAN DIFFERENCE IN THE CORRELATIONS AND IN GOODNESS OF FIT BETWEEN RISK PREFERENCE (p) AND UTILITIES' RATIO ($\hat{p}$)

| Choice Dilemma Type | Experimental Condition (N=90) | | | | Control Condition (N=62) | | | |
|---|---|---|---|---|---|---|---|---|
| | $r_{p_1\hat{p}_1}$ | $r_{p_2\hat{p}_2}$ | $r_2-r_1$ | $\lvert p_1-\hat{p}_1\rvert-\lvert p_2-\hat{p}_2\rvert$ | $r_{p_1\hat{p}_1}$ | $r_{p_2\hat{p}_2}$ | $r_2-r_1$ | $\lvert p_1-\hat{p}_1\rvert-\lvert p_2-\hat{p}_2\rvert$ |
| Risky | | | | | | | | |
| A | .51** | .43** | -0.08 | 0.47** | .57** | .69** | 0.12 | 0.38 |
| B | .42** | .51** | 0.09 | 0.41* | .58** | .70** | 0.12 | 0.08 |
| C | .38** | .44** | 0.06 | 0.46* | .55** | .71** | 0.16 | 0.19 |
| Mean | .43** | .46** | 0.02 | 0.44*** | .56** | .70** | 0.13 | 0.21 |
| Conservative | | | | | | | | |
| D | .44** | .51** | 0.07 | 0.48* | .33** | .38* | 0.05 | 0.13 |
| E | .50** | .62** | 0.12 | 0.47* | .54** | .55** | 0.01 | 0.30 |
| F | .37** | .56** | 0.19 | 0.45 | .25* | .57** | 0.32 | 0.75* |
| Mean | .43** | .56** | 0.13 | 0.47*** | .37** | .50** | 0.13 | 0.39** |
| Neutral | | | | | | | | |
| G | .53** | .57** | 0.04 | 0.24 | .49** | .50** | 0.01 | 0.26 |
| H | .40** | .52** | 0.12 | 0.32 | .59** | .63** | 0.04 | 0.05 |
| Mean | .46** | .54** | 0.08 | 0.28* | .54** | .56** | 0.02 | 0.16 |

Note: All tests are two-tailed.

SDs of differences in goodness of fit are provided in Appendix L.

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

correlations within Ss across items. The mean initial correlation within S, (based on Z transformation), in the experimental condition increases from r = .74 to r = .89 (difference significant; $p < .001$) as well as in the control condition from r = .72 to r = .81 (difference significant; $p < .01$). The conclusion that can be drawn from these results is that to the extent that increased rationality occurred, it was only small, and more important, it was not due to the group discussion since similar increases in correlations occurred in both conditions.

However, increase in the magnitude of the correlations between p and $\hat{p}$ may only suggest--but not prove--that increased rationality occurred. As was mentioned above, the crucial test concerning rationality lies in the goodness of fit between p and $\hat{p}$. For that matter the absolute difference between the two values was compared before and after group discussion i.e., $|p_1-\hat{p}_1|-|p_2-\hat{p}_2|$. These computations were performed across Ss for every single choice dilemma item separately and then, again, for every S across the eight items. For the experimental condition there were significant increases in rationality (decrease in differences between p and $\hat{p}$) after group discussion for every risky item, for two out of three conservative items (but significant for pooled data of the conservative items) and small nonsignificant increase in rationality in the two neutral items. The mean goodness of fit within Ss across the items also increased by .41 (from 1.75 to 1.33; difference significant beyond the .001 level). In the control condition, these computations yielded only small nonsignificant increases in goodness of

fit in seven out of eight items. The mean goodness of fit within Ss across the eight items increased by .27 (from 1.74 to 1.47; difference significant beyond the .01 level) somewhat lower than in the experimental condition though the difference between the two conditions was not significant.

It may be concluded then that slight increase in rationality appeared in both conditions as indicated by the small increases in correlations; more importantly, there was an increase in goodness of fit for every single item, as well as within Ss across the eight items. However, since these increases appeared in both conditions they cannot be attributed to group discussion, but rather are probably due to increased experience with the task. Nevertheless, the increases in goodness of fit appear to be greater in the experimental condition than in the control condition on almost every item. These greater increases may be attributed to the group discussion. Consequently, it is important to determine to what extent these increases in goodness of fit could also account for the shifts in p toward greater risk and conservatism that are also due to group discussion.

Suppose the initial p for the risky items was above the initial $\hat{p}$ and the initial p for the conservative items was below the initial $\hat{p}$. That is to say, the person initially violates rationality in the former case by being too cautious and in the latter case by being too risky. Then, if as a result of the group discussion on each item the p moved closer to the initial $\hat{p}$ (i.e., decrease in p for risky items and increase in p for the conservative items), it could unequivocally be concluded that the shifts occur because the individual has become more

rational, and he has become more rational because of the discussion. Close examination of the data discloses that this is not the case. Consider the results that were presented in Table 5 (p. 70). It is clear that for the three risky items, the risk preferences p before discussion are virtually identical to those of the $\hat{p}$ (p = 4.17; 4.73; 4.09 and $\hat{p}$ = 4.12; 4.71; 4.21, respectively). So, the risky-shifts produced on these items cannot be accounted for by increased rationality since there were no deviations from rationality on these items to begin with.

For the three conservative items the initial p was always higher (rather than lower) than the corresponding $\hat{p}$ (p = 7.07; 7.61; 7.60 and $\hat{p}$ = 6.16; 6.60; 6.67, respectively). So, if any process of rationality occurs on these items, it should lead to risky-shifts!

When more rigorous analysis of the data is performed to test the rationality hypothesis, the rationality hypothesis becomes untenable. According to the model presented in Table 1 (p. 56), in order to support the rationality hypothesis the analysis requires that $|p_1-\hat{p}_1|>|p_2-\hat{p}_2|$ for total means of both risky and conservative items, provided that the shifts in p are greater than those in $\hat{p}$ (i.e., $|p_2-p_1|>|\hat{p}_2-\hat{p}_1|$). The results of this analysis in the experimental condition are presented in Table 8 (p. 81).

These data make it evident that the risky items do not demonstrate any increase in rationality that could account for the risky-shifts. The conservative items demonstrate a negligible increase in goodness of fit. However, as will be shown below, this increase in goodness of fit was not due to changes in p but rather to changes in

TABLE 8

MEAN GOODNESS OF FIT BEFORE AND AFTER GROUP DISCUSSION AND MEAN INCREASE IN GOODNESS OF FIT ON RISKY, CONSERVATIVE AND NEUTRAL ITEMS

| Choice Dilemma Type | Goodness of fit before | Goodness of fit after | Increase in Goodness of fit |
|---|---|---|---|
| | $\lvert p_1-\hat{p}_1\rvert$ | $\lvert p_2-\hat{p}_2\rvert$ | $\lvert p_1-\hat{p}_1\rvert-\lvert p_2-\hat{p}_2\rvert$ |
| Risky | | | |
| A | 0.04 | 0.09 | -0.05 |
| B | 0.02 | 0.01 | 0.01 |
| C | 0.12 | 0.08 | 0.04 |
| Mean | 0.06 | 0.06 | 0.00 |
| Conservative | | | |
| D | 1.34 | 0.95 | 0.39 |
| E | 0.85 | 0.76 | 0.09 |
| F | 1.68 | 1.54 | 0.14 |
| Mean | 1.29 | 1.08 | 0.21 |
| Neutral | | | |
| G | 1.01 | 0.89 | 0.12 |
| H | 1.36 | 1.28 | 0.08 |
| Mean | 1.18 | 1.08 | 0.10 |

$\hat{p}$, and therefore, cannot be interpreted as a result of a rationality process.

Finally, if we reexamine Table 6 (p. 74) it is clear that the small increase in goodness of fit that was found in the earlier analysis cannot account for <u>any</u> part of the shifts in risk preference due to group discussion. For the risky items, the changes in $\hat{p}$ were

virtually identical to those in p (-.92 compared to -.96, respectively). For the conservative items the changes in $\hat{p}$ were even greater than those in p (.74 compared to .53). Consequently, increased goodness of fit due to changes in p alone (shifts in risk preference) is nowhere in evidence.

Thus our first experiment demonstrated that individuals are fairly rational in terms of maximization of SEU. Though the shifts toward greater risk and conservatism can in no way be explained by an increase in rationality, they cannot be explained by an affective process either. This is because only increases in the goodness of fit between p and $\hat{p}$ were observed rather than decreases required by the affective hypothesis. Therefore, these results provide even stronger evidence against the affective hypothesis than against the rationality hypothesis.

## Conclusions and Discussion

This experiment produced results which provide direct support to the SEU model of individual choice behavior and also to the informational influence hypothesis. It also produced direct and strong evidence against the affective hypothesis and the rationality hypothesis purported to account for the shifts in risk preference. More specifically:

1. The basic factor responsible for shifts both in risk preference (i.e., risky and conservative shifts) and in assessments of utilities' ratio is group discussion.

2. Initial risk preference is moderately correlated with utilities' ratio for every choice dilemma across Ss and strongly correlated with utilities' ratio within Ss across choice dilemmas.
3. There is some small increase in rationality in both experimental and control conditions and mainly within Ss which appears to be the result of increased experience with the task rather than due to the group discussion.
4. The shifts in risk preference toward greater risk and conservatism are correlated with consistent shifts in assessment of the utilities' ratio for all choice dilemmas both across and within Ss.

It is commonly accepted in psychology that an individual's choice behavior is determined by his assessment of the potential rewards and punishments (i.e., utilities) in the situation. If so, the correlations obtained between risk preference and utilities' ratio indicate a causal relationship. That is to say, S's assessment of the utilities' ratio determines his risk preference in a choice dilemma. On the basis of this argument one can conclude that the shifts in risk are due to a cognitive process of informational influence regarding the assessment of the utilities of the outcomes in the choice dilemma situation. Thus, our results support the informational influence hypothesis. However, this should not be considered conclusive evidence for the hypothesis until the possibility of a consistency effect is ruled out. This will be the purpose of the following experiments.

# CHAPTER V

## INDIRECT MEASURES OF UTILITIES' RATIO: EXPERIMENTS 2 and 3

These two experiments provide additional tests for the hypotheses while attempting to minimize the possibility of a consistency effect (i.e., Ss trying to adapt one measure $\hat{p}$, to another p, in order to appear consistent). Unlike Experiment 1, in these experiments Ss'assessment of the utilities' ratio ($\hat{p}$) will be measured indirectly by obtaining separate judgments of the utilities of the outcomes. The utilities' ratio is then computed from these separate judgments. With this method of assessing utilities it may be possible to determine whether the shifts in risk occur as a result of a change in the utility of a particular outcome, of all outcomes or, alternatively, of particular combinations depending on the choice dilemma item.

### Subjects

A total of 164 male students from the introductory courses in psychology at The University of Michigan participated as subjects in the two experiments. The students participated during the winter semester of 1970 as part of their course requirements. Eighty-five Ss participated in Experiment 2; all were run in 17 five-man groups. Seventy-nine Ss participated in Experiment 3. They were run in 15

five-man groups and one four-man group, composing a total of sixteen groups. Each experimental session with a group lasted approximately seventy-five minutes.

Material

(a) Risk-taking measure: the same Choice Dilemmas task (i.e., questionnaires) that were used in Experiment 1 for the measurement of $p_1$, $p_G$, and $p_2$ were used in these two experiments. Due to a time limitation on the availability of the Ss for these two experiments, one item was omitted from the Qs of Experiment 2 and two items were omitted from the Qs of Experiment 3. Thus the Choice Dilemmas task employed in these experiments consists of seven items in Experiment 2 and six items in Experiment 3 as follows:

| | Experiment 2 | Experiment 3 |
|---|---|---|
| Risky items: | A, B | A, B |
| Conservative items: | D, E, F | E, F |
| Neutral items: | G, H | G, H |

Again, the items were arranged in the Qs so that no two items of the same type (i.e., risky, conservative or neutral) appeared adjacently. The scoring of the risk preference (p) was identical to the standard method used in Experiment 1.

(b) Assessment of utilities' ratio: two different methods of assessing utilities were attempted.

In Experiment 2, the utilities of the outcomes: $U_f$, $U_s$ and $U_c$, were each assessed separately. Below each of the seven choice dilemmas there was a desirability scale (see Appendix H). The scale consists of a line (140 mm) with the left and right endpoints representing the least and most desirable event or outcome that the S could conceive. The instructions were as follows:

> Try to place yourself in the position of Mr. X, (i.e., the central figure in the choice dilemma situation), and, Indicate with lines across the scale and letters above the lines, the desirabilities of the following alternatives and their outcomes:
>
> F: (that of the uncertain alternative when it is attempted and fails--a short description of that event is provided).
>
> S: (that of the uncertain alternative when it is attempted and succeeds--a short description of that event is provided).
>
> C: (that of the certain alternative--a short description of that event is provided).

Ss were instructed to make their assessments in the same order presented by the letters F, S and C.

The utility of each outcome was scored according to the distance in mm of the intersection of the line representing this utility from the left-hand endpoint of the desirability scale. Thus low values indicate low utilities. The utilities' ratio was calculated according to formula [7] (see p. 52) and multiplied by 10 to make the scores comparable to the risk-taking score as follows: $\hat{p} = 10 \frac{U_c - U_f}{U_s - U_f}$.

In Experiment 3 as in Experiment 2, the assessment of the utilities' ratio ($\hat{p}$) again involved the separate assessment of each of its components i.e., $U_f$, $U_s$ and $U_c$. However, unlike in Experiment 2, these assessments are done independently of one another on separate sets of semantic differential scales provided on the page below each item (see Appendix J). The particular four bi-polar adjectives

chosen are known to have high loading on the evaluative factor of the semantic differential (see Osgood et al., 1957). The position of the positive and negative adjectives were reversed from left to right all along the sets of scales so as to make it difficult to respond in an ostensibly consistent fashion.

A score of "one" was assigned to responses at the negative endpoint, increasing up to "nine" for responses at the positive endpoint. For each set of four scales, the four scores were then summed. This sum was taken as the score representing the utility of the particular outcome assessed by the four scales. Thus, low scores represent low utility outcomes and high scores represent high utility outcomes. The utilities' ratio ($\hat{p}$) was computed from the outcomes utilities' scores in the same manner as in Experiment 2.

The following Qs with their instructions were used as the instruments for the indirect assessment of the utilities' ratio in Experiments 2 and 3 presented in Table 9 (p. 88).

## Experimental Design and Procedure

The experimental design and procedure of Experiments 2 and 3 was identical to that of the experimental condition in Experiment 1 (Table 2, p. 61). The difference among them lies only with the methods employed for assessing the utilities' ratio. Whereas a direct assessment of the utilities' ratio was employed in Experiment 1, two different, indirect methods of assessment were employed in Experiments 2 and 3.

TABLE 9

UTILITIES ASSESSMENT INSTRUMENT: QUESTIONNAIRES MEASURING $U_f$, $U_s$ and $U_c$

| Questionnaire | Measure | Instructions in Appendix |
|---|---|---|
| Experiment 2: | | |
| General Desirability Estimation Questionnaire | $\hat{p}_1$ | H |
| General Desirability Estimation Questionnaire (final personal estimation) | $\hat{p}_2$ | I |
| Experiment 3: | | |
| General Desirability Estimation Questionnaire | $\hat{p}_1$ | J |
| General Desirability Estimation Questionnaire (final personal estimation) | $\hat{p}_2$ | K |

## Results

SEU model for individual choice behavior. The following analysis is identical with that performed on the results of the previous experiment. Again we are concerned with the validity of the SEU as a model for individual choice behavior. The results relevant to this analysis are the product moment correlations between utilities' ratio ($\hat{p}$) and risk preference (p) across Ss for each item. But even more relevant are the correlations within Ss across the choice dilemma items. Some of these results are presented in Table 10 (p. 89).

