CAUTIOUSNESS IN ADULTHOOD AND OLD AGE

by

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ABSTRACT

The present study examined the question of age related cautiousness in decision making. Traditional approaches to the study of age-related patterns of choice behaviour and theoretical explanations of cautiousness in risky choice situations were evaluated. An alternate approach to the study of choice behaviour in different age groups, which emphasizes the role of outcome direction, probabilities, and payoff values was presented.

Peoples' preference for completely predictable and probabilistically determined response options was assessed. The sample consisted of 12 men and 12 women in 4 age groups representing young (20-30), middle (35-45) and late (50-60) adulthood, and old age (65-75).

The number of completely predictable options chosen by each subject across (1) all situations, (2) gain situations only, and (3) loss situations only were calculated. An analysis of variance performed on the total number of completely predictable options chosen indicated that people of all age groups chose equivalent numbers of certain options. There were no significant effects for age group, sex, nor the age x sex interaction. A repeated measures analysis of variance performed on subjects' scores in gain and loss situations indicated that people chose more completely predictable options in gain than in loss situations. The effects of age group and sex were not significant, nor were the two and three way interactions.

A second set of analyses were undertaken to relate subjects' choices to (1) the outcome direction of the situations, and (2) the
expected payoff, or outcome, of the situations. Expected payoff was found to be a better predictor of choice behaviour than was outcome direction.

The implications of these findings for theories of age-related cautiousness are discussed. It is suggested that theories of adult choice behaviour may have to be modified to account for the impact of situational variables on peoples' choice behaviour.
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INTRODUCTION

During the past two decades, the issue of age-related differences in patterns of decision making has been the subject of controversy in the gerontological literature (Okum, 1976a). The problems of interest have been whether elderly people exhibit different patterns of choice behaviour than young people in risky situations, and whether such differences, if indeed they exist, are indicative of a general, age-related, propensity to avoid or minimize the risk factor in choice situations. Researchers have been somewhat divided in opinion on this matter. A number of researchers have maintained that differences do exist, and that the elderly are either generally cautious in risk situations (Wallach and Kogan, 1961; Rabbit, 1977), or averse to taking risks if other options are available to them (Botwinick, 1969, 1973). Alternatively, it has been suggested that the 'cautious' behaviour of the elderly may have been an artifact of their sensitivity to certain parameters of risk decision situations.

Although a large body of research dealing with these problems has developed, it has yielded equivocal results. A number of studies have produced results suggesting that elderly people will attempt to avoid risky alternatives when participating in uncertain or risky tasks, while younger people will seldom exhibit such behaviour (Botwinick, 1966, 1969; Wallach and Kogan, 1961). Other studies have indicated that the performance of the elderly and the young is essentially identical in certain choice situations (Sanford, 1968; Griew, 1972; Okum, 1977). At present the debate is unsettled, and both sides are able
to cite reasonable arguments for their positions.

For the most part, gerontological research has been conducted independently of studies examining formal models of decision making. At present, there is a considerable body of literature dealing specifically with decision making under conditions of risk, some of which is directly relevant to the gerontological debate. For example, risk seeking and risk avoiding are among the taking behaviours identified by researchers (Kahneman and Tversky, 1978). In addition, decision theorists have offered several explanations of the conditions under which such behaviours can be expected to occur. Unfortunately, such information has not been integrated into the gerontological literature.

The isolation of these two bodies of research is apparent when one examines the gerontological literature. In this literature there are few specific references to decision making. There are, however, many references to studies examining decision making, some of which deal with decision making. But even in studies dealing with choice behaviour there is seldom more than a passing mention of traditional decision theory. While it is difficult to say why such a split exists, the most likely reason is that the two areas are concerned with different problems. While decision theorists have been interested in mathematical models of choice behaviour (Slovic and Lichenstein, 1967), the issue which gerontological researchers have focused on is age related changes in cautiousness (Botwinick, 1973). The decision making paradigm has been used more as a convenient technique for producing instances of cautious behaviour than as a means of studying the decision process per se. Most of the research on age related performance has resulted from this
special focus of gerontological researchers.

The subordination of the study of decision making to the study of cautiousness in the gerontological literature is a direct result of a series of historical developments. During the 1950's, several researchers (Basowitz and Korchin, 1957) reported that the elderly, as a group, exhibited a general reluctance to initiate action when faced with ambiguous conditions. This reluctance to act was interpreted as cautiousness. The presumed cautiousness was then used as an explanatory variable to account for age group performance differences on a variety of perceptual, psychophysical, and intelligence testing tasks (Okum, 1976a). As other researchers reported instances of cautious behaviour on the part of the elderly, a tradition of studying age group differences in cautiousness emerged (Botwinick, 1973).

Decision making became important in the study of cautiousness more through accident that through intrinsic interest on the part of gerontological researchers. In 1961, Wallach and Kogan, while studying several aspects of decision making, reported age group performance differences on a measure of disutility of failure to the individual (Wallach and Kogan, 1961). Their results suggested that elderly people required a higher level of certainty before entering a risky situation than did younger people. The researchers attributed this to a greater conservatism, or cautiousness, on the part of the elderly. Subsequently, other investigators turned to the study of decision making (Botwinick, 1966; Okum, 1976b), but unlike Wallach and Kogan, their primary interest was in describing the appearance of cautious behaviour in elderly subjects. The decision making paradigm was merely a tool
to demonstrate age related changed in cautiousness.

As a direct result of this sequence of events, the study of decision making in the gerontological literature focused primarily on identifying the personal attributes that could influence choice behaviour in risky situations. In keeping with the theoretical tendencies of the 1950's and early 1960's, decision making was interpreted within a personality framework. Because of this emphasis on personality variables, little attention was paid to the traditional aspects of the decision or choice paradigm. Situational parameters such as expected payoffs, outcome values, and outcome directions were deemed to be of minimal interest. Researchers also seem to have operated with vague, informal models of the decision making process, and seldom consulted the decision making literature when designing studies or interpreting results.

The use of such an informal approach seems to have resulted in a number of inadequacies in the gerontological research. The literature on formal models of choice behaviour (Kahneman and Tversky, 1978; Slovic and Lichenstein, 1967) indicates that situational parameters are very important in determining choice behaviour, and that it is necessary to precisely control all parameters of a decision situation, including probabilities and payoffs. However, as noted previously, interest in studying situational parameters has been visibly lacking in the gerontological literature. Most studies have been very lax with respect to defining the component values of decision situations. Of the reported studies on decision making in risky situations, only two (Okum, 1977; Burkhill and Schaie, 1976) analyzed the relationship
between parameters of the risk taking situation and people's behaviour. Since peoples' choice behaviour may reflect the contingencies and information present in the decision situation, experimental results may actually have been a function of uncontrolled situational parameters rather than a function of risk taking predilections on the part of the elderly subjects.