The results of Experiment 2 demonstrate moderate correlations between utilities' ratio and risk preference for the choice dilemmas

TABLE 10

MEANS OF INITIAL UTILITIES' RATIO ($\hat{p}_1$), RISK PREFERENCE ($p_1$), AND PRODUCT MOMENT CORRELATIONS BETWEEN UTILITIES' RATIO AND RISK PREFERENCE

| Choice Dilemma | Experiment 2 (N=85) | | | Experiment 3 (N=79) | | |
|---|---|---|---|---|---|---|
| | $\hat{p}_1$ | $p_1$ | $r_{p_1\hat{p}_1}$ | $\hat{p}_1$ | $p_1$ | $r_{p_1\hat{p}_1}$ |
| A | 3.55 | 3.87 | .31** | 2.69 | 4.25 | .40** |
| B | 5.03 | 4.98 | .49** | 5.77 | 5.01 | .18 |
| D | 5.29 | 6.46 | .35** | | | |
| E | 7.29 | 7.80 | .54** | 9.51 | 7.59 | .28* |
| F | 5.84 | 8.73 | .41** | 4.65 | 8.32 | .32** |
| G | 6.79 | 6.65 | .29** | 7.04 | 7.25 | .12 |
| H | 4.54 | 6.87 | .49** | 2.84 | 7.08 | .06 |

Note: All tests are two tailed

For SD of values of $\hat{p}_1$ and $p_1$ in this table see Appendices M and N.

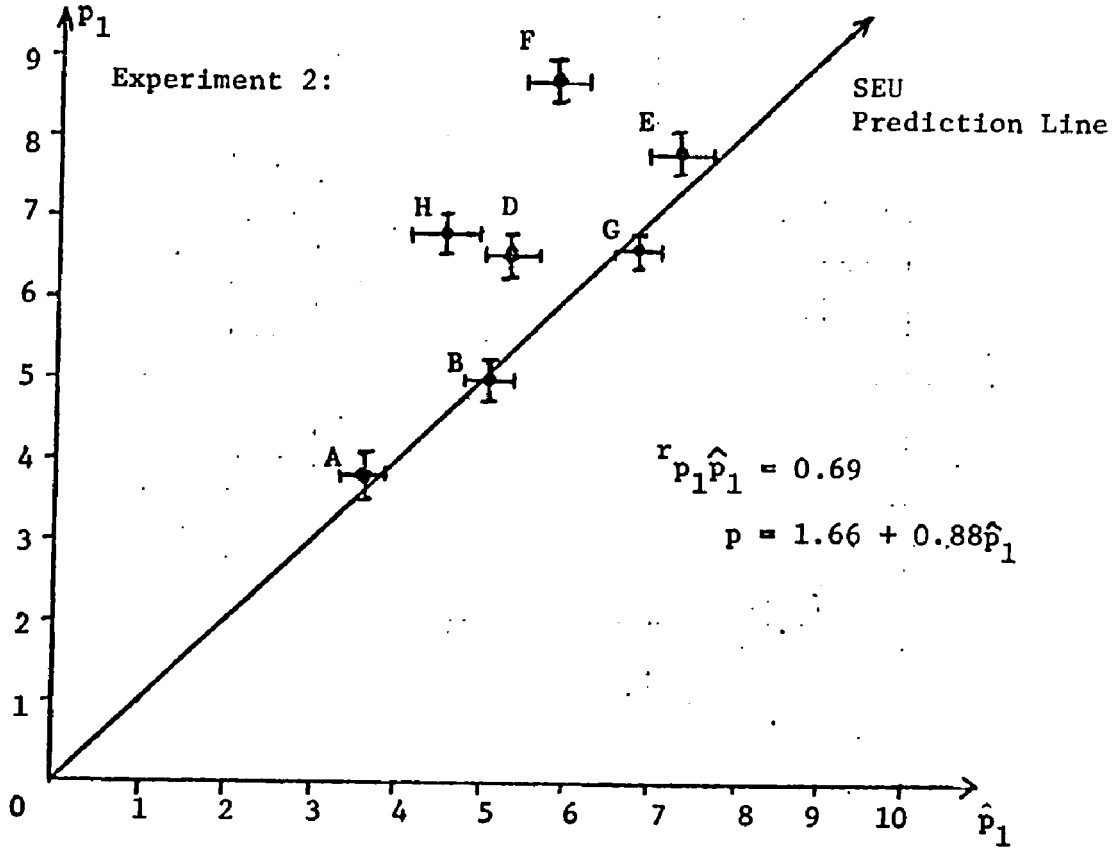
* $p < .05$

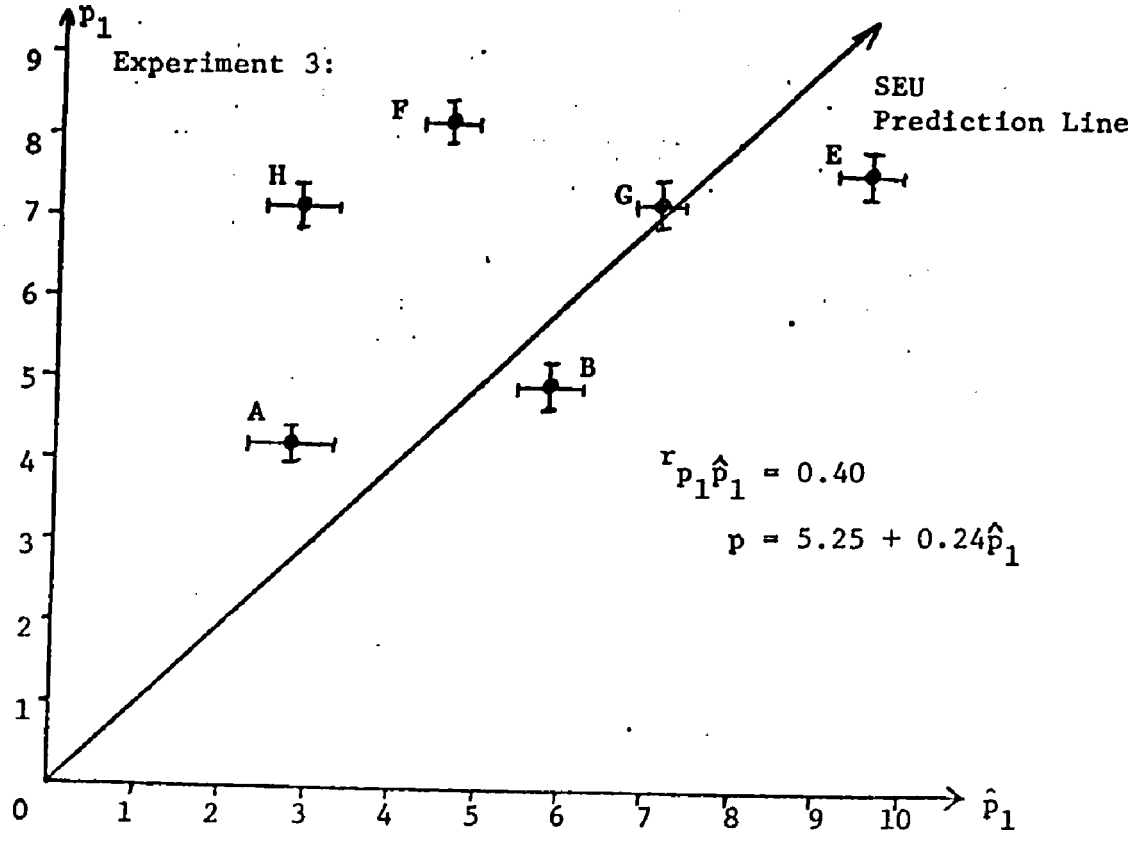
** $p < .01$

across Ss. All the correlations are significant beyond the .01 level. The results of Experiment 3 are not fully consistent with those of Experiment 2 as only three out of the six correlations are of moderate value and significant.

The means of $\hat{p}_1$ and $p_1$ in Experiments 2 and 3 were plotted against a prediction line prescribed by the SEU model and are presented in Figure 2 (p. 90).

Fig. 1. MEANS OF UTILITIES' RATIO ($\hat{p}$) AND RISK PREFERENCE (p) OF SEVERAL CHOICE DILEMMAS PLOTTED AGAINST SEU MODEL PREDICTION LINE




Note: Each data point is surrounded by two standard errors (i.e., one in each direction) of $p_1$ and $\hat{p}_1$.

Thus, the correlations across Ss for the choice dilemmas support the SEU model, with the exception that in Experiment 3 there were three items that did not demonstrate significant correlations. Close examination of the data revealed that on these items, there were a few Ss (less than 2%) that deviated from the basic assumption of the model (see p. 50) and assessed the utilities of the outcome of the certain alternative $U_c$ either lower than $U_f$ or higher than $U_s$. These assessments strongly affected the utilities' ratio and created strong deviations that led to the small correlation of these particular items.

However, these deviations from the model that were caused by a few Ss could not affect the crucial test of SEU model; the correlations within Ss across the choice dilemmas. Again, product moment correlations within Ss were computed and transformed to Z scores. The mean Z scores were .65 in Experiment 2 and .38 in Experiment 3, corresponding to $r = .57$ and $r = .36$, respectively. Although these correlations between p and $\hat{p}$ are somewhat weaker than those obtained in Experiment 1, they are nevertheless statistically significant ($p < .001$ for both). Since these correlations were obtained through separate and independent assessments of utilities, they provide additional support for the SEU model above and beyond that provided by the results of Experiment 1.

How the utilities' ratio changes: analysis of the informational influence hypothesis. The results pertinent for this analysis are presented in Table 11 (p. 92).

TABLE 11: MEAN SHIFTS IN RISK PREFERENCE (p) AND IN UTILITIES' RATIO ($\hat{p}$)

| Choice Dilemma Type | Experiment 2 | | | | | Experiment 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Shifts in Risk | | | Shifts in Utilities' Ratio | No. of Groups | Shifts in Risk | | | Shifts in Utilities' Ratio | No. of Groups |
| | $p_G-p_1$ | $p_2-p_G$ | $p_2-p_1$ | $\hat{p}_2-\hat{p}_1$ | N | $p_G-p_1$ | $p_2-p_G$ | $p_2-p_1$ | $\hat{p}_2-\hat{p}_1$ | N |
| Risky | | | | | | | | | | |
| A | -1.22*** | 0.06 | -1.16*** | -0.83*** | 17 | -1.15*** | 0.00 | -1.15*** | -1.88 | 16 |
| B | -1.13*** | 0.34 | -0.79** | -1.07 | 17 | -1.02*** | 0.09 | -0.93*** | -2.02 | 16 |
| Mean | -1.17*** | 0.20 | -0.97*** | -0.95** | 34 | -1.08*** | 0.04 | -1.04*** | -1.95* | 32 |
| Conservative | | | | | | | | | | |
| D | 0.26 | 0.12 | 0.38 | 0.55 | 17 | | | | | 16 |
| E | 0.74* | -0.07 | 0.68* | 0.37 | 17 | 1.08** | -0.13 | 0.95** | 0.69 | 16 |
| F | 0.33 | -0.01 | 0.32 | 0.88** | 17 | 0.96*** | -0.01 | 0.95*** | 1.37** | 16 |
| Mean | 0.44** | 0.02 | 0.46** | 0.60** | 51 | 1.02*** | -0.07 | 0.95*** | 1.03** | 48 |
| Neutral | | | | | | | | | | |
| G | -0.14 | 0.03 | -0.11 | -0.52* | 17 | 0.02 | 0.06 | 0.08 | -0.14 | 16 |
| H | 0.26 | 0.18 | 0.44** | 1.01* | 17 | 0.07 | 0.03 | 0.10 | 0.93 | 16 |
| Mean | 0.06 | 0.11 | 0.16 | 0.24 | 34 | 0.05 | 0.05 | 0.09 | 0.39 | 32 |

Note: All tests are two-tailed correlated t-tests.
For SD of values in this table see Appendices M and N.

*p < .05
**p < .01
***p < .001

The pattern of results of Experiments 2 and 3 is virtually identical to that produced in the experimental condition of Experiment 1. Risky-shifts were produced on the risky items ($p < .001$), conservative-shifts on the conservative items (significant beyond .01 for every item in Experiment 3 and for the pooled data in Experiment 2), and no shifts were found for the neutral items (see columns $p_G - p_1$). These shifts remain for individual decisions following the group discussion as shown in column $p_2 - p_1$. Moreover, the shifts in utilities' ratio ($\hat{p}$) are almost perfectly consistent with the shifts in risk preference (p). There are decreases in $\hat{p}$ on the risky items[1] and increases in $\hat{p}$ on the conservative items. These shifts based on pooled data obtained from items on the same type are statistically significant beyond the .05 level. Although there are some shifts in $\hat{p}$ on the neutral items, they are not consistent. The correlation between mean shifts in risk ($p_2 - p_1$) and in utilities' ratio ($\hat{p}_2 - \hat{p}_1$) across items is $r = .85$ ($p < .05$) for Experiment 2 and $r = .93$ ($p < .01$) for Experiment 3.

Again, the more stringent test of the informational influence hypothesis regarding the correlations between shifts in p and $\hat{p}$

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[1]These decreases (i.e., negative utilities' ratio shifts) are substantial. Nevertheless, the mean shift in item B in Experiment 2 and in items A and B in Experiment 3 is statistically not significant. The lack of statistical significance is the result of the responses of three Ss (one in each item) whose utilities' assessments deviated from the basic assumption concerning the applicability of the SEU model for a choice dilemma (see p. 50, the assumption stating that $U_f < U_c < U_s$). These Ss assessed the utility of the certain alternative ($U_c$) either much lower than the utility of failure ($U_f$) in the uncertain alternative, or much higher than the utility of success ($U_s$) in the uncertain

within Ss was performed. The correlation between $p_2-p_1$ and $\hat{p}_2-\hat{p}_1$ across items was computed for each S and transformed to Z scores. The mean Z scores were transformed again, resulting in correlations of $r = .40$ and $r = .63$ for Experiments 2 and 3, respectively. Both correlations were statistically significant beyond the .001 level.

The pattern of results demonstrated by Experiments 2 and 3 is identical to that produced by Experiment 1. Consequently, substantial support has been added to the informational hypothesis.

Shifts in utility of individual outcomes: the utilities' ratio decomposed. The utilities' ratio was obtained in Experiments 2 and 3 through direct assessments of its components (i.e., the utilities of the three outcomes $U_f$, $U_s$ and $U_c$ involved in each choice dilemma). Thus it may be possible to find out whether the shifts in risk preference occurred as a result of a change in the utility of a particular outcome or, alternatively, whether the shifts occurred as a result of changes in the assessment of all outcomes or different ones depending on the particular item. For this analysis, the assessment of each outcome after the group discussion was subtracted from the initial assessment before the group discussion. The mean differences (shifts) in the assessments of outcomes' utility for each item are presented in Table 12 (p. 95).

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alternative. These few, but strong, 'deviant' responses strongly affected the magnitude of the utilities' ratio and the variance resulting in shifts which are statistically not significant. To demonstrate this we eliminated the data of the groups where the deviant responses occurred (only one group in each item) and computed the mean utilities' ratio shift again. The computation produced substantial negative shifts of -.57 for item B in Experiment 2, and -1.05 and -.92 for items A and B respectively, in Experiment 3, all significant beyond the .05 level.

TABLE 12

MEAN SHIFTS IN OUTCOMES' UTILITY ($U_f$, $U_c$, $U_s$)
FOLLOWING GROUP DISCUSSION

| Choice Dilemma Type | Experiment 2 (N=85) | | | Experiment 3 (N=79) | | |
|---|---|---|---|---|---|---|
| | $U_{f2}-U_{f1}$ | $U_{c2}-U_{c1}$ | $U_{s2}-U_{s1}$ | $U_{f2}-U_{f1}$ | $U_{c2}-U_{c1}$ | $U_{s2}-U_{s1}$ |
| Risky | | | | | | |
| A | 2.99 | -3.79 | -0.13 | 1.74** | -1.03 | 0.63* |
| B | 6.91** | -1.43 | 0.96 | 1.83** | -0.67 | 0.67* |
| Mean | 4.95** | -2.61 | 0.41 | 1.78** | -0.85* | 0.65** |
| Conservative | | | | | | |
| D | 3.68 | 6.15* | -1.82 | | | |
| E | -2.58 | 1.72 | 2.66 | -0.06 | 0.41 | -0.44 |
| F | 0.02 | 8.54** | -1.08 | -0.44** | 3.14*** | -0.02 |
| Mean | 0.37 | 5.47** | -0.08 | -0.25 | 1.77*** | -0.23 |
| Neutral | | | | | | |
| G | -0.26 | -2.35 | 2.13 | -0.26 | -0.08 | 0.47 |
| H | 0.45 | 10.29 | -3.56** | 0.64 | 2.26** | -0.10 |
| Mean | 0.09 | 3.97 | 0.71 | 0.19 | 1.09 | 0.18 |

Note: All tests are two-tailed correlated t-tests.
For SD of values in this table see Appendices M and N.
*$p < .05$
**$p < .01$
***$p < .001$

Keep in mind that the values tabulated in Experiment 2 represent millimeters and those in Experiment 3 represent sum of scores of four semantic differential scales. The scores therefore cannot be compared across the experiments.

Overall, the results in Table 12 show a complex pattern. The extent to which changes in utilities of specific outcomes contributed to the change in the ratio varies from item to item. For example, in item A, the increase in $U_f$, in combination with a decrease in $U_c$, contributed most to the decrease of the utilities' ratio for that item. For item B, the change in $U_f$ alone contributed more than any other utility change to the decrease in the utilities' ratio. Similarly, for item F, the main determinant of change in the utilities' ratio is the change in $U_c$. The results of the above mentioned items are identical in both experiments, and those results concerning the remaining items are also comparatively close.

It therefore seems that the locus of the informational influence varies from item to item; on some items, the major informational influence concentrates on the assessment of the utility of one particular outcome or alternative, and on other items, it concentrates on the utility of another outcome, or combinations thereof. There is no completely consistent pattern of influence that cut across the items. Nevertheless, it seems that the informational influence on the risky items is mainly concentrated on the consequences of failure at the uncertain alternative whereas the informational influence on the conservative items is mainly concentrated on the consequences of the certain alternative.

Shifts in risk: analysis of the rationality and the affective hypotheses. Again, the same analysis that was performed on the results of Experiment 1 in order to determine whether a rationality process or an affective process could account for the shifts in risk, was also performed on the results of Experiments 2 and 3.

It has already been discussed that according to the SEU model, a process of rationality implies that Ss change and move their risk preference (p) toward their initial assessed utilities' ratio (i.e., they move the p closer to the $\hat{p}$). Increased correlations between p and $\hat{p}$ after group discussion, namely $r_{p_2\hat{p}_2} > r_{p_1\hat{p}_1}$, may give some indication for the existence of a process of rationality. However, as was already mentioned, the real test of increased rationality should be based on the goodness of fit between p and $\hat{p}$. Increased goodness of fit (i.e., decreased difference) is direct indication of enhanced rationality, provided it occurs as a result of the change in p (and not in $\hat{p}$). The obverse (i.e., decrease in goodness of fit because of changes in p) is evidence for an affective process. The results relevant for this analysis are presented in Table 13 (p. 98).

These results do not indicate enhancement of rationality following discussion. First, the correlations between p and $\hat{p}$ did not increase after group discussion in Experiment 2. Some increases were observed in Experiment 3 but these were negligible. There were however substantial increases in correlations within Ss in both experiments. The mean initial correlation within Ss (based on Z transformation) in Experiment 2 increased from r = .57 to r = .73,

TABLE 13: PRODUCT MOMENT CORRELATIONS AND MEAN DIFFERENCE IN THE CORRELATIONS AND IN GOODNESS OF FIT BETWEEN RISK PREFERENCE (p) AND UTILITIES' RATIO ($\hat{p}$) BEFORE AND AFTER GROUP DISCUSSION

| Choice Dilemma Type | Experiment 2 (N=85) | | | | Experiment (N=79) | | | |
|---|---|---|---|---|---|---|---|---|
| | $r_{p_1\hat{p}_1}$ | $r_{p_2\hat{p}_2}$ | $r_2-r_1$ | $\lvert p_1-\hat{p}_1\rvert-\lvert p_2-\hat{p}_2\rvert$ | $r_{p_1\hat{p}_1}$ | $r_{p_2\hat{p}_2}$ | $r_2-r_1$ | $\lvert p_1-\hat{p}_1\rvert-\lvert p_2-\hat{p}_2\rvert$ |
| Risky | | | | | | | | |
| A | 0.31** | 0.39** | -0.08 | 0.51* | 0.40** | 0.39** | -0.01 | -0.33 |
| B | 0.49** | 0.12 | -0.37 | -0.52 | 0.18 | 0.33** | 0.15 | -0.90 |
| Mean | 0.40** | 0.25* | -0.15 | 0.00 | 0.29* | 0.36** | 0.07 | -0.62 |
| Conservative | | | | | | | | |
| D | 0.35** | 0.29** | -0.06 | 0.26 | | | | |
| E | 0.54** | 0.45** | -0.09 | -0.59 | 0.28** | 0.49** | 0.21 | -0.04 |
| F | 0.41** | 0.38** | -0.03 | 0.44 | 0.32** | 0.45** | 0.13 | 0.20 |
| Mean | 0.43** | 0.37** | -0.06 | 0.04 | 0.30** | 0.47** | 0.17 | 0.08 |
| Neutral | | | | | | | | |
| G | 0.29** | 0.34** | 0.05 | 0.37* | 0.12 | 0.31** | 0.19 | -0.01 |
| H | 0.49** | 0.31** | -0.18 | 0.33 | 0.06 | 0.37** | 0.31 | 0.75 |
| Mean | 0.39** | 0.32** | -0.06 | 0.35* | 0.09 | 0.34** | 0.25 | 0.37 |

Note: All tests are two-tailed.

For SD of values in this table see Appendices M and N.

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

as well as in Experiment 3 from r = .36 to r = .65. Both differences were significant beyond the .001 level. While we do not have a control condition with no discussion it seems that these increases in the correlations within Ss, as in Experiment 1, were due to increased experience with the task rather than to other factors. The analyses that follows strengthen this impression.

A second reason for rejecting the idea of enhanced rationality is that there were no increases in the goodness of fit in both Experiments 2 and 3 for the risky or the conservative items. There were, however, some increases in goodness of fit for the two neutral items in Experiment 2 and for one neutral item in Experiment 3. Most importantly, there were no significant increases in the means of goodness of fit between p and $\hat{p}$ within Ss in either experiment. In Experiment 2, the means of the goodness of fit within Ss before and after group discussion were 2.22 and 2.09, respectively, with negligible nonsignificant differences of 0.12. In Experiment 3, these means were 3.12 and 3.18 with a negative difference of -0.06. These latter findings differ from those of Experiment 1 in that they show no real sign of increased rationality due to group discussion. Therefore, it seems unlikely that the shifts in risk preference that were produced in these two experiments can be accounted for by rationality. Moreover, to determine more conclusively whether rationality could account for at least part of the shifts in risk preference, we performed further analysis, as in Experiment 1. Recall that support for the rationality hypothesis requires that $|p_1-\hat{p}_1|-|p_2-\hat{p}_2|>0$ for the total means of both risky and conservative

items, provided this increase in goodness of fit occurred as a result of shifts in p but not in $\hat{p}$. The results of this analysis are presented in Table 14 (p. 101).

It is clear that no real increase in the goodness of fit following discussion occurs in either experiment. However, the conservative and the neutral items show some small increases in the goodness of fit, but, as in Experiment 1, these cannot be interpreted as enhanced rationality. Closer examination of the data presented in Table 11 discloses that the increase in goodness of fit for the conservative items was the result of the big shifts in $\hat{p}$ rather than in p, contrary to what the rationality hypothesis predicts. For these items, the mean shifts in p was .46 and the mean shift in $\hat{p}$ was .60 in Experiment 2. These mean shifts were .95 and 1.06 in Experiment 3, respectively.

It is also clear that no real consistent <u>decreases</u> in the goodness of fit occurred in Experiments 2 and 3 either. Consequently, it is most reasonable to conclude that the rationality and the affective hypotheses are untenable.

## Conclusions

Although different methods of assessment have been used to obtain the data in Experiments 2 and 3, the results of these experiments are in perfect agreement and also parallel the results of Experiment 1. The possibility of a consistency effect has been sharply reduced by the indirect assessment of the utilities' ratio employed in Experiments 2 and 3. Thus additional support is

TABLE 14: MEAN GOODNESS OF FIT BEFORE AND AFTER GROUP DISCUSSION AND MEAN INCREASE IN GOODNESS OF FIT ON RISKY, CONSERVATIVE AND NEUTRAL ITEMS

| Choice Dilemma Type | Experiment 2 | | | Experiment 4 | | |
|---|---|---|---|---|---|---|
| | Goodness of fit before | Goodness of fit after | Increase in Goodness of fit | Goodness of fit before | Goodness of fit after | Increase in Goodness of fit |
| | $\lvert p_1-\hat{p}_1\rvert$ | $\lvert p_2-\hat{p}_2\rvert$ | $\lvert p_1-\hat{p}_1\rvert-\lvert p_2-\hat{p}_2\rvert$ | $\lvert p_1-\hat{p}_1\rvert$ | $\lvert p_2-\hat{p}_2\rvert$ | $\lvert p_1-\hat{p}_1\rvert-\lvert p_2\hat{p}_2\rvert$ |
| Risky | | | | | | |
| A | 0.31 | 0.01 | 0.30 | 1.55 | 2.28 | -0.73 |
| B | 0.05 | 0.23 | -0.18 | 0.76 | 0.32 | 0.44 |
| Mean | 0.18 | 0.12 | 0.06 | 1.15 | 1.30 | -0.15 |
| Conservative | | | | | | |
| D | 1.16 | 0.99 | 0.17 | | | |
| E | 0.50 | 0.81 | -0.31 | 1.91 | 1.66 | 0.25 |
| F | 2.88 | 2.32 | 0.56 | 3.66 | 3.24 | 0.42 |
| Mean | 1.51 | 1.37 | 0.14 | 2.78 | 2.45 | 0.33 |
| Neutral | | | | | | |
| G | 0.14 | 0.27 | -0.13 | 0.21 | 0.43 | -0.22 |
| H | 2.32 | 1.75 | 0.57 | 4.23 | 3.40 | 0.83 |
| Mean | 1.23 | 1.01 | 0.22 | 2.22 | 1.92 | 0.30 |

provided for the conclusions that have already been drawn on the basis of the results of Experiment 1.

Overall, the results of Experiments 2 and 3 lend additional support to the SEU model of individual choice behavior and the informational influence hypothesis as an explanation for the shifts in risk preference. In particular, the results of these two experiments demonstrated that the locus of the informational influence varies from item to item. On some items, the major informational influence concentrates on the assessment of the utility of one particular outcome or alternative, and on other items, it concentrates on the utility of another outcome or combination thereof. There is no completely consistent pattern of influence that cut across the items nor even within each category of risky, conservative or neutral items. Nevertheless, it seems that the informational influence on the risky items is mainly concentrated on the consequences of failure at the uncertain alternative whereas the informational influence on the conservative items is mainly concentrated on the consequences of the certain alternative.

Finally, the results of these two experiments, together with the results of Experiment 1, demonstrated fairly conclusively that the enhancement of rationality and the affective hypotheses as explanations of the shifts in risk preference are untenable.

# CHAPTER VI

## GROUP DISCUSSION AND GROUP DECISION ON THE UTILITIES' RATIO: EXPERIMENT 4

In this experiment the potential occurrence of a consistency effect is entirely eliminated by omitting all measures of risk preference from the design. Thus only the assessment of the utilities' ratio is obtained before and after group discussion. Furthermore, unlike all other experiments, the group discussion in this experiment is on the utility of the certain alternative, $U_c$, relative to the utilities of the outcomes of the uncertain alternative, $U_f$ and $U_s$. In other words, the group discussion to consensus is on the utilities' ratio, $\hat{p}$, rather than on risk, p. According to the informational influence hypothesis we expect to find the same shifts in the utilities' ratio in this experiment as in Experiment 1. These shifts should correspond in direction to the shifts in risk found in Experiments 1, 2 and 3 on the same items.

### Subjects

Seventy-six Ss participated in this experiment. The Ss were male students from the introductory courses in psychology at The University of Michigan. They particpated in the experiment during the winter semester of 1970 as part of their course requirements. The Ss

were run in 16 groups; 13 five-man groups, 2 four-man groups and one three-man group.

## Experimental Design and Procedure

Briefly, the experimental design and procedure consisted of the administration of three Qs in succession, two of which are identical to those used in Experiment 1. The first Q was administered to obtain Ss' private assessment of the utilities' ratio on each choice dilemma before the group discussion ($\hat{p}_1$) (see Appendix E). The second Q was administered to obtain unanimous group decision (assessment) regarding the utilities' ratio ($\hat{p}_G$) (for instructions see Appendix B). The third Q was administered to obtain private assessment of the utilities' ratio after the group discussion ($\hat{p}_2$) (for instructions see Appendix F). The experimental procedure is identical to that used in Experiment 1, the critical difference being that the group must decide about $U_c$ relative to $U_f$ and $U_s$ (i.e., the utilities' ratio), instead of about p (i.e., risk preference) as in past work where group decisions are always about p.

## Results and Discussion

The results are presented in Table 15 (p. 105). For comparison purposes, data from our earlier experiments are included.

These results demonstrate a clear cut pattern. Negative utilities' ratio shifts were produced in the risky items (significant beyond the .001 level for the pooled data). Positive utilities'

TABLE 15: MEAN SHIFTS IN UTILITIES' RATIO ($\hat{p}$) IN EXPERIMENTS 1 AND 4
MEAN SHIFTS IN RISK PREFERENCE (p) IN EXPERIMENTS 1, 2 AND 3

| Choice Dilemma Type | Mean Shifts in Utilities' Ratio | | | | Mean Shifts in Risk |
|---|---|---|---|---|---|
| | Experiment 4 (N=16 Groups) | | | Experiment 1 (N=18 Groups) | Experiments 1, 2, 3 |
| | $\hat{p}_G-\hat{p}_1$ | $\hat{p}_2-\hat{p}_G$ | $\hat{p}_2-\hat{p}_1$ | $\hat{p}_2-\hat{p}_1$ | $p_2-p_1$ |
| Risky | | | | | |
| A | -1.41*** | -0.05 | -1.36*** | -1.18*** | -1.21*** |
| B | -1.55** | 0.29 | -1.26** | -0.92*** | -0.88*** |
| C | -0.42 | -0.04 | -0.46 | -0.66** | -0.62** |
| Mean | -1.12*** | 0.10 | -1.03*** | -0.92*** | -0.90*** |
| Conservative | | | | | |
| D | 0.18 | -0.14 | 0.04 | 0.66* | 0.32* |
| E | 1.38 | -0.12 | 1.26*** | 0.87*** | 0.80*** |
| F | 1.69*** | -0.06 | 1.63*** | 0.69** | 0.60*** |
| Mean | 1.08*** | -0.11 | 0.98*** | 0.74*** | 0.57*** |
| Neutral | | | | | |
| G | -0.30 | 0.06 | -0.24 | 0.15 | 0.00 |
| H | 0.35 | -0.11 | 0.24 | 0.12 | 0.19 |
| Mean | 0.02 | -0.02 | 0.00 | 0.13 | 0.10 |

Note: All tests are two-tailed correlated t-tests.
For SD of values in this Table see Appendix O.