In light of these considerations, it seems imperative to begin to integrate the gerontological and formal decision making literature. The remainder of this section will be devoted to that goal. Because the basic differences in the two areas make it difficult to simultaneously comment on research development, representative studies from each area will be presented and reviewed. Following this review, the common features and areas of mutual interest will be identified and discussed.

The first study of decision making to appear in the gerontological literature was a study by Wallach and Kogan (1961). These researchers examined the role of four variables in decision making: extremity of judgement, subjective probability of error in judgement, confidence in judgement, and disutility of failure. Subjects were men and women in two age groups loosely categorized as young and elderly. The mean age of elderly subjects was approximately 70, while the mean age of younger subjects was approximately 20.

Since only the disutility of failure index yielded results relevant to this presentation, it alone will be discussed. To measure disutility of failure, Wallach and Kogan administered a 12-item choice dilemma instrument to each subject. Each item involved a central
character facing a decision of whether or not to take a risky action. If the character chose to take the action, he/she might either gain or lose money, prestige, or comfort. If the character chose not to take the risky action, the outcome would be completely predictable, i.e., it would lead to a continuation of the present situation.

Subjects were asked to indicate on a scale ranging from 1/10 to 9/10 the probability of success that they would require before advising the character to take the risky action. If the subject chose to advise the person not to take the action, the response was scored as 10/10. This scoring procedure was based on the assumption that the decision not to take action lay on the same qualitative continuum as the other choices.

Each subject's responses were summed across the 12 items to yield a disutility of failure index. According to Wallach and Kogan, if the subject's score was high, he required a greater chance of success, and therefore there was a higher disutility of failure. They also suggested that higher scores were associated with conservatism or cautiousness.

The main finding of this segment of the study was that, on the average, older people of both sexes required a higher probability of success before advising someone to enter into a risky situation than did younger people. This was interpreted as evidence that the elderly are more cautious or conservative than younger people.

Wallach and Kogan also reported that subjects responded differentially to a number of the items. They found that elderly people, for example, tended to be particularly conservative in situations involving
money. The researchers interpreted this as suggesting that the conflicts being faced by each group influenced their choice behaviour. They then hypothesized that the differential response patterns observed in the study were a function of the relevance of the situations to the subjects' present circumstances.

Several years elapsed before Wallach and Kogan's work was extended by other gerontological researchers. The next report of cautiousness in decision making was made by Botwinick in 1966. Unlike Wallach and Kogan, who were interested in decision making, Botwinick was interested primarily in the issue of age related cautiousness, and his work was aimed at clarifying the conditions under which cautious behaviour could be observed. Wallach and Kogan's twin findings of age specific differences in patterns of choice, and differential responding to item content, led Botwinick to replicate the study using an expanded set of life dilemma situations. While Wallach and Kogan had used items appropriate to younger age groups, such as changing jobs, attending university, and winning a football game, Botwinick developed items centered on situations dealing with aspects of later adult life, such as remarrying, retiring from work, and visiting grandchildren. He then combined the new items with Wallach and Kogan's original items to produce a 24 item life dilemma questionnaire.

Using the scoring procedures developed by Wallach and Kogan, Botwinick administered the expanded questionnaire to a group of young (mean age 21) subjects and to a group of elderly (mean age 75) subjects. Both groups contained equal numbers of men and women. The results of this study were similar to those obtained by Wallach and
Kogan. Regardless of sex or educational level, older people required higher levels of assurance of success than younger people before advising another person to enter into a risky situation. Botwinick also reported an interaction between age and item content, although not of the expected kind. He found that both old and young subjects required a higher level of assurance of success when the central character was young than when the character was elderly. The implication of this finding was that "both old and young regarded the aged as having less to lose should the risky course of action prove ill advised" (Okum, 1976a).

As a secondary analysis, Botwinick examined the distribution of responses across choice options. This analysis indicated that the number of elderly adults choosing the no-action (completely certain) alternative was significantly higher than the number of younger adults doing so. Since the no-action alternative received the highest score, this phenomenon accounted for the observed differences in overall scores. As Botwinick's procedure was identical to that of Wallach and Kogan, the implication was that Wallach and Kogan's results were due to a similar phenomenon. The presence of this pattern led Botwinick to question the hypothesis that the no action alternative lay on the same qualitative continuum as the other response options. He then went on to suggest that perhaps the elderly, rather than being cautious in their general use of decision criterion, were disinclined to enter into any risky situations regardless of the probability of success, when a safe, non-risky, option was available to them.

To test the hypothesis that the elderly's behaviour was controlled
by such a specific kind of risk aversion, Botwinick replicated his study using the 24 item questionnaire, but eliminated the no-action alternative. He reasoned that if there was a continuum of risk taking ranging from very cautious to very risk oriented, removing the no action choice would result in the elderly people choosing the next safest alternative, which would be 9/10. Alternatively, if the older subjects' behaviour was characterized by a very specific form of cautiousness, or risk aversion, this pattern would not necessarily appear.

In this second study, Botwinick assessed the choice behaviour of elderly women (mean age 76), elderly men (mean age 75), young men (mean age 20), and young women (mean age 21). Using the 24-item questionnaire with the no action alternative eliminated, Botwinick found no differences between age groups in choices of preferred level of probability of success. Regardless of sex, both young and old subjects tended to choose mid-range probability levels. The age by item interaction reported in earlier studies also disappeared. However, Botwinick found that the elderly were slightly less cautious than younger subjects when the central character was younger. These findings led Botwinick to conclude that old people are inclined to avoid risk only is a no risk option is available.

Following Botwinick's lead, several other researchers used the life situation dilemma questionnaire to examine age related differences in decision making. As with earlier studies, the results obtained seem dependent on the experimental procedures used.

Tonberg (1970) replicated Botwinick's second experiment using a
30-item life dilemma questionnaire. The 30 items included the 24 used by Botwinick, and 6 new items constructed by Tonberg. This revised questionnaire was administered to young, middle-aged, and elderly adults. The mean age for the young group was 29. For the middle-ages group, the mean age was 41. The mean age for the elderly subjects was 58. As in the Botwinick study, Tonberg found no evidence of age differences in level of assurance required by subjects in the choice situations.

Vroon and Pahl (1971), using a 5-item subset of the Wallach and Kogan items, and including the no-action choice, examined the decision choices of 1,400 businessmen between the ages of 22 and 58. These researchers reported a small but statistically significant correlation \( r = .08, p = .01 \) between age and level of assurance required before advising entry into a risky situation.