*p < .05
**p < .01
***p < .001

ratio shifts were produced in the conservative items (significant beyond the .01 level for the pooled data). The utilities' ratio shifts that were produced in the neutral items were small, inconsistent and statistically not significant. Moreover, the negative and positive significant shifts in utilities' ratio also appear in comparing pre and post group decisions of the utilities' ratio (see column $\hat{p}_2-\hat{p}_1$). This indicates private acceptance of the group decisions regarding the assessment of the utilities' ratio with only negligible differences between the group decisions and the second private assessments (see column $\hat{p}_2-\hat{p}_G$). Furthermore, these shifts are very close to those found in Experiment 1.

The product moment correlation between the mean shifts in utilities' ratio (column $\hat{p}_2-\hat{p}_1$) of the present experiment and the mean shifts in risk preference in Experiments 1, 2 and 3 column ($p_2-p_1$) is $r = .93$ ($p < .01$). Thus, these results regarding shifts in utilities' ratio closely parallel the pattern of results regarding shifts in risk preference which were obtained on same choice dilemmas in Experiments 1, 2 and 3. This rules out the interpretation that the results of these experiments were due to a consistency effect i.e., Ss adapting their assessment of utilities' ratio to changes (shifts) in risk preference in order to appear consistent.

According to the informational influence hypothesis the shifts in risk are merely an epiphenomenon of the changes in the assessment of the outcomes (i.e., utilities' ratio shifts). Therefore, it is reasonable to expect that the latter shifts would be of

equal or greater magnitude than the former ones. For this analysis the means of the utilities' ratio shifts in Experiment 4 were compared to the means shifts in risk preference in Experiments 1, 2 and 3. The mean shift in utilities' ratio for the risky items was 1.02 and the corresponding risky shift was .90. The mean shifts in utilities' ratio for conservative items was .97 and the corresponding conservative shift was .57. Thus on both risky and conservative items the shifts in utilities' ratios were greater than the shifts in risk preference, as predicted by the informational influence hypothesis.

Thus, all the results of this experiment provided strong additional evidence in support of the informational influence hypothesis.

# CHAPTER VII

# CONCLUSIONS, DISCUSSION AND IMPLICATIONS FOR FUTURE RESEARCH

## A Review of the Purpose of this Study, the Major Results and Conclusions

This study focused on the cognitive and affective processes that were thought to produce shifts toward greater risk and conservatism in decision making following group discussion.

In order to test three specific hypotheses derived from these processes an SEU model for individual choice behavior was applied to the Choice Dilemma task. Three experiments (1, 2 and 3) demonstrated that individuals' decisions regarding risk (i.e., minimum probability of success, p) were based on a rational decision rule which is maximization of subjective expected utility (SEU). When risk preferences were predicted from the relative utilities of the possible outcomes (i.e., utilities' ratio) these estimated values were quite close to the actual risk level chosen, p. The function $p = \hat{p}$ described the obtained relationship fairly well, before as well as after group discussion (see pp. 77, 98) Significant product moment correlations of moderate size between actual risk preference, p, and the risk preference predicted from the relationship among the utilities, $\hat{p}$, (i.e., utilities' ratio) of the outcomes were demonstrated in

Experiments 1 (p. 70), 2(p.89) and 3 (p.89). More importantly, higher product moment correlations were demonstrated within Ss across the choice dilemmas in each of these experiments $r = 0.74, 0.57, 0.36$; $p < .001$, respectively.

Two hypotheses that accounted for the shifts in terms of cognitive processes were tested. The first hypothesis, informational influence, suggests that new information raised during the group discussion influences the person's view of the situation (i.e., his assessment of the utilities of the potential outcomes) and this in turn influences his decision regarding risk. Shifts in risk, therefore, may be considered an epiphenomenon, the inevitable result of changes in utilities produced during group discussion. This hypothesis was supported by the results of all four experiments. First, it was shown in Experiment 1 that group discussion is responsible for the shifts in risk as well as for changes (i.e., shifts) inthe utilities' ratio. Consistent shifts in either risk, p, or utilities' ratio, $\hat{p}$, did not occur in the control condition without group discussion (p. 74). Second, significant shifts in the utilities' ratio following group discussion were found in all four experiments. Furthermore, these mean shifts in utilities' ratio closely correspond to the mean shifts in risk preference in Experiments 1, 2 and 3, with product moment correlations between shifts in p and shifts in $\hat{p}$ across choice dilemma items of $r = 0.98, 0.85, 0.93$ respectively, all significant beyond the .05 level. These correlations within Ss were $r = 0.51, 0.40$ and $0.63$, respectively, all significant beyond the .001 level. Moreoever, the results of Experiment 4, where only utilities' ratio measures

were taken including group discussion on the utility of the certain alternative relative to the utilitites of the uncertain alternative rather than on risk, demonstrated again the same significant and consistent shifts in utilities' ratio as in the other experiments (p.105). In addition, the results of Experiment 2 and 3 demonstrated that the locus of the informational influence varies from item to item; on some items, the major informational influence concentrates on the assessment of the utility of one particular outcome or alternative, and on other items, it concentrates on the utility of another outcome or combinations thereof. There is no completely consistent pattern of influence that cut across the items. Nevertheless, it seems that the informational influence on the risky items is mainly concentrated on the consequences of failure at the uncertain alternative whereas the informational influence on the conservative items is mainly concentrated on the consequences of the certain alternative (see p. 95).

The second cognitive hypothesis, the rationality hypothesis, suggests that the shifts in risk are the result of increasing rationality. More specifically, it asserts that better use of the SEU maximization rule is made during the group discussion than when the individual decides alone (i.e., discussion enhances rationality). This enhanced rationality then influences a person's decision regarding risk. In contrast, a third hypothesis suggests that the shifts in risk are the result of an affective process. It argues that there are significant rewards and punishments, available in a group situation, e.g., approval and disapproval, and these influence the person's decisions regarding risk.

Neither the rationality hypothesis nor the affective hypothesis were supported by the results. In fact, the bulk of the evidence is against these hypotheses. The results of Experiment 1 demonstrated an increase in the goodness of fit between risk preference and utilities' ratio within Ss in their repeated choices and assessments, suggesting enhanced rationality. However, this increased goodness of fit occurred also in the control condition, suggesting the effect is not due to group discussion, but possibly to increased experience with the task (p. 77). Furthermore. there was no indication of an increase or a decrease in the goodness of fit between p and $\hat{p}$ within Ss in Experiments 2 and 3 where different instruments were used for assessing utilities. However, since the rationality hypothesis is purported to account for the mean shift in risk for a choice dilemma, a more direct test would be based on total means across Ss for each item. This analysis was carried out on the data of Experiments 1, 2 and 3, and produced results that refute the hypothesis. There was no increase in the goodness of fit between risk preference and utilities' ratio after group discussion on the three risky choice dilemmas in any of the three experiments. There was a small increase in the goodness of fit on the conservative choice dilemmas. This increase, however, was not due to increased rationality. Further analysis demonstrated that the increased goodness of fit was the result of shifts in utilities' ratio moving closer to the risk preference rather than the risk preference moving closer to the initial utilities' ratio, as the rationality hypothesis would require.

Moreover, it was demonstrated that for items yielding a conservative shift the mean risk preference was greater than the mean utilities' ratio. If the rationality process had been operative during group discussion on these choice dilemmas, then risky-shifts should have been obtained by p moving toward $\hat{p}$. However, in contrast to what the rationality hypothesis predicts, these choice dilemmas produced conservative-shifts.

Nowhere in these experiments were significant decreases in the goodness of fit between risk preference and utilities' ratio in evidence and, consequently, the affective hypothesis was not supported.

Implications for Behavioral Decision Theory Concerning Individual Choice Behavior.

In general, the early studies of decision making produced evidence in support of SEU maximization as a descriptive model of choice behavior (Mosteller and Nogee, 1951; Davidson, Suppes and Siegel, 1957; Coombs and Kmorita, 1958). Recent work, however, provides more rigorous tests of the SEU model and its assumptions. These studies employed measurement-free tests based on a theory of conjoint measurement (Coombs, Benzembinder and Goode, 1967; Tversky, 1967a; Tversky, 1967b). They added substantial new support for the SEU model, but also raised some problems.

Although the basic assumption of the SEU model concerning the independence of utility and subjective probability was confirmed by the experiments, it by no means applies to every

situation. The vast literature on achievement motivation demonstrating that utility is not independent of subjective probability, is just one case in point (see Atkinson and Feather, 1966).

As already mentioned, the experimental tests of the SEU model have been limited to a small range of experimental tasks and situations. It has usually consisted of outcomes with the same single value dimension--most often money--and subjects working for either imaginary or real, but small monetary payoffs (see Becker and McClintock, 1967). Moreover, these experiments were usually limited to situations with constant expected value. In contrast, the Choice Dilemmas task offers a variety of situations involving outcomes with several value dimensions (e.g., health, money, prestige) and also allows for a wider range of subjective expected utility. Furthermore, the usual procedure requires subjects to bid on a two-outcome gamble. In contrast, the Choice Dilemmas task requires subjects to determine what the minimum probability of obtaining a specific outcome should be in order to prefer an uncertain alternative to another alternative with a sure outcome. It is because of these differences in tasks and procedures that the results of the present study constitute additional support for the SEU model as a general theory of choice behavior.

Nevertheless, the best support of the SEU model in the present study consists of mean correlations within Ss that are not greater than .74, which, of course, explain no more than 50 percent of the variance. Additional shortcomings of the SEU model were pointed

out by Coombs and Huang:

> SEU theory rests on three assumptions: 1) that utility and subjective probability are independent, 2) that utility is risk invariant, 3) that subjective probabilities must add to one. It is the first assumption that the earlier experiments tested directly and that additive conjoint measurement does test with a measurement-free procedure. And this assumption is generally confirmed by experiment. But Tversky's (1967a) experiment led him to the conclusion that the other two requirements could not both be satisfied by his data. He found that by assuming utility to be risk invariant, numerical assignments to subjective probabilities failed to add to one--and that if it were required that subjective utilities add to one, then utility violated the assumption of risk invariance (Coombs and Huang, 1968).

Furthermore, generalizations from the results of this study to different situations should be withheld until further investigations clarify the following issues: 1) To what extent are choices in real situations similar to the choices made in the hypothetical choice dilemmas as recommendations for others? 2) What factors besides the probabilities of outcomes and their utilities govern individual choice behavior?

It is likely that social norms in part determine the utility of the choice itself, in addition to the utilities of its outcomes. For example, a daring 'risky' play in footbal or a dangerous venture in combat may have considerable utility based on certain social norms and values. In the context of behavioral decision theory such variance, which cannot be accounted for by the SEU model, is often attributed to an hypothetical residual category of "utility for risk" or "utility forgambling" related to the choice (see Tversky, 1967a). In some cases, however, it is conceivable that variance unaccounted for by the SEU model is due to social norms that

determine the utility of the choice regardless of the utilities and probabilities of its outcomes. Consequently, utility for risk cannot account for this variance.

For example, a doctor is socially obliged to do his best to help his patient regardless of the patient's chances for survival. More illuminating is the example of several Ss who argued on a choice dilemma concerning an abortion to save a woman's life (item F) that this action should not be taken regardless of its outcomes and their probabilities. For some situations (e.g., football, combat) the utility of the choice (e.g., a risky play in football) is not independent of the utilities of its outcomes and their probabilities. The more rewarding but unlikely victory is, the greater the utility for this risk may be. In other words, the utility for the risky choice is not risk invariant and the SEU model could not simply be modified in order to apply to this or similar cases, since one of its basic assumptions is being violated. In contrast, the SEU model could be simply modified to apply to the former situation (e.g., a doctor working to save a patient) where the social norms determine the utility of the choice regardless of the utilities and probabilities of the outcomes, since the utility of the choice is risk invariant.

## Implications for Risk-Taking, Decision-Making, Attitudes and Behavior.

The centrality of the concept of risk in most of the theoretical and empirical work regarding shifts in probability preference is epitomized by the name given to the phenomenon: the "risky-shift".

Yet, this work led us down a blind alley, at least as far as understanding risk-taking or decision-making is concerned. The domain of decision-making involving risk is undoubtedly important, but the usefulness of the concept of risk is open to question. Conceptual problems concerning its definition and the lack of convergent validity in its assessment (Goodman, 1970; Slovic, 1962; Slovic, 1964) suggest that future research may benefit more by focusing on the decision-making process itself--and leave risk for the gamblers.

This course of action was taken in the present study by employing a general model of decision-making that does not require assumptions about risk. It is important to note that in the context of the present study, the term 'risk' was used instead of the term 'probability of success'. The term was used merely because of tradition, with no residual meaning, and nothing was assumed about it as a concept. The success of this study in providing a comprehensive explanation of the shifts toward greater risk and conservatism, without invoking a theory of risk-taking, argues strongly that nothing is being risked by doing away with the concept of risk.

Moreover, the application of the SEU model to individual choice behavior which has proved to be useful in this study may be beneficial for researchers in other areas who are concerned with attitudes and behavior. A recent study conducted by Brickman, Shaver and Archibald (1969) concerning scientists' attitude toward American tactics and goals in Vietnam demonstrated this point. Their study showed that the choice of a particular strategy (e.g., withdrawal, escalation) was strongly related to (1) the desirability of various outcomes that could result from these strategies as

assessed by the subjects, and (2) their belief (subjective estimation) concerning the likelihood that any given strategy will lead to particular outcomes. Close examination of data from this study, reported in the form of group means, suggests that the application of the SEU model to the data might result in additional support for the model, as well as producing more elegant results concerning the relationship among the variables studied.

Application of the SEU model could be even more useful in analyzing a crucial problem in social psychology: the relationship between attitudes and behavior. Recent studies that lean heavily on an SEU model incorporating social norms and expectations about behavior have yielded encouraging positive results concerning this relationship (Ajzen, 1969; Ajzen and Fishbein, 1969; Fishbein, 1967).

## Implications for Group Processes

The present study demonstrated that the application of the SEU model was useful in determining the particular group process responsible for changes in behavior. Thus, it was shown that an informational influence process and not an affective process was the crucial factor responsible for shifts in risk preference. It seems that a great variety of studies concerned with group processes and their effects (e.g., conformity studies, studies on negotiation and conflict resolution) might benefit by using the SEU model in a similar fashion. For example, the basic paradigm employed in this study could be useful in conformity studies to determine a key

dependent variable: whether changes in behavior are due to informational influence or normative influence exerted by the group (Deutsch and Gerard, 1955). The first is a form of private acceptance of the influence that is manifested in covert attitude change and internalization. The second is a form of public compliance manifested only in overt behavior but not in covert attitude change (see also Kelman, 1958). If a subject shifts his risk preference following group discussion without concomitantly shifting his utilities' ratio, and this shift is away from the initial utilities' ratio, he is manifesting an overt opinion change due to normative influence. On the other hand, if he shifts his utilities' ratio in correspondence to the shift in risk preference, he is manifesting a covert opinion change due to informational influence.

Similar applications of the SEU model could be made in studies of negotiation and conflict resolution in identifying the nature of an agreement between the parties to the conflict. The parties' cognitive differences may constitute the major problem (see Hammond, 1965). Is an agreement merely based on a compromise for the sake of agreement (i.e., because of the immediate advantages that the parties can draw from the agreement for their ultimate goals), or is it based on a new cognitive structuring of the situation and goals, as changes in the utilities of the potential outcomes may indicate? The basis for any agreement undoubtedly has far reaching implications for how stable and lasting the agreement may be.