Taken in combination, the data from these five studies seem to provide support for Botwinick's notion of a specific kind of cautiousness or risk aversion in elderly people. Only in studies which included a no action option that was scored highest were age differences apparent. In each case, age differences seem to have been due to a disproportionate number of older people choosing the no-action alternative. On the other hand, in studies where a risky decision was unavoidable, age differences disappeared altogether.

When interpreting these results, however, the limitations of the choice dilemma instrument must be considered. In a discussion of the flaws inherent in the choice dilemma questionnaire, Okum (1976) mentioned the following serious problems. (1) The instrument is based
on hypothetical choices rather than on personal risk taking. (2) People's judgements may be made independently of the odds presented in the situation. (3) People's perceptions of what constitutes a high risk may differ. (4) The life situations contained irrelevant or insufficient information. (5) The instrument instructions are difficult to follow. (6) The instrument is semi-projective in nature and the degree of personal involvement by the subjects cannot be controlled.

While such detailed criticisms may seem to be a case of overkill, they do serve to underscore a very general problem of the questionnaire. When the choice dilemma instrument was constructed, the situational parameters for each item were not precisely specified. Points 2, 3, 4, 5, and to some extent, point 6, all revolve around the same theme, i.e., that there is no way of knowing if subjects' responses indicate an aversion to risk, or a reaction to some other aspect of the item. A strong argument could be put forth that any one of the factors listed by Okum, or any combination of these, could have produced the results reported by Botwinick and other researchers. For example, elderly adults have been reported to be more sensitive than younger people to the amount and quality of information presented in experimental situations (Labouvie-Vief and Chandler, 1978). As Okum (1976) has pointed out, it is difficult to distill information from the choice dilemma situations. If the elderly were sensitive to information content, and reacted negatively to vague or non-specific information, the choice not to take action could have reflected a dislike for situations in which inadequate information was supplied, rather than a trait of cautiousness or risk aversion.
Dissatisfied with the limitations of the choice dilemma instrument, Okum attempted to examine choice behaviour within a behavioural framework. In two related experiments, Okum and his associates examined risk taking in a personal choice situation. Using performance on a vocabulary test task as a dependent measure, they systematically manipulated several aspects of the risk situation and measured the resulting choice behaviour. In the first experiment (Okum et al., 1976b), the relation between age and condition of instructions in risk taking situations was examined. In the second study (Okum et al., 1978), the researchers looked at the impact of the payoff matrix associated with choices on people's risk taking behaviour.

In the first experiment, the researchers assessed the risk taking behaviour of old (mean age 69) and young (mean age 21) males. The subjects were assessed for verbal proficiency using a standard vocabulary testing task in which they could win points for each correct answer that they gave. In this segment of the experiment, subjects were required to choose the difficulty level of the items they would work with. They were also informed of the probability of their answering an item of a particular difficulty level correctly. (Probability estimates were based on each subject's pre-testing performance.) After each trial, the subjects were given feedback on their performance. In addition, the subjects were exposed to supportive, challenging, or neutral instructions.

Okum hypothesized that elderly people would consistently choose low difficulty items and that they would also exhibit more risk taking behaviours under supportive conditions. Consistent with his
first hypothesis, he found that elderly adults tended to choose lower levels of difficulty than the younger subjects. His second hypothesis, however, was not supported as varying the instructions had no impact on the subjects' performances.

Okum interpreted these findings as evidence for the notion of age related increases in cautious behaviour. As an explanation of his results, he proposed that the age group differences were a function of different levels of need for achievement in the two groups. According to Okum, elderly people lowered their aspirations of success, partly as a consequence of failure to meet life goals, and consequently were less inclined to seek out risky tasks. He also suggested that the reported finding of risk aversion could be seen as attempts by the elderly to avoid negative evaluation.

In later research, Okum (1978) modified this position. He noted that in the above study, the expected payoff, or number of points, that a subject could earn on any particular trial was unrelated to the difficulty level of the items the person chose to work with. The expected reward for answering the most difficult item was exactly the same as the expected reward for the easiest one. This suggested that the elderly people may have chosen the low difficulty items, not because they were cautious, but because there was no reason for them to do otherwise. In other words, their strategy or pattern of choices may have been no less effective than that of younger people in terms of winning the maximum number of points. In fact, one can hypothesize that the elderly subjects may have been more efficient than the younger ones because the ratio of energy expended to points won may
have been lower.

This finding again raises the possibility that the elderly subjects, rather than being overly cautious or risk averse, may instead be very sensitive to situational parameters. Their 'reluctance' to take action in the face of vague information can easily be interpreted as a sign of mature judgement, while the behaviour of younger subjects can be seen as a foolish wasteful expenditure of energy.

To test the possibility that performance on risk taking tasks was a function of the payoffs associated with high and low difficulty items, Okum conducted a second experiment. Elderly men (mean age 68) and young men (mean age 21) were assessed using the vocabularly testing task described previously. In one experimental condition, the expected reward for a correct item increased with increasing item difficulty so that the most difficult items had the highest payoff. In a second condition, the expected payoff decreased with increasing difficulty level so that the easiest items had the highest payoff. All subjects were exposed to each condition.

When the results were examined, it was found that all subjects performed equivalently in both conditions, and that both groups shifted their performance criterion when the payoff conditions were changed. In the face of this data, Okum interpreted the results as suggesting that the elderly will avoid risk, but only under particular conditions. He suggested that risk avoiding behaviour would be observed if the payoffs associated with risky choices were inadequate to make the risk worthwhile.

These conclusions are supported in part by Burkhill and Schaie
(1975). These authors found that elderly subjects (mean age 73) took more risks on an intelligence test if there was a monetary incentive for doing so, and if there was no penalty for failure to perform unsuc-

cessfully.

The researchers examined the intelligence test performances of elderly males and females (mean age 73) under different reinforcement contingencies. The experimental conditions included situations in which high and low risk taking was either discouraged or encouraged by making monetary rewards or losses contingent upon certain performance patterns. They found that elderly subjects showed the highest rate of risk taking when correct responses were rewarded and failure to respond was not penalized. When failure was penalized, responding remained low, even when correct performance was rewarded.

Although Burkhill and Schaie interpreted these results as suppor-
ting Botwinick's position that the elderly hesitate to become involved in a risky situation when the degree of risk is high, they can also be seen as being consistent with Okum's conclusions (1978). The finding that elderly people's performance is determined by environmental con-
tingencies fits very well with Okum's report that the elderly are sensitive to situational parameters. Both reports indicate that when faced with risky decision situations, elderly adults may be extremely responsive to the probabilities and outcomes associated with the res-
ponse options available to them.