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APPENDIX A

Name_____

OPINION QUESTIONNAIRE

On the following pages, you will find a series of situations that are likely to occur in everyday life. The central person in each situation is faced with a choice between two alternative courses of action, which we might call X and Y. Alternative X is more desirable and attractive than alternative Y, but the probability of attaining or achieving X is less than that of attaining or achieving Y.

For each situation of the following pages, you will be asked to indicate the minimum odds of success you would demand before recommending that the more attractive or desirable alternative, X, be chosen.

> An example: "Mr. S is a war prisoner in a prisoner-of-war camp. Conditions in the camp are quite bad; hard physical labor, poor diet, no medical treatment. He notes a possibility of an excape. If he succeeds he will enjoy freedom again but if he fails, he will be executed by the enemy."

Try to place yourself in the position of Mr. S. How high would the chances of success have to be before you would want to give the uncertain alternative (i.e., attempting the escape) a try? In other words, how high must the chances of successful escape be before you would recommend to attempt the escape? For example, suppose you felt the chances had to be at least 7 in 10 that Mr. S would succeed in escaping in order for him to attempt it, then you would check the following scale, as indicated:

He would attempt the escape if the chances are at least

___ 1 in 10 that he will succeed.
___ 2 in 10 that he will succeed.
___ 3 in 10 that he will succeed.
___ 4 in 10 that he will succeed.
___ 5 in 10 that he will succeed.
___ 6 in 10 that he will succeed.
_X_ 7 in 10 that he will succeed.
___ 8 in 10 that he will succeed.
___ 9 in 10 that he will succeed.
___ Place a check here if you think Mr. S should not attempt the escape, no matter what the probabilities.

Read each situation carefully before giving your judgment. Try to place yourself in the position of the central person in each of the situations.

Before you start, there are two points I should like to bring to your attention:

> It is important to remember that you are not being asked your opinion of what you feel the chances really are, but rather what you feel the minimum chances of success would have to be before it would be advisable for the central person to choose the uncertain alternative.
>
> Also, remember that in every case, the central person would rather succeed at the uncertain alternative than choose the certain one, but he would rather choose the certain one than fail at the uncertain one.

There is essentially no time limit, so take your time and consider the problems carefully.

Mr. A is the captain of College X's football team. College X is playing its traditional rival, College Y, in the final game of the season. The game is in its final seconds, and Mr. A's team, College X, is behind in the score. College X has time to run one more play. Mr. A, the captain, must decide whether it would be best to settle for a tie score with a play which would be almost certain to work or, on the other hand, should he try a more complicated and risky play which could bring victory if it succeeded, but defeat if not.

Imagine that you are advising Mr. A. Check the lowest probability that you would consider acceptable for the risky play to be attempted.

Mr. A should attempt the risky play if the chances are at least

___ 1 in 10 that the risky play will work.
___ 2 in 10 that the risky play will work.
___ 3 in 10 that the risky play will work.
___ 4 in 10 that the risky play will work.
___ 5 in 10 that the risky play will work.
___ 6 in 10 that the risky play will work.
___ 7 in 10 that the risky play will work.
___ 8 in 10 that the risky play will work.
___ 9 in 10 that the risky play will work.
___ Place a check here if you think Mr. A should not attempt the risky play, no matter what the probabilities.

Mr. B is currently a college senior who is very eager to pursue graduate study in chemistry leading to the Doctor of Philosophy degree. He has been accepted by both University X and University Y. University X has a world-wide reputation for excellence in chemistry. While a degree from University X would signify outstanding training in this field, the standards are so very rigorous that only a fraction of the degree candidates actually receive the degree. University Y, on the other hand, has much less of a reputation in chemistry, but almost everyone admitted is awarded the Doctor of Philosophy degree, though the degree has much less prestige than the corresponding degree from University X.

Imagine that you are advising Mr. B. Check the lowest probability that you would consider acceptable to make it worthwhile for Mr. B to enroll in University X rather than University Y.

Mr. B should enroll in University X, if the chances are at least

___ 1 in 10 that he would receive a degree from University X.
___ 2 in 10 that he would receive a degree from University X.
___ 3 in 10 that he would receive a degree from University X.
___ 4 in 10 that he would receive a degree from University X.
___ 5 in 10 that he would receive a degree from University X.
___ 6 in 10 that he would receive a degree from University X.
___ 7 in 10 that he would receive a degree from University X.
___ 8 in 10 that he would receive a degree from University X.
___ 9 in 10 that he would receive a degree from University X.
___ Place a check here if you think Mr. B should not enroll in University X, no matter what the probabilities.

Mr. C, a married 30-year-old research physicist, has been given a five-year appointment by a major university laboratory. As he contemplates the next five years, he realizes that he might work on a difficult, long-term problem which, if a solution could be found, would resolve basic scientific issues in the field and bring high scientific honors. If no solution were found, however, Mr C would have little to show for his five years in the laboratory, and this would make it hard for him to get a good job afterwards. On the other hand, he could, as most of his professional associates are doing, work on a series of short-term problems where solutions would be easier to find, but where the problems are of lesser scientific importance.

Imagine that you are advising Mr. C. Check the lowest probability that you would consider acceptable to make it worthwhile for Mr. C to work on the more difficult long-term problem.

Mr. C should choose the long-term problem if the chances are at least

___ 1 in 10 that he would solve the long-term problem.
___ 2 in 10 that he would solve the long-term problem.
___ 3 in 10 that he would solve the long-term problem.
___ 4 in 10 that he would solve the long-term problem.
___ 5 in 10 that he would solve the long-term problem.
___ 6 in 10 that he would solve the long-term problem.
___ 7 in 10 that he would solve the long-term problem.
___ 8 in 10 that he would solve the long-term problem.
___ 9 in 10 that he would solve the long-term problem.
___ Place a check here if you think Mr. C should not choose the long-term, difficult problem, no matter what the probabilities.

Mr. D is contemplating marriage to Miss T, a girl whom he has known for a little more than a year. Recently, however, a number of arguments have occurred between them, suggesting some sharp differences of opinion in the way each views certain matters. Indeed, they decide to seek professional advice from a marriage counselor as to whether it would be wise for them to marry. On the basis of these meetings with a marriage counselor, they realize that a happy marriage, while possible, would not be assured.

Imagine that you are advising Mr. D and Miss T. Check the lowest probability that you would consider acceptable for Mr. D and Miss T to get married.

Mr. D and Miss T should marry if the chances are at least

___ 1 in 10 that their marriage would be happy and successful.
___ 2 in 10 that their marriage would be happy and successful.
___ 3 in 10 that their marriage would be happy and successful.
___ 4 in 10 that their marriage would be happy and successful.
___ 5 in 10 that their marriage would be happy and successful.
___ 6 in 10 that their marriage would be happy and successful.
___ 7 in 10 that their marriage would be happy and successful.
___ 8 in 10 that their marriage would be happy and successful.
___ 9 in 10 that their marriage would be happy and successful.
___ Place a check here if you think Mr. D and Miss T should not marry, no matter what the probabilities.

Mr. E is about to board a plane at the airport at the beginning of his overseas vacation. Although he has been looking forward to this trip for some time, he is troubled because he awoke in the morning with a severe abdominal pain. Because he has never flown before, he thinks that the pain may simply be an upset stomach brought on by anticipation of the flight. Although he is not far from a hospital where he knows he will obtain quick attention, he realizes that a visit to the hospital will cause him to miss his flight which in turn will seriously disrupt his vacation plans. The pain has gotten more severe in the last few minutes.

Imagine that you are advising Mr. E. Check the lowest probability that you would consider acceptable for Mr. E to board the plane.

Mr. E should board the plane if the chances are at least

___ 1 in 10 that his abdominal pain will not become more severe during the trip.

___ 2 in 10 that his abdominal pain will not become more severe during the trip.

___ 3 in 10 that his abdominal pain will not become more severe during the trip.

___ 4 in 10 that his abdominal pain will not become more severe during the trip.

___ 5 in 10 that his abdominal pain will not become more severe during the trip.

___ 6 in 10 that his abdominal pain will not become more severe during the trip.

___ 7 in 10 that his abdominal pain will not become more severe during the trip.

___ 8 in 10 that his abdominal pain will not become more severe during the trip.

___ 9 in 10 that his abdominal pain will not become more severe during the trip.

___ Place a check here if you think Mr. E should not board the plane, no matter what the probabilities.

Mr. and Mrs. F have been attempting to have a child for a number of years. Mrs. F. is now pregnant but a complication has arisen. The doctor has advised Mr. and Mrs. F that if the pregnancy is allowed to progress, Mrs. F's life could be in danger. If further complications do develop, the doctor will not be able to save the child and may not be able to save Mrs. F. If the pregnancy is terminated, at this time, it will be impossible for Mrs. F to become pregnant again.

Imagine that you are advising Mr. and Mrs. F. Check the lowest probability that you would consider acceptable for Mr. and Mrs. F to allow the pregnancy to progress.

Mr. and Mrs. F should allows the pregnancy to progress if the chances are at least

___ 1 in 10 that further complications will not arise.
___ 2 in 10 that further complications will not arise.
___ 3 in 10 that further complications will not arise.
___ 4 in 10 that further complications will not arise.
___ 5 in 10 that further complications will not arise.
___ 6 in 10 that further complications will not arise.
___ 7 in 10 that further complications will not arise.
___ 8 in 10 that further complications will not arise.
___ 9 in 10 that further complications will not arise.
___ Place a check here if you think Mr. and Mrs. F should not allow the pregnancy to progress, no matter what the probabilities.

Mr. G is president of a light metals corporation in the United States. The corporation is quite prosperous, and has strongly considered the possibilities of business expansion by building an additional plant in a new location. The choice is between building another plant in the U.S., where there would be a moderate return on the initial investment, or building a plant in a foreign country. Lower labor costs and easy access to raw materials in that country would mean a much higher return on the initial investment. On the other hand, there is a history of political instability and revolution in the foreign country under consideration. In fact, the leader of a small minority party is committed to nationalizing, that is, taking over, all foreign investments.

Imagine that you are advising Mr. G. Check the lowest probability that you would consider acceptable for Mr. G's corporation to build a plant in the foreign country.

Mr. G's corporation should build a plant in the foreign country if the chances are at least

___ 1 in 10 that the plant will not be nationalized.
___ 2 in 10 that the plant will not be nationalized.
___ 3 in 10 that the plant will not be nationalized.
___ 4 in 10 that the plant will not be nationalized.
___ 5 in 10 that the plant will not be nationalized.
___ 6 in 10 that the plant will not be nationalized.
___ 7 in 10 that the plant will not be nationalized.
___ 8 in 10 that the plant will not be nationalized.
___ 9 in 10 that the plant will not be nationalized.
___ Place a check here if you think that Mr. G's corporation should not build the plant in the foreign country, no matter what the probabilities.

Mr. H, a 45-year-old accountant, has recently been informed by his physician that he has developed a severe heart ailment. The disease would be sufficiently serious to force Mr. H to change many of his strongest life habits--reducing his work load, drastically changing his diet, giving up favorite leisure-time pursuits. The physician suggest that a delicate medical operation could be attempted which, if successful, would completely relieve the heart condition. But its success could not be assured, and in fact, the operation might prove fatal.

Imagine that you are advising Mr. H. Check the lowest probability that you would consider acceptable for the operation to be performed.

Mr. H should attempt the operation if the chances are at least

___ 1 in 10 that the operation will be a success.
___ 2 in 10 that the operation will be a success.
___ 3 in 10 that the operation will be a success.
___ 4 in 10 that the operation will be a success.
___ 5 in 10 that the operation will be a success.
___ 6 in 10 that the operation will be a success.
___ 7 in 10 that the operation will be a success.
___ 8 in 10 that the operation will be a success.
___ 9 in 10 that the operation will be a success.
___ Place a check here if you think Mr. H should not have the operation, no matter what the probabilities.

APPENDIX B

Name_____

OPINION QUESTIONNAIRE

(group discussion and group decision)

In front of you is the same opinion questionnaire that you filled out before. You have taken it in order to familiarize yourself with all the situations, and to give you some idea where you might stand on each one.

What we are really interested in now is having the group discuss each situation in turn and arrive at a unanimous decision on each. You will recognize that a unanimous decision is different from a majority vote.

When the group reaches its decision, each of you should mark it in his own booklet so that you have a record of the group's decision. You may not return to a situation; discuss each one until the group decision is reached and then go to the next.

Most groups are able to come to some decision if those who disagree will restate their reasons, and if the problem is reread carefully. Differences of opinion can be bridged by discussion.

I am not going to participate in the discussion although I will be here to answer any procedural questions which may arise.

## APPENDIX C

Name_____

### OPINION QUESTIONNAIRE

(final personal decisions)

Attached are additional copies of the same situations. Refer to each of these now and indicate your own present personal decision.

In some cases you may feel that the group decision was the best one which could have been made and you will mark it as your own present personal decision. In other cases you may disagree with the group decision, in which case you'll mark different odds as your own decision at present. Please do not feel bound by what you marked before. What is important is that you consider each problem seriously and carefully and check what you consider the best decision now. Please remember to complete this part without discussion with the others.

APPENDIX D

Name_____

OPINION QUESTIONNAIRE

(final opinions)

In front of you is the same opinion questionnaire that you filled out before. You have taken it in order to familiarize yourself with all the situations and to give you some idea where you might stand on each one. Possibly by reconsidering each situation after having seen it before, you will have a better idea of the kind of decision that you would like to make.

We would like you now to make your final decision on each situation. Please, do not feel bound by what you marked as your decision on the practice booklet. Whether or not you change, or how much you change is not important. What is important is that you reconsider each answer carefully.

## APPENDIX E

Name_____

### DESIRABILITY ESTIMATION QUESTIONNAIRE

Imagine yourself participating in a television game where you can choose between two alternatives. You can either receive $300 or choose to go for a prize that lies behind a curtain. From watching the program in the past you know that behind the curtain can be either a very valuable prize (say $1000), or a booby prize (say $15).

If you choose the certain alternative the result is a sure outcome (i.e., $300). If you choose the uncertain alternative, the prize behind the curtain, it can result either in the most valuable and desirable outcome (i.e., $1000), or in the least desirable outcome (i.e., $15).

These three outcomes can be represented as points on a desirability scale as shown below, where the right end of the scale is the desirability of the most valuable and desirable outcome and the left end is the desirability of the least desirable outcome, the booby prize. The desirability of the certain alternative must fall between these two points:

Low desirability (Value) — High desirability (Value)

Desirability of booby prize: __:__:__:__:X:__:__:__:__:__:__:__:__:__ Desirability of the valuable prize

Value of the Certain Alternative (sure outcome)

The points could be relabeled in terms of dollars:

Low desirability — High desirability

___:__:__:__:X:__:__:__:__:__:__:__:__:____

$15 — $300 — $1000

There are many similar situations in real life which do not involve money. That is, there are times when someone is confronted with two alternative courses of action, an uncertain alternative and a certain alternative. The uncertain alternative has two possible outcomes, one of which is more desirable, the other outcome being less desirable than the certain alternative's outcome. Consider the following example:

> "Mr. S is a war prisoner in a prisoner-of-war camp. Conditions in the camp are quite bad. He notes a possibility for escape. If he succeeds, he will enjoy freedom again; but if he fails, he will be executed by the enemy."

Try to place yourself in the position of Mr. S and consider the desirabilities of the three possible outcomes of the two alternatives: failing in the attempt to escape, succeeding in the escape, and not attempting to escape, thereby remaining in the camp.

Mr. S would obviously prefer succeeding in the escape in remaining in the camp. Equally obvious is that he would prefer remaining in camp to failing in the escape. That is, the desirabilitity of the certain alternative with a known sure outcome, i.e., remaining in the camp, is less than the desirability of succeeding and more than that of failing in the escape. Therefore, the desirability of remaining in the camp must lie between the endpoints of a desirability scale where the outcomes of the uncertain alternative, i.e., succeeding and failing, represent these endpoints.