The idea that elderly people are responsive to the probability and outcome of a choice event has received collateral support from studies examining the ability of people to estimate the probability
of events occurring. Sanford, Griew, and O'Donnel (1972) compared the ability of old men and women (mean age 68.8) with that of young men and women (mean age 17.8) on two simple prediction tasks. All subjects were asked first to predict the probability of occurrence of two alternating events which occurred with biased probabilities. The specific task was to predict the probability of (a) a head and (b) a tail, when a rigged coin was flipped. They were then asked to perform a similar task in a situation with three discrete events. The subjects were asked to predict the probabilities of red, white, and blue balls being drawn from an urn. The researchers reported that all subjects, regardless of age, quickly identified the probability of each class of events occurring. They interpreted this as evidence that the young and the elderly are equivalent in their sensitivity to and ability to detect probability patterns.

This finding parallels an earlier report by Griew (1968) that both old and young subjects distributed viewing time while performing an observation task on the basis of the probability that a signal would occur. Griew examined the performances of elderly (age range 62-71) and young (age range 18-23) subjects on a signal monitoring task. All subjects were asked to listen to a two channel tape recorder with signals occurring on each channel with different probabilities. Although the two channels were presented simultaneously, only one channel could be listened to at a time. Subjects were then asked to detect as many signals on each channel as possible. This forced the subjects to apportion their listening time between the two channels. Griew found that channel selection of the elderly more closely matched the signal
probabilities per channel than did the channel selection of the younger subjects, although both groups matched the signal probabilities reasonably well. This study is of particular relevance in that not only did subjects identify the probability patterns, but they did not use the most conservative choice strategy of monitoring the high frequency signal. Instead they switched channels frequently, indicating their willingness to take a risk on a lower probability signal.

While neither of these experiments deal specifically with cautionness in decision making, they are of some importance in demonstrating that the elderly are not only capable of distilling probabilistic information in decision situations, but that they can use that information when performing choice tasks.

The results of the five studies examining risk taking in behavioural settings, Griew's task in particular, are somewhat at odds with the results of studies using hypothetical life dilemma situations. Both (1978) and Burkhill and Schaie (1976) found that risk avoiding behaviour, even when a safe alternative was available, seemed to be a function of the payoffs and probabilities of success associated with the response alternatives, and was not due to the use of a blanket strategy of risk avoiding. The Sanford (1972) and Griew (1968) findings that old people respond accurately to probabilistic information and can use this information in performing vigilance tasks is also at odds with the notion that people use blanket strategies of avoiding risk in choice situations. The elderly subjects could have chosen simply to monitor continuously the high frequency signal channel in order to avoid risk. In the single behavioural risk taking study in which
elderly people appeared to be more cautious than younger people (Okum, 1975), certain aspects of the situation appear to have influenced the choice behaviours.

In summary, the choice dilemma questionnaires, the behavioural risk taking situations and the probability matching studies have yielded a complex and confusing pattern of results. In experimental tasks where risk has been unavoidable, or there has been a high payoff for taking a risk, or both, the decision making behaviour of the young and the elderly has been equivalent. In situations where risk has been avoidable and payoffs for taking a risky action have been low or a substantial loss might be incurred, the elderly have avoided taking risks. This pattern was not evident in the younger subjects studied. Finally, the elderly have been shown to be competent at distilling probabilistic information from experimental situations and they are able to integrate probabilities and payoffs into efficient choice strategies (Okum, 1978).

Theoretical explanations of patterns of choice behaviour exhibited by elderly people have been offered by several researchers. Generally, their attempts have been less than perfectly satisfactory. Because the study of choice behaviour in the elderly developed slowly over a long period of time, and because it developed independently of the decision making literature, these explanations have tended to be ad hoc in nature. The shifting patterns of results in the studies previously mentioned have been mirrored in the theoretical explanations developed over the years. These have, as a rule, been limited by the tendency to reflect the special biases of gerontological researchers
and have been able to explain only certain subsets of the choice behaviour data.

Since the first studies of age related changes in decision making, gerontological researchers have put forth the claim that old people are more cautious or risk averse than younger people, and explanatory attempts have consequently been aimed at explicating this development. In addition, researchers have tended to assume a decrement model of human functioning and, in developing theories, have focused primarily on declines in functional abilities that, in turn, could produce cautious behaviour.

The most widely cited formulation of the genesis of cautious or risk averse behaviour was developed by Botwinick (1969, 1973). He proposed that elderly people perceive themselves as being inefficient or incompetent performers who are likely to fail when attempting to perform complex tasks. He then hypothesized that this perception would cause people to avoid situations in which they could fail to perform adequately. In choice situations, this would lead them to choose non-risky alternatives, as was reported in choice dilemma studies. In Botwinick's system, performance patterns were seen as evidence of cautiousness or risk aversion. This, in turn, was seen as the manifestation of a perception of personal inadequacy which became interpreted into a blanket strategy of risk avoidance.

This explanation, which is based primarily on data obtained from the choice dilemma studies, explicates those results quite well. It becomes less effective, however, in describing other findings. For example, the theory cannot account for the pattern of results reported
by Okum (1978) in which the payoff associated with particular response options determined people's choice behaviour. Nor can it easily account for the findings of Burkhill and Schaie (1976) suggesting that performance is affected by situational contingencies. Both of these findings indicate that certain aspects of choice situations affect choice patterns. Botwinick's theory cannot adequately deal with such results as it does not make allowances for the role of such variables in choice situations.

The theory also leaves several unanswered questions. While Botwinick postulated that the elderly suffer from feelings of personal inadequacy, he does not demonstrate that people actually perceive themselves in such a manner, or suggest how such a perception could develop. It is difficult to imagine why elderly people would perceive themselves as incompetent when, as Botwinick himself demonstrated, their performance is equivalent to that of younger people. While it is possible to speculate that the elderly consistently ignore or misunderstand their performance, or that they reach a state of mind in which all action is seen as potentially dangerous, it seems unnecessary to do so merely for the sake of theoretical consistency.

Rabbit (1977) has also expressed the opinion that elderly people behave cautiously because of performance deficiencies. Echoing Botwinick's notion that decrements in performance capabilities lead to a reluctance to be involved in risky situations, he noted that, "Perhaps it (cautiousness) may also be seen as a tendency to choose a completely predictable outcome because the utility maximization strategy for the risky alternative may be too difficult to work out." He then
suggested that cautious behaviour on the part of the elderly is a function of information processing deficiencies arising from unspecified, age related, physiological changes. He also predicted that these deficiencies would lead to performance differences between the old and young in situations where people are required to integrate probability and payoff information into effective behavioural strategies.

Again, this theory explains some, but not all, of the available data. This formulation can adequately account for accurate performance of the elderly on simple prediction tasks, as these do not require a high degree of information integration. This would also be true of choice dilemma situations where subjects presumably avoid risk for the reasons given previously. But the theory cannot explain Okum's finding that the behaviour of elderly people shifts as a function of payoff and probability information, since such a shift implies that the person is effectively integrating several sources of information in order to choose the best option.

Rabbit's theory is also incomplete in that the specific types of information processing deficiencies that are the supposed causes of cautious behaviour are not identified. Since there is no indication that systematic loss of brain function occurs with increasing age, with the possible exception of people suffering from cardio-vascular disease, Rabbit's use of the concept of information processing deficiencies is simply too vague and inaccurate to be of use.

A less widely known explanation of performance patterns in decision studies was offered by Okum (1976b, 1978). He hypothesized that
age differences in cautiousness were due to differential need achievement levels in the young and the elderly, with the elderly behaving like low need achievers. He also suggested that the elderly fear failure, ostensibly as a result of negative life experiences, and this fear of failure leads them to protect themselves from engaging in potentially negative evaluative situations. Although Okum (1977) subsequently modified this stance as a result of patterns observed in his own data, he never completely abandoned the need for achievement/fear of failure model of risk taking behaviour.

The same criticisms applied to Botwinick's and Rabbit's theories also apply to Okum's. The concept of differential need achievement motivation is interesting but lacks empirical support. Okum's arguments would have been much more convincing if he could have demonstrated that the young and elderly actually differ on some measure of need achievement. Okum's hypothesis that the elderly may have experienced more failure in life situations than young people is also interesting, but like Botwinick's perceptions of inadequacy and Rabbit's notion of information processing deficiencies, it does not have empirical data for support.

In general, these explanations of decision making or choice behaviour are inherently unsatisfying. Perhaps the most undesirable aspects are that they deal with hypothetical traits rather than observable events and they necessitate postulating additional hypothetical states to support their existence. The proclivity of gerontological researchers to engage in such hypothetical speculation has had the unfortunate effect of distracting attention away from the basic
process of decision making. Researchers have shifted attention from the actual process of decision making to an investigation of personality correlates of choice behaviour and the patterns of choices themselves have been of little interest.

Another shortcoming of the theoretical formulations is that they have been unable to account for certain configurations of data. They are generally capable of explaining cases of supposed risk avoidance, but are less successful in dealing with cases of age group equivalencies on choice tasks. Thus, the data from the choice dilemma studies supports the model offered by Botwinick (1966) and Okum (1976b), but the data from the prediction and several of the behavioural risk taking studies do not fit at all well. As was noted previously, the theories demand stability of performance across situations, as they are postulating that people use general strategies when facing risky situations. Consequently, they cannot cope with the occurrence of systematic change. Since change seems to occur often in the gerontological studies, the utility of speculating that the elderly consistently use any variety of risk avoiding strategies seems highly questionable.

In short, the experiments and theories developed by researchers to explicate age related changes in choice behaviour have not been successful. Almost 20 years ago, Wallach and Kogan questioned whether the young and elderly performed equivalently in risky decision situations. Today, that question has not yet been adequately answered. The variety of confusing, often contradictory, experimental data has sparked the controversy, but still has failed to clarify the questions
of interest. Theorists are still unable to agree on whether there is a generalized or specific tendency on the part of the elderly to avoid risk, or whether people of all ages perform equivalently in decision situations.

Finally, the notion that age related differences in choice behaviour exist is complicated by the fact that all studies to date have been based on cross sectional designs in which age and cohort effects are hopelessly confounded. Even if actual differences were noted, there would be no logical necessity that those differences would be a function of age and not some other factor. In fact, the considerable variations in historical and socio-cultural factors between the age groups suggests that other factors than age could have influenced the results.

Given the general confusion surrounding the gerontological literature on choice behaviour, it seems imperative to systematically identify the conditions that affect choice behaviour. The traditional gerontological paradigms for studying choice behaviour have suffered from several problems that have hindered this study. But despite these shortcomings, the results of studies examined in this review indicate that one approach to the analysis of choice behaviour is in terms of the information contained in the choice situations. Such an approach has been used with some success in formal studies of decision making.

Researchers interested in formal models of decision making have recognized the importance of parametric values in determining performance in decision situations. It is commonly accepted by decision theorists that choices in risky situations generally reflect the
subject's evaluation of the subjective worth or value of the available alternatives (Edwards, 1962). It has been suggested that these evaluations reflect a procedure in which the person weights the subjective worth of an outcome with its associated probability. This weighting procedure yields a single value describing the worth of the alternative. These subjective value judgements have been demonstrated to closely approximate the expected values generated using the actual outcome and probability values in a choice situation (Pitz and Downing, 1967). It has also been suggested that the person's goal in decision situations is to maximize gains and minimize losses. Decision making in total, then, has been characterized as a process of evaluating alternative end states with the goal of finding an optimal outcome.

Several mathematical models have been offered as characterizations of these evaluative procedures, and have been reported to be quite successful in describing and predicting choice behaviour (Edwards, 1962). The primary goal in developing the models has been to describe the strategies that people use to optimize their performance in decision situations. The models have tended to assume that people treat probabilistic information with a certain mathematical exactitude, and that their choices in decision situations are a direct function of the outcome values and probabilities in the choice situation. Most models have also incorporated the notion that people maximize their gains and minimize losses using the two step procedure described above.

For example, given a choice between a 50% chance of winning $60, and a 60% chance of winning $40, a person is hypothesized to determine the value or utility of each option using a weighting procedure to
integrate the probability and outcome information. If the person were to use the information in a mathematically precise manner, weighting the first outcome, $60, by its associated probability yields \( \times \) 0.5 \times 60, or $30. Weighting the second outcome, $40, by its associated probability yields \( \times \) 0.6 \times 40, or $24. The $30 and $24 are mathematical representations of the expected worth of each alternative. Next, the person is assumed to compare the expected outcome or utility of the two alternatives and choose the one leading to the most desirable end state. The minimization/maximization principle suggests that people will choose the option with the greatest value, and since the expected outcome of the first alternatives leads to higher expected gains, the person would be expected to choose that alternative.

Similarly, if a person were faced with a choice dealing with losses, most models of decision making would predict that the most attractive response option would be the one leading to the smallest expected loss.