Where on the scale would you place the desirability of the certain alternative, i.e., remaining in the camp?

If you feel that remaining in the camp is equally undesirable as failing in an attempt to escape (with its consequences), you indicate it by placing an 'X' at the point labeled A (see scale below). If you feel that remaining in the camp is somewhat more desirable than failing in the escape, but much less desirable than succeeding in the escape, you will place the X around the point

labeled B. However, if you feel that remaining in the camp is much more desirable than failing in the escape, and only somewhat less desirable than succeeding in the escape, you will place the X around the point labelled C.

| Low desirability | | High desirability |
|---|---|---|
| Escape attempted; fails | A : : : : B : : : : : : C : : : : | Escape attempted; succeeds |

The other situations in this questionnaire are similar to this one. In each case, your task is to place yourself in the position of the person described and indicate the desirability of the certain alternative on the desirability scale which accompanies each situation.

Extremely Important: In order to determine where on the scale you should place the 'X' representing the desirability of the certain alternative, you have to compare its desirability to both outcomes of the uncertain alternative. The X should be placed where it represent the proper distances from both scale endpoints, i.e., outcomes of the uncertain alternative.

For instance, remember that the X which you will place has to indicate how much remaining in the camp is more desirable than failing in the escape, as well as how much less desirable it is than succeeding in the attempt.

To familiarize yourself with the task, try it yourself on the scale below:

Where would you put the X?

| Low desirability | | High desirability |
|---|---|---|
| Escape attempted; fails | : : : : : : : : : : : : : : : : : | Escape attempted; succeeds |

ARE THERE ANY QUESTIONS ABOUT WHAT YOU ARE TO DO?

Mr. A is the captain of College X's football team. College X is playing its traditional rival, College Y, in the final game of the season. The game is in its final seconds, and Mr. A's team, College X, is behind in the score. College X has time to run one more play. Mr. A, the captain, must decide whether it would be best to settle for a tie score with a play which would be almost certain to work or, on the other hand, should he try a more complicated and risky play which could bring victory if it succeeded, but defeat if not.

Try to place yourself in the position of Mr. A. Place an 'X' on the desirability scale to indicate the relative <u>desirability of the play which would result in a tie</u>.

| Low desirability | | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risky play fails; defeat | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Risky play succeeds; victory |

Mr. B is currently a college senior who is very eager to pursue graduate study in chemistry leading to the Doctor of Philosophy degree. He has been accepted by both University X and University Y. University X has a world-wide reputation for excellence in chemistry. While a degree from University X would signify outstanding training in this field, the standards are so very rigorous that only a fraction of the degree candidates actually receive the degree. University Y, on the other hand, has much less of a reputation in chemistry, but almost everyone admitted is awarded the Doctor of Philosophy degree, though the degree has much less prestige than the corresponding degree from University X.

Try to place yourself in the position of Mr. B. Place an 'X' on the desirability scale to indicate the relative <u>desirability of going and getting the degree in University Y</u>.

| Low desirability | | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Goes to University X; Does not receive degree | __ 1 | __ 2 | __ 3 | __ 4 | __ 5 | __ 6 | __ 7 | __ 8 | __ 9 | __ 10 | __ 11 | __ 12 | __ 13 | __ 14 | __ 15 | Goes to University X; Does receive degree |

Mr. C, a married 30-year-old research physicist, has been given a five-year appointment by a major university laboratory. As he contemplates the next five years, he realizes that he might work on a difficult, long-term problem which, if a solution could be found, would resolve basic scientific issues in the field and bring high scientific honors. If no solution were found, however, Mr. C would have little to show for his five years in the laboratory, and this would make it hard for him to get a good job afterwards. On the other hand, he could, as most of his professional associates are doing, work on a series of short-term problems where solutions would be easier to find, but where the problems are of lesser scientific importance.

Try to place yourself in the position of Mr. C. Place an 'X' on the desirability scale to indicate the relative <u>desirability of working on and finding a solution to the short-term problems</u>.

| Low desirability | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Works on long-term problem; finds no solution | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 Works on long-term problem; finds solution |

Mr. D is contemplating marriage to Miss T, a girl whom he has known for a little more than a year. Recently, however, a number of arguments have occurred between them, suggesting some sharp differences of opinion in the way each views certain matters. Indeed, they decide to seek professional advice from a marriage counselor as to whether it would be wise for them to marry. On the basis of these meetings with a marriage counselor, they realize that a happy marriage, while possible, would not be assured.

Try to place yourself in the position of Mr. D and Miss T. Place an 'X' on the desirability scale to indicate the relative desirability of their condition if they do not get married.

| Low desirability | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marry; unhappy or unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Marry; happy and successful |

Mr. E is about to board a plane at the airport at the beginning of his overseas vacation. Although he has been looking forward to this trip for some time, he is troubled because he awoke in the morning with a severe abdominal pain. Because he has never flown before, he thinks that the pain may simply be an upset stomach brought on by anticipation of the flight. Although he is not far from a hospital where he knows he will obtain quick attention, he realizes that a visit to the hospital will cause him to miss his flight which in turn will seriously disrupt his vacation plans. The pain has gotten more severe in the last few minutes.

Try to place yourself in the position of Mr. E. Place an 'X' on the desirability scale to indicate the relative desirability of his condition if he visits the hospital and has his pains diagnosed and treated.

| Low desirability | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Board plane; pains become more severe during trip | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Board plane; pains do not become more severe |

Mr. and Mrs. F have been attempting to have a child for a number of years. Mrs. F is now pregnant but a complication has arisen. The doctor has advised Mr. and Mrs. F that if the pregnancy is allowed to progress, Mrs. F's life could be in danger. If further complications do develop, the doctor will not be able to save the child and may not be able to save Mrs. F. If the pregnancy is terminated, at this time, it will be impossible for Mrs. F to become pregnant again.

Try to place yourself in the position of Mr. and Mrs. F. Place an 'X' on the desirability scale to indicate the relative <u>desirability of their condition if pregnancy is terminated</u>.

| Low desirability | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pregnancy allowed to progress; complications arise | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Pregnancy allowed to progress; <u>no</u> complications |

Mr. G is president of a light metals corporation in the United States. The corporation is quite prosperous, and has strongly considered the possibilities of business expansion by building an additional plant in a new location. The choice is between building another plant in the U.S., where there would be a moderate return on the initial investment, or building a plant in a foreign country. Lower labor costs and easy access to raw materials in that country would mean a much higher return on the initial investment. On the other hand, there is a history of political instability and revolution in the foreign country under consideration. In fact, the leader of a small minority party is committed to nationalizing, that is, taking over, all foreign investments.

Try to place yourself in the position of Mr. G. Place an 'X' on the desirability scale to indicate the relative <u>desirability of building and having another plant in the U.S.</u>

| Low desirability | | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foreign plant built; nationalized | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Foreign plant built; not nationalized |

Mr. H, a 45-year-old accountant, has recently been informed by his physician that he has developed a severe heart ailment. The disease would be sufficiently serious to force Mr. H to change many of his strongest life habits--reducing his work load, drastically changing his diet, giving up favorite leisure-time pursuits. The physician suggests that a delicate medical operation could be att attempted which, if successful, would completely relieve the heart condition. But its success could not be assured, and in fact, the operation might prove fatal.

Try to place yourself in the position of Mr. H. Place an 'X' on the desirability scale to indicate the relative desirability of the condition of Mr. H if the operation is not attempted.

| Low desirability | | | | | | | | | | | | | | | | High desirability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operation attempted; proved fatal | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Operation attempted; proved successful |

APPENDIX F

Name_____

DESIRABILITY ESTIMATION QUESTIONNAIRE

(final personal estimation)

This part of the questionnaire contains the scale of desirability just as a previous part did. Go through them now and mark your present personal opinion about the desirability of the certain alternative relative to the desirabilities of succeeding and failing at the uncertain alternative. Perhaps you have considered new facets of the situations which have cause you to change your opinion of the desirabilities. Or perhaps your opinion has remained about the same. Therefore, do not worry about how you marked the scale the first time, but simply mark your present opinion about the desirabilities of the different outcomes. Go ahead and do this part. Work alone, with no discussion with others.

APPENDIX G

FINAL QUESTIONNAIRE

Name_____

Age: _____

Year (circle):

Fresh, Soph, Jun, Sen.

Major: _____

Do not write in box

Condition _____

Group # _____

Subject # _____

Order _____

1. Generally speaking, how valuable were the group discussions in illuminating new aspects and helping you to improve your judgments concerning the situations?

__ very valuable

__ quite valuable

__ somewhat valuable

__ slightly valuable

__ not at all valuable

2. Can you remember being influenced by the group discussion on any of the following situations? Check blank(s) that apply:

__ Mr. A Football team captain choosing strategy.

__ Mr. B College senior enrolling for Ph.D.

__ Mr. C research physicist choosing between long and short-term problems.

__ Mr. D and Miss T contemplating marriage.

__ Mr. E waiting to board a plane.

__ Mr. and Mrs. F considering a termination of pregnancy.

__ Mr. G considering building a plant in a foreign country.

__ Mr. H considering a heart operation to relieve his heart ailment.

3. If given a choice to participate in another experiment similar to this one, I would:

___ definitely want to participate.

___ probably want to participate.

___ possibly want to participate.

___ not want to participate.

4. In your judgment the group members were:

___ very involved in discussing the situations.

___ quite involved in discussing the situations.

___ somewhat involved in discussing the situations.

___ not at all involved in the discussions.

5. What do you think the experiment was all about?

6. What did the experiment try to prove? (Try to guess if you are unsure.)

## APPENDIX H

Name _____

### GENERAL DESIRABILITY ESTIMATION QUESTIONNAIRE

Consider the following case:

Mr. S, a young engineer, invented a new device which he thinks will eliminate pollution in gasoline-motor engines. To test the effectiveness of the device would require considerable investment.

Mr. S is confronted with a choice between two alternative courses of action. One alternative, the certain alternative, leads to a sure outcome; he can accept a lucrative offer that has been made by the auto industry for the immediate and complete rights to his device. The other alternative is uncertain, as it may wind up in success with the most desirable outcome, or in failure, with the least desirable outcome. For Mr. S, this uncertain alternative consists of investing his own savings to test the device on his own. If the tests prove successful, he could make a fortune, in addition to the professional recognition he would receive. But if he fails, he will not be able to even recover his investment.

Try to place yourself in the position of Mr. S and consider the desirabilities of the three possible outcomes of the two alternatives: tests prove failure, tests prove success, and device's rights sold to industry.

Mr. S would obviously prefer succesful tests on his own to selling the rights to the industry at this stage. Equally obvious is that he would prefer selling the rights now to failure with the tests on his own and losing his investment. That is, the desirability of the certain alternative with a known sure outcome, i.e., the lucrative offer for selling the rights, is less than the desirability of succeeding, and it is more than the desirability of failing in the tests done on his own. Therefore, the desirability of selling the rights lies between the desirabilities of the outcomes of the uncertain alternative, i.e., succeeding and failing in testing.

Now you will be presented with an ultimate desirability scale. The endpoints of this scale represent the most desirable and the least desirable events or outcomes that you can personally conceive of. For instance, if, in your opinion, death is the least desirable (most undesirable) outcome, it should be represented by the left endpoint of this scale. Since the best and the worst outcomes that you can conceive of constitute the endpoints of the ultimate desirability scale, all other outcomes, including those of Mr. S, must lie on a continuum between the endpoints of this scale.

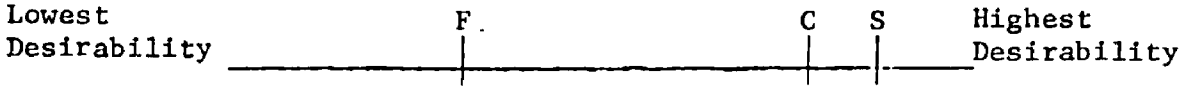
For example, you can indicate your estimation of the desirabilities of Mr. S's possible outcomes on the scale below in the following way. (See sample scale below):

1. Start with the outcome of the uncertain alternative when it fails, i.e., tests of device on his own result in failure. Indicate its desirability with a vertical line across the scale and write an "F" above it.

2. Then indicate the desirability of the other outcome of the uncertain alternative, i.e., tests of device on his own result in success, with another line across the scale and write an "S" above it.

3. Finally, estimate the desirability of the certain alternative, i.e., accepting the lucrative offer for the rights now, and likewise indicate it between the previous marks with a letter "C" above the line.

(SEE SAMPLE SCALE BELOW)




Try it yourself on the scale below:



The other situations in this questionnaire are similar to this one. In each case, your task is to read each situation carefully, then place yourself in the position of the person described and indicate the desirabilities of the alternatives' outcomes on the ultimate desirability scale which accompanies each sitatuion as explained above.

ARE THERE ANY QUESTIONS ABOUT WHAT YOU ARE SUPPOSED TO DO?

Mr. A is the captain of College X's football team. College X is playing its traditional rival, College Y, in the final game of the season. The game is in its final seconds, and Mrs. A's team, College X, is behind in the score. College X has time to run one more play. Mr. A, the captain, must decide whether it would be best to settle for a tie score with a play which would be almost certain to work or, on the other hand, should he try a more complicated and risky play which could bring victory if it succeeded, but defeat if not.

Try to place yourself in the position of Mr. A.

Indicate with lines across the scale, and letters above the lines, the desirabilities of the following alternatives and their outcomes:

F : Risky play attempted, resulting in defeat.
S : Risky play attempted, resulting in victory.
C : The certain play attempted, resulting in a tie.

Lowest desirability (death) _____ Highest desirability

(The actual length of the original scale was 140 mm.)

Mr. B is currently a college senior who is very eager to pursue graduate study in chemistry leading to the Doctor of Philosophy degree. He has been accepted by both University X and University Y. University X has a world-wide reputation for excellence in chemistry. While a degree from University X would signify outstanding training in this field, the standards are so very rigorous that only a fraction of the degree candidates actually receive the degree. University Y, on the other hand, has much less of a reputation in chemistry, but almost everyone admitted is awarded the Doctor of Philosophy degree, though the degree has much less prestige than the corresponding degree from University X.

Try to place yourself in the position of Mr. B.

Indicate with lines across the scale, and letters above the desirabilities of the following alternatives and their outcomes:

F : Goes to University X and does not receive the degree.
S : Goes to University X and receives the degree.
C : Goes to University Y and receives the degree.

Lowest desirability (death) _____ Highest desirability

(The actual length of the original scale was 140 mm.)

Mr. D is contemplating marriage to Miss T, a girl whom he has known for a little more than a year. Recently, however, a number of arguments have occurred between them, suggesting some sharp differences of opinion in the way each views certain matters. Indeed, they decide to seek professional advice from a marriage counselor as to whether it would be wise for them to marry. On the basis of these meetings with a marriage counselor, they realize that a happy marriage, while possible, would not be assured.

Try to place yourself in the position of Mr. D and Miss T.

Indicate with lines across the scale, and letters above the lines, the desirabilities of the following alternatives and their outcomes:

F : They marry and it results in an unhappy, unsuccessful marriage.

S : They marry and it results in a happy, successful marriage.

C : Their condition if they do not get married.

Lowest desirability (death) _____ Highest desirability

(The actual length of the original scale was 140 mm.)

Mr. E is about to board a plane at the airport at the beginning of his overseas vacation. Although he has been looking forward to this trip for some time, he is troubled because he awoke in the morning with a severe abdominal pain. Because he has never flown before, he thinks that the pain may simply be an upset stomach brought on by anticipation of the flight. Although he is not far from a hospital where he knows he will obtain quick attention, he realizes that a visit to the hospital will cause him to miss his flight which in turn will seriously disrupt his vacation plans. The pain has gotten more severe in the last few minutes.

Try to place yourself in the position of Mr. E.