The hypothesized use of a minimization/maximization principle in combination with the mathematical weighting procedure implies that a special kind of asymmetry exists in risky choice situations, with choice behaviour in gain and loss situations systematically shifting as a function of situational values. If people were placed in a set of gain and loss situations in which the alternatives had equal probabilities, equal outcomes and reversed outcome directions, the minimization/maximization principle suggests that peoples' choice behaviour should reverse itself as the situations change from gains to losses or vice versa. This should occur because when the outcome
of a choice situation is reversed from gains to losses, alternatives that led to maximal gains in gain situations should lead to maximal losses in loss situations. Conversely, alternatives that led to maximal losses would lead to maximal gains.

For example, in a choice between a sure gain of $5 and a 40% chance of winning $10, the $5 should be more attractive as it leads to the highest expected gain. If, however, the direction of the outcome were changed so that the choice was between losing $5 and a 40% chance of losing $10, the risky alternative should be the most attractive as it leads to the lowest expected losses. In general, then, changing the direction of a choice situation while leaving the other parameters unaffected should bring about predictable changes in behaviour, if people are using minimization/maximization strategies.

Recently, however, researchers have reported that while such shifts do occur, choice patterns deviate from the exact models in certain cases. Kahneman and Tversky (1978) found that people exhibited what they termed risk seeking and risk avoiding behaviour that was unrelated to the expected payoffs calculated in certain choice situations. They found that, within certain limits, and regardless of the theoretical expected payoff or outcome of choice options, people tended to avoid risky options when given a choice between a certain and a risky gain, and to seek risk options when given a choice between a certain and a risky loss. According to the researchers, this occurred because people assigned an unrealistically high value to the certain option in gain situations, and an unrealistically low value to the certain option in the loss situations.
This is best seen in a specific context. Given a choice between a sure gain of $5 and a 60% chance of gaining $10, the expected payoff is $5 for the certain option and $6 for the risky choice. On the basis of expected values, then, one might predict that the second alternative would be the most valuable as it leads to the highest expected gain. Kahneman and Tversky found that across a variety of these situations, people consistently chose the safe alternative, despite the fact that the risky alternative had the highest expected payoff. Because people seemed to prefer the certain to the risky option, they termed this pattern one of risk avoiding behaviour.

Conversely, they found that when the people were given a choice between a certain loss and a risky loss, such as between losing $5 and a 60% chance of losing $10, people consistently chose the risky option despite the fact that it was mathematically expected to yield a greater loss. Because people seemed to prefer risky to certain losses, they labelled this pattern of behaviour risk seeking.

It is beyond the scope of this paper to deal with the complexities of the formal models of decision making in an evaluative context. Therefore, the relative merits of the particular formulations describing people's choice behaviour will not be discussed. The literature seems to be in consensus, however, on the point that within certain limitations, peoples' choice behaviour should exhibit systematic shifts in gain and loss situations. It is this hypothesized shifting of choice as a function of outcome direction that should be of particular interest to gerontological researchers.

There are two reasons why shifts in choice behaviour are of
particular relevance to the gerontological literature. First, the possibility that performance changes as a function of outcome direction suggests that a thorough analysis of choice behaviour of the elderly under conditions of risk must include situations involving gains as well as situations involving losses. In the gerontological literature, attention has been focused primarily on gain situations (Okum, 1976b, 1978) or on situations involving complicated combinations of gains and losses (Wallach and Kogan, 1961). Second, the observation of systematic performance changes on the part of young (university students) and middle aged (university faculty members) that were described as risk avoiding behaviour, suggests that the use of such strategies is not simply a consequence of the aging process, but is probably related to different aspects of the decision situation. Studying the behaviour of people in different age groups under conditions that have been reported to stimulate behaviour shifts could enhance our understanding of age group performance patterns.

These possibilities have not been seriously considered in the gerontological literature, although they are directly related to suggestions by both Botwinick and Rabbit that the elderly prefer completely predictable over risky outcomes. Although neither of those authors explicitly states that situational information and outcome direction are irrelevant factors in choice behaviour, they neglect the importance of these variables. Instead, they focus on personality and physiological variables that are hypothesized to affect choice behaviour. However, since their theoretical formulations have implied behavioural stability across choice situations, the occurrence of behaviour shifts,
such as those predicted by decision making theories, would be both unexpected and difficult to handle.

Since these two bodies of literature suggest that people treat similar choice situations in quite different ways, several issues of age related decision making might be answered if the approaches could be integrated. If it could be demonstrated that people of different ages choose safe or risky alternatives because of the outcome direction, it would be difficult to maintain that the elderly use blanket risk avoiding strategies. On the other hand, if it could be shown that elderly people are not sensitive to shifts in outcome direction, or other situational values, this could be seen as support for the position that elderly peoples' decision strategies are independent of situational factors.

As has been demonstrated, the gerontological and decision making literatures lead to different conclusions regarding the nature of performance patterns in risky decision situations. Differential predictions regarding choice behaviour under conditions of risk can be generated from each position. The overlap of the two fields suggests the possibility of clarifying the questions of age related differences in decision making through an integration of decision making and gerontological research strategies.

The present study attempted to make that integration in an examination of the choice behaviour of people in four age groups (20-30, 35-45, 50-60, 65-75) across gain and loss situations involving choices between certain and risky options. It has been suggested that in these types of situations elderly, but not younger people, exhibit
cautious or risk avoiding behaviour (Wallach and Kogan, 1961; Botwinick, 1973). To examine the position that preference for certain options is a function of age group membership, several aspects of decision making were examined, including preference for completely predictable outcomes and situational stability of choice behaviour.

The investigation focused on people's preferences in situations involving choices between completely predictable and probabilistically determined gains, and between completely predictable and probabilistically determined losses. Subjects were presented with a series of twelve situations logically similar to those used by Botwinick (1966, 1969) in that subjects were presented with a choice between a risky and a certain option. However, in this study, all parametric values including probabilities and payoffs and outcome direction were specified. In addition, these values were varied across choice situations to permit an analysis of the impact of situational information on choice behaviour.

It was predicted that preference for completely predictable options, as opposed to risky options, would be equivalent for people in each of the four age groups. It was further predicted that peoples' preference for certain and probabilistically determined options would be related to the outcome direction of the choice situations.

The design of the study also permitted an examination of the manner in which subjects treated information presented in the choice situations. The three pertinent factors in the situations were the probability of occurrence of the event, the payoff associated with the event, and the outcome direction of the situation. The analysis
focused on whether subjects' choices in the situations could be seen as a simple function of the outcome direction, or, alternatively, as a joint function of the probabilities and payoffs associated with the response options. This was done as an exploratory analysis, and no hypotheses were offered as to which of the alternatives would best describe the subjects' behaviour.

In summary, two aspects of risky decision making were examined in a cross-sectional, age group design: preference for completely predictable options and situational stability of choice behaviour. In addition, subjects' responsiveness to several parameters of choice situations, including probabilities, payoffs, and outcome direction was examined. It was hypothesized that (a) across all age groups, peoples' preferences for completely predictable options would be similar, and (b) peoples' preference for risky and completely predictable options would vary as a function of the outcome direction of the choice situation.
METHOD

Subjects

Subjects were 12 men and 12 women in each of four age groups representing young adulthood (age range 20-30), middle adulthood (age range 35-45), late adulthood (age range 50-60) and old age (age range 65-75).

Subjects in the young, middle, and late adulthood groups were recruited at Langara Community College, the University of British Columbia Summer School, and the Vancouver Public Library. Subjects in the old age groups were recruited at the University of British Columbia Centre for Continuing Education, Brock House Senior Citizens Centre, and the Silver Harbour Activity Centre.

Detailed descriptions regarding the choices of age groupings and the subject sampling procedures are presented in Appendices A and B.

Table 1 shows the socio-demographic characteristics of subjects within each age group. Examination of this table indicates that across all age groups the average level of educational achievement was high, with most subjects reporting at least some university education. The educational levels of the young, middle, and late adults were similar, while the elderly adults received somewhat less education than people in the other groups. Analysis of variance procedures indicated that there were significant differences between the groups, with the elderly differing from the other groups, $F(3,88) = 4.61$, $p = .002$.

Across all age groups, the majority of subjects (56%) were married. Fifteen percent of the subjects were single and 12% separated.
### Table 1

**Socio-Demographic Characteristics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Young Adults</th>
<th>Middle Adults</th>
<th>Late Adults</th>
<th>Elderly Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td><strong>Age (in years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>27.3</td>
<td>27.7</td>
<td>38.9</td>
<td>39.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.3</td>
<td>2.2</td>
<td>3.4</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>15.7</td>
<td>15.9</td>
<td>16.3</td>
<td>15.4</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.6</td>
<td>1.7</td>
<td>2.1</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>9</td>
<td>4</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Common Law</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Divorced/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separated</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Widowed</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Never Married</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Employ. Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Unemployed</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>In training</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Retired</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Homemaker</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Three percent were divorced and 3% were living in a common-law arrangement. As might be expected, a considerable number of elderly women were widowed (50%). Three percent of the subjects did not report their marital status.

Across the three younger age groups, both males and females tended to be employed (56%), while in the old age group the majority of the people (79%) were retired. A small number of people (7%) were in training for employment. Five percent of the sample reported being unemployed, 3% listed themselves as being homemakers, and 2% did not report their employment status.

Apparatus

Instrument Development. The risk taking instrument was based on a questionnaire developed by the author. In its initial form, the questionnaire contained 20 two-alternative choice items. The outcome of one alternative course of action was completely predictable, while the outcome of the other occurred with some specified probability. The 20 items were divided into 10 pairs, each pair consisting of a situation involving a potential loss, and a corresponding situation involving a potential gain. For the two members of an item pair, the probability and outcome values were equivalent, while the outcome direction was reversed. If the $p_{\text{winning}}$ in a gain situation was .5 and the amount to be won was $50, the $p_{\text{losing}}$ in the corresponding loss situation was .5 and the amount to be lost $50.

The parametric values of the item sets were controlled with probabilities ranging from .5 to 1.0, and amounts ranging from $6 to $10,000. The probabilities and outcome values were balanced across
situations, so that in one half of the situations, regardless of outcome direction, the expected outcome of the certain alternative was highest, while in the remaining half the expected outcome of the risky alternative was highest.

In scoring the questionnaire, the completely predictable alternative was assigned the value of 1 and the risky alternative the value of 2. Subjects' scores were cumulated for the gain and loss situations, yielding two scores, one summarizing behaviour in gain situations, the other describing behaviour in loss situations.

The 20-item instrument was pretested on a sample of 55 university undergraduate students ranging in age from 18 to 45. Risk seeking scores were computed for both the gain and loss situations. This yielded two subscales focusing on gain and loss situations. Reliability checks involving different combinations of items were performed for each subscale using the Spearman-Brown split half reliability coefficient as a target. Items that contributed little to, or detracted from the value of the coefficient were discarded. The 6 item pairs yielding the best scale characteristics were retained and used in the final instrument.

Reliability Information. Since the final questionnaire assessed choice behaviour in two distinct types of situations, Spearman-Brown split half reliability coefficients were computed separately for each subscale. All coefficients were based on pre-test data. The reliability coefficient for the gain subscale was .64 and the coefficient for the loss subscale was .58. Because the length of a test strongly influences the value of the reliability coefficient, and because the
scales were of limited length, a variation of the Spearman-Brown coefficient was used to estimate scale reliability independently of scale length. As recommended by Ferguson (1971), reliability coefficients were calculated for tests with 100 items. The reliability estimates obtained with this procedure were .97 for the gain items, and .94 for the loss items. The estimates obtained with this procedure indicated that the initial moderate estimates were due to test length, rather than to inconsistencies in the questions.

The Final Instrument. The 6 item pairs contained in the final instrument are listed in Appendix C. The 12 situations were designed to be analogues of real life economic dilemmas. Efforts were made to make the items as realistic as possible, with item topics such as moving to a new neighbourhood, buying a car, and investing money. Each situation has two potential outcomes, one completely predictable, the other associated with some specified degree of risk. For each situation, subjects were asked to decide which alternative was most appropriate to the situation. Separate scores were calculated for the gain and loss situations. A third score based on the number of completely predictable options chosen was also computed.

Procedure

All subjects were approached and asked to participate in a study of decision making. If they expressed willingness to participate, they were given a 12 item forced choice questionnaire containing 6 gain and 6 loss situations. The experimenter briefly explained the instrument and the instructions for recording choices. It was emphasized that the questionnaire was not a test, that there were neither
right nor wrong answers, and that the experimenter was only interested in the choice patterns of the people being tested. After completing the test, the subjects were informed in more detail of the hypotheses being tested. All interested subjects were sent a brief description of the findings and the interpretations of the results.
RESULTS

In the first stage of the analysis, three indices of risk taking were computed. The first, preference for certainty, was based on the total number of completely predictable options chosen by each subject. Completely predictable options were scored as 1 and summed across situations yielding an index with a value range of 0-12, with higher scores associated with a stronger preference for certainty. The second and third indices measured peoples' choice preferences in gain and loss situations. Choices of the completely predictable option were scored as 1 and of the risky option as 2. Scores were summed over each type of outcome yielding two indices with value ranges of 6-12. Thus low scores were associated with preference for certain options and high scores with preference for risky options.