Indicate with lines across the scale, and letters above the lines, the desirabilities of the following alternatives and their outcomes:

F : Boarding plane; pains become more severe.

S : Boarding plane; pains do not become more severe.

C : Missing flight and visiting hospital; having pains diagnosed and treated.

Lowest desirability (death) _____ _____ _____ Highest desirability

(The actual length of the original scale was 140 mm.)

Mr. and Mrs. F have been attempting to have a child for a number of years. Mrs. F is now pregnant but a complication has arisen. The doctor has advised Mr. and Mrs. F that if the pregnancy is allowed to progress, Mrs. F's life could be in danger. If further complications do develop, the doctor will not be able to save the child and may not be able to save Mrs. F. If the pregnancy is terminated, at this time, it will be impossible for Mrs. F to become pregnant again.

Try to place yourself in the position of Mr. and Mrs. F.

Indicate with lines across the scale, and letters above the lines, the desirabilities of the following alternatives and their outcomes:

F : Pregnancy allowed to progress and complications arise.

S : Pregnancy allowed to progress and complications do not arise.

C : Their condition if pregnancy is terminated.

Lowest desirability (death) _____ Highest desirability

(The actual length of the original scale was 140 mm.)

Mr. G is president of a light metals corporation in the United States. The corporation is quite prosperous, and has strongly considered the possibilities of business expansion by building an additional plant in a new location. The choice is between building another plant in the U.S., where there would be a moderate return on the initial investment, or building a plant in a foreign country. Lower labor costs and easy access to raw materials in that country would mean a much higher return on the initial investment. On the other hand, there is a history of political instability and revolution in the foreign country under consideration. In fact, the leader of a small minority party is committed to nationalizing, that is, taking over, all foreign investments.

Try to place yourself in the position of Mr. G.

Indicate with lines across the scale, and letters above the lines, the desirabilities of the following alternatives and their outcomes:

F : Foreign plant built and is nationalized.
S : Foreign plant built and is not nationalized.
C : Building and having another plant in U.S.

Lowest desirability (death) _____ ___ ___ ____ Highest desirability

(The actual length of the original scale was 140 mm.)

Mr. H, a 45-year-old accountant, has recently been informed by his physician that he has developed a severe heart ailment. The disease would be sufficiently serious to force Mr. H to change many of his strongest life habits--reducing his work load, drastically changing his diet, giving up favorite leisure-time pursuits. The physician suggests that a delicate medical operation could be attempted which, if successful, would completely relieve the heart condition. But its success could not be assured, and in fact, the operation might prove fatal.

Try to place yourself in the position of Mr. H.

Indicate with lines across the scale, and letters above the lines, the desirabilities of the following alternatives and their outcomes:

F : Operation is attempted and proved fatal.

S : Operation is attempted and proved successful.

C : Mr. H's condition if operation is not attempted.

Lowest desirability (death) _____ Highest desirability

(The actual length of the original scale was 140 mm.)

APPENDIX I

Name_____

GENERAL DESIRABILITY ESTIMATION QUESTIONNAIRE

(final personal estimation)

This part of the questionnaire contains the scales of desirability just as a previous part did. Go through them now and mark your present personal estimation of the desirabilities of the outcomes of the uncertain alternative and that of the certain alternative. Perhaps you have considered new facets of the situations which have caused you to change your opinion of the desirabilities. Or perhaps your opinion has remained about the same. Therefore, do not worry about how you marked the scale the first time, but simply mark your present opinion about the desirabilities of the different outcomes. Go ahead and do this part. Work alone, with no discussion with others.

## APPENDIX J

Name_____

### GENERAL DESIRABILITY ESTIMATION QUESTIONNAIRE

This questionnaire contains the same series of situations as the previous one did. Again, each situation involves someone who is confronted with two alternative courses of action, an uncertain alternative and a certain alternative. The uncertain alternative has two possible outcomes, one of which is more desirable, the other outcome being less desirable than the certain alternative's outcome.

Below each situation you will find scales noting various aspects of each alternative and its outcome.

What we ask you to do nowis to read each situation again. Then, try to place yourself in the position of the person described in each situation, and, with an 'X', indicate on the scales your estimation of each alternative with its respective outcome.

Mr. A is the captain of College X's football team. College X is playing its traditional rival, College Y, in the final game of the season. The game is in its final seconds, and Mr. A's team, College X, is behind in the score. College X has time to run one more play. Mr. A, the captain, must decide whether it would be best to settle for a tie score with a play which would be almost certain to work or, on the other hand, should he try a more complicated and risky play which would bring victory if it succeeded, but defeat if not.

Try to place yourself in the position of Mr. A.

Risky play attempted, resulting in victory:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Risky play attempted, resulting in defeat:

desirable __:__:__:__:__:__:__:__ undesirable
bad __:__:__:__:__:__:__:__ good
beneficial __:__:__:__:__:__:__:__ harmful
punishing __:__:__:__:__:__:__:__ rewarding

Certain play attempted, resulting in a tie:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Mr. B is currently a college senior who is very eager to pursue graduate study in chemistry leading to the Doctor of Philosophy degree. He has been accepted by both University X and University Y. University X has a world-wide reputation for excellence in chemistry. While a degree from University X would signify outstanding training in this field, the standards are so very rigorous that only a fraction of the degree candidates actually receive the degree. University Y, on the other hand, has much less of a reputation in chemistry, but almost everyone admitted is awarded the Doctor of Philosophy degree, though the degree has much less prestige than the corresponding degree from University X.

Try to place yourself in the position of Mr. B.

Goes to University X and receives the degree:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Goes to University X and does not receive the degree:

desirable __:__:__:__:__:__:__:__ undesirable
bad __:__:__:__:__:__:__:__ good
beneficial __:__:__:__:__:__:__:__ harmful
punishing __:__:__:__:__:__:__:__ rewarding

Goes to University Y and receives the degree:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Mr. E is about to board a plane at the airport at the beginning of his overseas vacation. Although he has been looking forward to this trip for some time, he is troubled because he awoke in the morning with a severe abdominal pain. Because he has never flown before, he thinks that the pain may simply be an upset stomach brought on by anticipation of the flight. Although he is not far from a hospital where he knows he will obtain quick attention, he relizes that a visit to the hospital will cause him to miss his flight which in turn will seriously disrupt his vacation plans. The pain has gotten more severe in the last few minutes.

Try to place yourself in the position of Mr. E.

Boarding plane; pains do not become more severe:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Boarding plane; pains become more severe:

desirable __:__:__:__:__:__:__:__ undesirable
bad __:__:__:__:__:__:__:__ good
beneficial __:__:__:__:__:__:__:__ harmful
punishing __:__:__:__:__:__:__:__ rewarding

Missing flight, and visiting hospital; having pains diagnosed and treated:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__: _:__:__:__: _ punishing

Mr. and Mrs. F have been attempting to have a child for a number of years. Mrs. F is now pregnant but a complication has arisen. The doctor has advised Mr. and Mrs. F that if the pregnancy is allowed to progress, Mrs. F's life could be in danger. If further complications do develop, the doctor will not be able to save the child and may not be able to save Mrs. F. If the pregnancy is terminated, at this time, it will be impossible for Mrs. F to become pregnant again.

Try to place your self in the position of Mr and Mrs. F.

Pregnancy allowed to progress and complications do not arise:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__: _:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Pregnancy allowed to progress and complications arise:

desirable __:__:__:__:__: _:__:__:__ undesirable
bad __:__:__:__:__:__:__:__ good
beneficial __:__:__:__:__:__:__:__ harmful
punishing __:__:__:__:__:__:__:__ rewarding

Their condition if pregnancy is terminated:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Mr. G is president of a light metals corporation in the United States. The corporation is quite prosperous, and has strongly considered the possibilities of business expansion by building an additional plant in a new location. The choice is between building another plant in the U.S., where there would be a moderate return on the initial investment, or building a plant in a foreign country. Lower labor costs and easy access to raw materials in that country would mean a much higher return on the initial investment. On the other hand, there is a history of political instability and revolution in the foreign country under consideration. In fact, the leader of a small minority party is committed to nationalizing, that is, taking over, all foreign investments.

Try to place yourself in the position of Mr. G.

Foreign plant built and is not nationalized:

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Foreign plant built and is nationalized:

desirable __:__:__:__:__:__:__:__ undesirable
bad __:__:__:__:__:__:__:__ good
beneficial __:__:__:__:__:__:__:__ harmful
punishing __:__:__:__:__:__:__:__ rewarding

Building and having another plant in U.S.

undesirable __:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__ punishing

Mr. H, a 45-year-old accountant, has recently been informed by his physician that he has developed a severe heart ailment. The disease would be sufficiently serious to force Mr. H to change many of his strongest life habits--reducing his work load, drastically changing his diet, giving up favorite leisure time pursuits. The physician suggests that a delicate medical operation could be attempted which, if successful, would completely relieve the heart condition. But its success could not be assured, and in fact, the operation might prove fatal.

Try to place yourself in the position of Mr. H.

Operation is attempted and proved successful:

undesirable __:__:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__:__ punishing

Operation is attempted and proved fatal:

desirable __:__:__:__:__:__:__:__:__ undesirable
bad __:__:__:__:__:__:__:__:__ good
beneficial __:__:__:__:__:__:__:__:__ harmful
punishing __:__:__:__:__:__:__:__:__ rewarding

Mr. H's condition if operation is not attempted:

undesirable __:__:__:__:__:__:__:__:__ desirable
good __:__:__:__:__:__:__:__:__ bad
harmful __:__:__:__:__:__:__:__:__ beneficial
rewarding __:__:__:__:__:__:__:__:__ punishing

APPENDIX K

Name_____

GENERAL DESIRABILITY ESTIMATION QUESTIONNAIRE

(final estimation)

This questionnaire contains the same situations and scales related to the alternative courses of action and their outcomes. Now go through them again, placing yourself in the position of the central person, and mark you present personal estimation on each scale. Perhaps you have considered new facets of the situations which have caused you to change your estimation. Or, perhaps your estimation has remained about the same. Therefore, do not worry about how you marked the scales the first time, but simply mark your present estimation about the alternatives and their outcomes. Go ahead and do this part. Work alone with no discussion with others.

## APPENDIX L

### EXPERIMENT 1

MEANS AND STANDARD DEVIATIONS OF RISK PREFERENCE (p), UTILITIES' RATIO ($\hat{p}$) AND STANDARD DEVIATIONS OF SHIFTS IN RISK PREFERENCE AND UTILITIES' RATIO IN THE EXPERIMENTAL CONDITION

| Variable / Item | $p_1$ | | $p_G$ | | $p_2$ | | $\hat{p}_1$ | | $\hat{p}_2$ | | $p_2-p_1$ | | $\hat{p}_2-\hat{p}_1$ | | $p_G-p_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | M | SD | M | SD | $SD_G$ | SD | $SD_G$ | SD | $SD_G$ |
| A | 4.17 | 2.48 | 2.78 | 1.36 | 2.84 | 1.69 | 4.12 | 2.64 | 2.94 | 2.14 | 0.69 | 1.85 | 0.85 | 2.14 | 0.79 |
| B | 4.73 | 2.17 | 3.78 | 1.19 | 3.80 | 1.67 | 4.71 | 2.29 | 3.78 | 1.98 | 0.76 | 1.66 | 0.88 | 1.87 | 0.83 |
| C | 4.09 | 2.04 | 3.33 | 1.21 | 3.47 | 1.54 | 4.21 | 2.07 | 3.55 | 1.89 | 0.99 | 1.85 | 0.76 | 1.92 | 0.98 |
| D | 7.01 | 2.19 | 7.23 | 1.54 | 7.28 | 1.79 | 5.66 | 2.34 | 6.32 | 2.25 | 0.63 | 1.36 | 1.11 | 2.13 | 0.77 |
| E | 7.72 | 2.32 | 8.58 | 1.21 | 8.50 | 1.57 | 6.86 | 2.44 | 7.73 | 2.14 | 0.84 | 1.74 | 0.83 | 2.08 | 1.02 |
| F | 8.26 | 2.08 | 8.87 | 1.21 | 8.80 | 1.49 | 6.57 | 2.59 | 7.26 | 2.71 | 0.69 | 1.74 | 0.98 | 2.12 | 0.77 |
| G | 7.81 | 2.02 | 7.89 | 1.46 | 7.84 | 1.76 | 6.80 | 2.38 | 6.95 | 2.41 | 0.85 | 1.60 | 0.78 | 2.29 | 0.89 |
| H | 7.40 | 1.73 | 7.51 | 1.34 | 7.44 | 1.50 | 6.04 | 2.21 | 6.15 | 2.19 | 0.87 | 1.68 | 0.95 | 2.22 | 0.99 |

Note: M : Mean based on all individual Ss scores (i.e., N=90).

SD : Standard deviation based on all individual Ss scores (i.e., N=90).

$SD_G$ : Standard deviation based on group means (i.e., N=18).

EXPERIMENT 1

MEANS AND STANDARD DEVIATIONS OF RISK PREFERENCE (p), UTILITIES' RATIO ($\hat{p}$) AND OF SHIFTS IN RISK PREFERENCE AND UTILITIES' RATIO IN THE CONTROL CONDITION

| Variable / Item | $p_1$ | | $p_2$ | | $\hat{p}_1$ | | $\hat{p}_2$ | | $p_2-p_1$ | | $\hat{p}_2-\hat{p}_1$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD |
| A | 3.85 | 2.41 | 3.69 | 2.42 | 4.23 | 3.00 | 3.61 | 2.74 | -.16 | 0.89 | -.62 | 2.01 |
| B | 4.89 | 2.25 | 5.19 | 2.27 | 4.83 | 2.60 | 4.83 | 2.55 | .30 | 1.32 | .01 | 2.07 |
| C | 4.10 | 1.87 | 4.40 | 2.15 | 4.19 | 2.34 | 4.00 | 2.37 | .30 | 1.54 | -.19 | 1.27 |
| D | 7.06 | 2.16 | 6.73 | 2.35 | 6.16 | 2.37 | 6.58 | 2.34 | -.33 | 1.25 | .42 | 1.38 |
| E | 7.61 | 2.75 | 7.68 | 2.25 | 6.60 | 2.78 | 6.82 | 2.40 | .07 | 1.66 | .22 | 2.14 |
| F | 7.60 | 2.49 | 8.05 | 2.08 | 6.67 | 2.67 | 7.08 | 2.52 | .45 | 1.78 | .41 | 2.18 |
| G | 7.71 | 1.94 | 7.39 | 2.08 | 6.61 | 2.37 | 6.73 | 2.39 | -.32 | 1.43 | .12 | 1.67 |
| H | 6.92 | 2.07 | 6.98 | 2.01 | 6.02 | 2.29 | 6.24 | 2.26 | .06 | 1.67 | .22 | 1.46 |

Note: M : Mean based on all individual Ss scores (i.e., N = 62).

SD : Standard deviation based on all individual Ss scores (i.e., N = 62).

EXPERIMENT 1

MEANS AND STANDARD DEVIATIONS OF GOODNESS OF FIT AND OF INCREASE IN GOODNESS OF FIT BETWEEN RISK PREFERENCE (p) AND UTILITIES' RATIO ($\hat{p}$)

| Condition | Experimental Condition (N=90) | | | | | | Control Condition (N=62) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | $\lvert p_1-\hat{p}_1\rvert$ | | $\lvert p_2-\hat{p}_2\rvert$ | | $\lvert p_1-\hat{p}_1\rvert - \lvert p_2-\hat{p}_2\rvert$ | | $\lvert p_1-\hat{p}_1\rvert$ | | $\lvert p_2-\hat{p}_2\rvert$ | | $\lvert p_1-\hat{p}_1\rvert - \lvert p_2-\hat{p}_2\rvert$ | |
| Item | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD |
| A | 1.65 | 1.91 | 1.17 | 1.72 | 0.47 | 1.66 | 1.63 | 2.00 | 1.25 | 1.62 | 0.38 | 1.67 |
| B | 1.61 | 1.77 | 1.19 | 1.36 | 0.41 | 1.72 | 1.51 | 1.65 | 1.43 | 1.30 | 0.08 | 1.74 |
| C | 1.62 | 1.60 | 1.15 | 1.42 | 0.46 | 1.79 | 1.47 | 1.40 | 1.27 | 1.22 | 0.19 | 1.36 |
| D | 1.95 | 1.92 | 1.47 | 1.69 | 0.48 | 1.97 | 1.87 | 2.04 | 1.73 | 1.95 | 0.13 | 1.42 |
| E | 1.60 | 1.94 | 1.12 | 1.47 | 0.47 | 1.71 | 1.89 | 2.09 | 1.59 | 1.75 | 0.30 | 1.95 |
| F | 2.14 | 2.32 | 1.65 | 2.15 | 0.45 | 2.30 | 2.27 | 2.47 | 1.52 | 1.80 | 0.75 | 2.30 |
| G | 1.55 | 1.82 | 1.30 | 1.78 | 0.24 | 2.10 | 1.84 | 1.61 | 1.58 | 1.73 | 0.26 | 1.69 |
| H | 1.94 | 1.66 | 1.62 | 1.63 | 0.32 | 2.08 | 1.48 | 1.58 | 1.43 | 1.39 | 0.05 | 1.75 |

Note: M:: Mean based on all individual Ss scores

SD:: Standard deviation based on all individual Ss scores.

APPENDIX M

EXPERIMENT 2

MEANS AND STANDARD DEVIATIONS OF RISK PREFERENCE (p), UTILITIES' RATIO ($\hat{p}$), AND STANDARD DEVIATIONS OF SHIFTS IN RISK PREFERENCE AND UTILITIES' RATIO AFTER GROUP DISCUSSION

| Variable / Item | $p_1$ | | $p_G$ | | $p_2$ | | $\hat{p}_1$ | | $\hat{p}_2$ | | $p_2-p_1$ | | $\hat{p}_2-\hat{p}_1$ | | $p_G-p_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | M | SD | M | SD | $SD_G$ | SD | $SD_G$ | SD | $SD_G$ |
| A | 3.87 | 2.01 | 2.65 | 1.53 | 2.71 | 1.56 | 3.55 | 2.42 | 2.72 | 2.09 | 0.61 | 1.81 | 0.64 | 2.12 | 0.67 |
| B | 4.98 | 2.10 | 3.85 | 1.41 | 4.19 | 1.69 | 5.03 | 2.61 | 3.96 | 5.56 | 0.86 | 1.82 | 2.20 | 5.44 | 1.05 |
| D | 6.46 | 2.21 | 6.72 | 1.72 | 6.84 | 1.73 | 5.29 | 2.43 | 5.84 | 2.21 | 0.95 | 1.88 | 1.10 | 2.33 | 1.18 |
| E | 7.80 | 2.31 | 8.54 | 1.94 | 8.47 | 2.07 | 7.29 | 2.68 | 7.66 | 4.15 | 0.96 | 1.72 | 1.60 | 3.80 | 1.07 |
| F | 8.73 | 1.66 | 9.06 | 0.81 | 9.05 | 0.94 | 5.84 | 2.95 | 6.72 | 2.69 | 0.65 | 1.55 | 0.90 | 2.28 | 0.76 |
| G | 6.65 | 2.06 | 6.51 | 1.02 | 6.54 | 1.48 | 6.79 | 1.67 | 6.26 | 1.83 | 1.04 | 1.90 | 0.88 | 1.70 | 0.92 |
| H | 6.87 | 1.99 | 7.13 | 1.43 | 7.31 | 1.63 | 4.54 | 2.73 | 5.55 | 2.36 | 0.56 | 1.25 | 1.45 | 2.59 | 0.69 |

Note: M : Mean based on all individual Ss scores (i.e., N=85).

SD : Standard deviation based on all individual Ss scores (i.e., N=85).

$SD_G$ : Standard deviation based on group means (i.e., N=17).

## EXPERIMENT 2

MEANS AND STANDARD DEVIATIONS OF THE UTILITIES OF THE CHOICE DILEMMAS' OUTCOMES AND OF SHIFTS IN THE ASSESSMENT OF THE UTILITIES AFTER GROUP DISCUSSION

| Variable / Item | $U_{f_1}$ | | $U_{f_2}$ | | $U_{f_2}-U_{f_1}$ | $U_{c_1}$ | | $U_{c_2}$ | | $U_{c_2}-U_{c_2}$ | $U_{s_1}$ | | $U_{s_2}$ | | $U_{s_2}-U_{s_1}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | SD | M | SD | M | SD | SD | M | SD | M | SD | SD |
| A | 47.48 | 19.81 | 50.47 | 23.12 | 19.64 | 71.92 | 22.53 | 68.13 | 23.37 | 23.69 | 117.69 | 17.56 | 117.56 | 20.14 | 17.03 |
| B | 35.05 | 19.55 | 41.96 | 23.44 | 20.76 | 80.51 | 21.03 | 79.08 | 19.92 | 17.87 | 122.92 | 11.31 | 123.88 | 11.64 | 9.24 |
| D | 24.36 | 15.36 | 28.04 | 18.32 | 17.23 | 77.93 | 23.99 | 84.08 | 23.39 | 22.51 | 125.21 | 12.51 | 123.39 | 12.55 | 9.76 |
| E | 20.54 | 14.12 | 17.96 | 14.75 | 15.75 | 83.27 | 25.68 | 84.99 | 26.42 | 26.38 | 106.18 | 19.73 | 108.84 | 24.45 | 21.16 |
| F | 8.05 | 9.61 | 8.07 | 9.41 | 11.79 | 75.68 | 35.15 | 84.22 | 29.22 | 26.03 | 122.89 | 14.49 | 121.81 | 16.10 | 12.83 |
| G | 33.14 | 17.79 | 32.88 | 17.48 | 16.38 | 85.48 | 17.05 | 83.13 | 17.98 | 19.61 | 111.42 | 16.59 | 113.55 | 17.79 | 14.79 |
| H | 4.26 | 6.06 | 4.71 | 5.94 | 5.06 | 58.42 | 32.75 | 68.71 | 27.73 | 30.96 | 124.64 | 14.50 | 121.08 | 16.45 | 11.80 |

Note: M : Mean based on all individual Ss scores (i.e., N=85).

SD : Standard deviation based on all individual Ss scores (i.e., N=85).

MEANS AND STANDARD DEVIATIONS OF GOODNESS OF FIT AND OF INCREASE IN GOODNESS OF FIT BETWEEN RISK PREFERENCE (p) AND UTILITIES' RATIO ($\hat{p}$) AFTER GROUP DISCUSSION

| Variable | $\lvert p_1-\hat{p}_1\rvert$ | | $\lvert p_2-\hat{p}_2\rvert$ | | $\lvert p_1-\hat{p}_1\rvert - \lvert p_2-\hat{p}_2\rvert$ | |
|---|---|---|---|---|---|---|
| Item | M | SD | M | SD | M | SD |
| A | 1.99 | 1.72 | 1.48 | 1.43 | 0.51 | 1.97 |
| B | 1.84 | 1.56 | 2.46 | 5.09 | -0.52 | 5.31 |
| D | 2.28 | 1.75 | 2.01 | 1.60 | 0.25 | 1.80 |
| E | 1.80 | 1.66 | 2.39 | 2.92 | -0.59 | 2.95 |
| F | 3.11 | 2.46 | 2.66 | 2.13 | 0.44 | 2.31 |
| G | 1.78 | 1.36 | 1.40 | 1.31 | 0.37 | 1.63 |
| H | 2.74 | 1.96 | 2.35 | 1.83 | 0.33 | 2.28 |

Note: M : Mean based on all individual Ss scores (i.e., N=85)

SD : Standard deviation based on all individual Ss scores (i.e., N=85).

## APPENDIX N

### EXPERIMENT 3

MEANS AND STANDARD DEVIATIONS OF RISK PREFERENCE (p), UTILITIES' RATIO ($\hat{p}$) AND STANDARD DEVIATIONS OF SHIFTS IN RISK PREFERENCE AND UTILITIES' RATIO AFTER GROUP DISCUSSION

| Variable | $p_1$ | | $p_G$ | | $p_2$ | | $\hat{p}_1$ | | $\hat{p}_2$ | | $p_2-p_1$ | | $\hat{p}_2-\hat{p}_1$ | | $p_G-p_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | M | SD | M | SD | M | SD | M | SD | M | SD | $SD_G$ | SD | $SD_G$ | SD | $SD_G$ |
| A | 4.25 | 1.89 | 3.10 | 1.10 | 3.10 | 1.35 | 2.69 | 4.36 | 0.81 | 6.54 | 0.88 | 1.59 | 3.40 | 6.22 | 0.90 |
| B | 5.01 | 2.23 | 3.99 | 1.32 | 4.08 | 1.61 | 5.77 | 2.84 | 3.75 | 9.01 | 0.86 | 1.86 | 4.64 | 9.77 | 0.96 |
| E | 7.59 | 2.28 | 8.67 | 1.16 | 8.54 | 1.52 | 9.51 | 3.78 | 10.20 | 5.25 | 0.92 | 2.06 | 1.57 | 4.09 | 1.03 |
| F | 8.32 | 2.11 | 9.28 | 0.55 | 9.27 | 0.76 | 4.65 | 2.01 | 6.02 | 3.51 | 0.68 | 1.96 | 1.54 | 3.05 | 0.78 |
| G | 7.25 | 1.86 | 7.27 | 1.20 | 7.33 | 1.47 | 7.04 | 2.21 | 6.90 | 2.35 | 0.67 | 1.37 | 1.03 | 2.52 | 0.65 |
| H | 7.08 | 2.03 | 7.15 | 1.76 | 7.18 | 1.86 | 2.84 | 3.48 | 3.77 | 3.07 | 0.44 | 1.37 | 1.70 | 3.91 | 0.58 |

Note: M : Mean based on all individual Ss scores (i.e., N=79).

SD : Standard deviation based on all individual Ss scores (i.e., N=79).

$SD_G$ : Standard deviation based on group means (i.e., N=16).

EXPERIMENT 3

MEANS AND STANDARD DEVIATIONS OF THE UTILITIES OF THE CHOICE DILEMMAS' OUTCOMES AND OF SHIFTS IN THE ASSESSMENT OF THE UTILITIES AFTER GROUP DISCUSSION

| Variable | $U_{f_1}$ | | $U_{f_2}$ | | $U_{f_2}-U_{f_1}$ | $U_{c_1}$ | | $U_{c_2}$ | | $U_{c_2}-U_{c_1}$ | $U_{s_1}$ | | $U_{s_2}$ | | $U_{s_2}-U_{s_1}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | M | SD | M | SD | SD | M | SD | M | SD | SD | M | SD | M | SD | SD |
| A | 13.54 | 5.59 | 15.28 | 5.59 | 5.43 | 20.37 | 4.87 | 19.34 | 4.84 | 4.79 | 33.53 | 3.54 | 34.16 | 2.68 | 2.64 |
| B | 13.84 | 5.69 | 15.67 | 5.58 | 5.54 | 26.09 | 4.20 | 25.42 | 4.95 | 4.28 | 34.28 | 2.89 | 34.95 | 2.03 | 2.43 |
| E | 6.73 | 2.90 | 6.67 | 2.90 | 2.49 | 28.54 | 5.53 | 28.95 | 6.06 | 4.97 | 30.64 | 4.70 | 30.23 | 5.66 | 4.03 |
| F | 5.85 | 2.17 | 5.41 | 1.94 | 1.42 | 18.77 | 5.18 | 21.91 | 6.88 | 4.08 | 33.96 | 2.90 | 33.94 | 3.70 | 2.92 |
| G | 8.99 | 4.93 | 8.73 | 4.66 | 4.03 | 25.92 | 4.89 | 25.84 | 4.18 | 4.63 | 33.14 | 3.30 | 33.61 | 3.11 | 2.53 |
| H | 6.87 | 3.40 | 7.51 | 4.25 | 3.25 | 15.56 | 4.92 | 17.82 | 5.70 | 5.31 | 33.80 | 3.04 | 33.70 | 3.27 | 2.89 |

Note: M : Mean based on all individual Ss scores (i.e., N=79).

SD : Standard deviation based on all individual Ss scores (i.e., N=79).

EXPERIMENT 3

MEANS AND STANDARD DEVIATIONS OF GOODNESS OF FIT AND OF INCREASE IN GOODNESS OF FIT BETWEEN RISK PREFERENCE (p) AND UTILITIES' RATIO ($\hat{p}$) AFTER GROUP DISCUSSION

| Variable | $\lvert p_1-\hat{p}_1\rvert$ | | $\lvert p_2-\hat{p}_2\rvert$ | | $\lvert p_1-\hat{p}_1\rvert - \lvert p_2-\hat{p}_2\rvert$ | |
|---|---|---|---|---|---|---|
| Item | M | SD | M | SD | M | SD |
| A | 3.00 | 3.05 | 3.33 | 5.64 | -0.33 | 5.86 |
| B | 2.41 | 2.32 | 3.38 | 7.91 | -0.90 | 7.00 |
| E | 2.91 | 3.12 | 2.95 | 3.99 | -0.04 | 3.83 |
| F | 4.01 | 1.75 | 3.80 | 2.55 | 0.20 | 2.98 |
| G | 1.99 | 1.82 | 1.98 | 1.32 | -0.01 | 2.04 |
| H | 4.40 | 3.72 | 3.64 | 2.62 | 0.75 | 4.02 |

Note: M : Mean based on all individual Ss scores (i.e., N=79).

SD : Standard deviation based on all individual Ss scores (i.e., N=79).

APPENDIX O

EXPERIMENT 4

MEANS AND STANDARD DEVIATIONS OF UTILITIES' RATIO ($\hat{p}$)
AND OF SHIFTS IN UTILITIES' RATIO AFTER GROUP DISCUSSION

| Variable | $\hat{p}_1$ | | $\hat{p}_G$ | | $\hat{p}_2$ | | $\hat{p}_2-\hat{p}_1$ | | $\hat{p}_G-\hat{p}_1$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| Item | M | SD | M | SD | M | SD | $SD_G$ | SD | M | $SD_G$ |
| A | 3.99 | 2.78 | 2.58 | 1.26 | 2.63 | 1.81 | 0.90 | 2.27 | -1.41 | 1.08 |
| B | 4.83 | 2.73 | 3.28 | 1.91 | 3.57 | 2.14 | 1.35 | 2.40 | -1.55 | 1.74 |
| C | 4.28 | 2.16 | 3.86 | 1.65 | 3.82 | 1.88 | 1.11 | 2.09 | -0.42 | 1.11 |
| D | 5.63 | 2.07 | 5.81 | 2.15 | 5.67 | 2.45 | 1.26 | 2.63 | 0.18 | 1.32 |
| E | 6.45 | 2.37 | 7.83 | 1.33 | 7.71 | 1.69 | 1.14 | 2.29 | 1.38 | 1.40 |
| F | 6.60 | 2.37 | 8.29 | 1.70 | 8.23 | 1.84 | 0.99 | 2.35 | 1.69 | 1.09 |
| G | 6.76 | 2.56 | 6.46 | 2.25 | 6.52 | 2.32 | 1.28 | 2.17 | -0.30 | 1.30 |
| H | 4.42 | 2.84 | 4.77 | 1.90 | 4.66 | 2.39 | 1.30 | 2.31 | 0.35 | 1.47 |

Note: M : Mean based on all individual Ss scores (i.e., N=76).

SD : Standard deviation based on all individual Ss scores (i.e., N=76).

$SD_G$ : Standard deviation based on group means (i.e., N=16).