The measures were analyzed using analysis of variance procedures as described in the Statistical Package for the Social Sciences. All measures were analyzed using a group by sex design. Theoretically, there was little reason to suspect that sex differences existed. Nevertheless, common stereotypes often depict women as inferior in decision situations. To determine if performance differences existed between men and women, sex was included as a design factor.

To test the hypothesis that people in older and younger age groups have similar preferences for completely predictable options, a 4x2 (age x sex) analysis of variance was performed, using the certainty index as the dependent measure. The results of this analysis are shown in Table 2.
Table 2

Analysis of Variance Results for the Certainty Index

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>3</td>
<td>22.59</td>
<td>7.53</td>
<td>1.82</td>
<td>.15</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>0.95</td>
<td>0.85</td>
<td>0.23</td>
<td>.63</td>
</tr>
<tr>
<td>Age x Sex</td>
<td>3</td>
<td>3.09</td>
<td>1.03</td>
<td>0.25</td>
<td>.86</td>
</tr>
<tr>
<td>Error</td>
<td>88</td>
<td>363.71</td>
<td>4.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>390.34</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This analysis revealed no statistically significant effects for either age, sex, or the age by sex interaction. Thus, the hypothesis that there are differences in members of different age groups' preferences for certain options was not supported.

Examination of the group means indicated that the elderly group scored slightly higher than the other groups. In addition, the mean values tended to increase with increasing age. The middle adults chose the fewest completely predictable options (6.04), followed by the young adults (6.54), the late adults (6.84), and the elderly adults (7.39). As noted earlier, however, these differences are not statistically significant.

The indices of risk taking in gain and loss situations were analyzed using a 4x2x2 (age group by sex by outcome type) analysis of variance, with repeated measures on the final factor of outcome type. This was done to test the hypothesis that people's choices are affected by outcome type. The results of this analysis are shown in Table 3.

The analysis revealed a statistically significant effect for outcome type, supporting the hypothesis that outcome type influences choice behaviour. There were no statistically significant effects for age groups or sex. Neither the two nor the three way interactions were statistically significant.

Examination of the mean values of the indices indicated that the significant effect of outcome type was due to subjects choosing more risky options in loss situations than in gain situations. In loss situations, people chose on the average 3 risky and 3 certain alternatives. In gain situations, subjects chose on the average 4 certain
Table 3
Analysis of Variance Results for the Gain and Loss Scores

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>3</td>
<td>11.60</td>
<td>3.87</td>
<td>1.87</td>
<td>.14</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>0.48</td>
<td>0.48</td>
<td>0.23</td>
<td>.63</td>
</tr>
<tr>
<td>Group x Sex</td>
<td>3</td>
<td>1.55</td>
<td>0.52</td>
<td>0.25</td>
<td>.86</td>
</tr>
<tr>
<td>Subjects (Groups)</td>
<td>88</td>
<td>181.86</td>
<td>2.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>1</td>
<td>24.08</td>
<td>24.08</td>
<td>14.78</td>
<td>.001</td>
</tr>
<tr>
<td>Group x Outcome</td>
<td>3</td>
<td>4.45</td>
<td>1.48</td>
<td>0.91</td>
<td>.44</td>
</tr>
<tr>
<td>Sex x Outcome</td>
<td>1</td>
<td>0.52</td>
<td>0.52</td>
<td>0.32</td>
<td>.57</td>
</tr>
<tr>
<td>Sex x Group x Outcome</td>
<td>3</td>
<td>3.18</td>
<td>1.06</td>
<td>0.65</td>
<td>.58</td>
</tr>
<tr>
<td>Outcome x Subjects (Groups)</td>
<td>88</td>
<td>143.41</td>
<td>1.63</td>
<td></td>
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</tr>
</tbody>
</table>
and 2 risky options. This pattern was very consistent across the age groups.

A second set of analyses were conducted to examine whether people's choices were a simple function of outcome direction or a joint function of probability and outcome values. To achieve this end, two indices were constructed. The first index represented agreement between subjects' choices and predictions generated based on the outcome direction of the choice problems. From this index, subjects' responses for each item were assigned the value 1 if they chose either a completely predictable option in a gain situation or a risky option in a loss situation. The second index represented agreement between subjects' choices and predictions generated based on the probability and payoff values of each situation. Subjects' scores were assigned a value of 1 if they chose the option leading to either the highest expected gain or the lowest expected loss. For each index, scores were summed across the 12 situations yielding two scores with value ranges of 1-12.

To determine if the number of correct predictions generated by the two sets of criterion differed, a 4x2 (age group by predictor type) repeated measures analysis of variance was conducted on the two above mentioned indices. The results of this analysis are presented in Table 4.

The analysis revealed a significant effect for predictor type. Neither the group effect nor the group by predictor type interaction was significant. Examination of the means indicated that more correct predictions were generated using both probability and payoff
Table 4

Analysis of Variance Results for Predictor Types

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>3</td>
<td>4.03</td>
<td>1.34</td>
<td>0.67</td>
<td>.57</td>
</tr>
<tr>
<td>Subjects (Age)</td>
<td>92</td>
<td>184.80</td>
<td>2.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>1</td>
<td>8.08</td>
<td>8.08</td>
<td>7.97</td>
<td>.006</td>
</tr>
<tr>
<td>Age x Type</td>
<td>3</td>
<td>5.34</td>
<td>1.74</td>
<td>1.72</td>
<td>.17</td>
</tr>
<tr>
<td>Type x Subj. (Age)</td>
<td>92</td>
<td>93.95</td>
<td>1.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
information than were generated using outcome direction alone.

Although there was a statistically significant effect for predictor type, the absolute number of matching predictions was not particularly high for either model (mean values of 7.5 and 6.3 for the probability/payoff and outcome predictions respectively). To determine if the mean number of correct predictions differed from values expected due to random fluctuation, the mean values were converted to proportions and compared to a random expectation of .50 correct predictions.

Before conducting this analysis, however, Chi Square analyses were conducted to determine if the age groups treated the individual items differently. It was found that, with one exception, the age groups responded in like manner to each situation. Because of the similarity across groups, it was decided to collapse the four groups into one. The following analyses are based on the response patterns of the entire sample.

$t$-tests for the difference between two proportions were then conducted for the two indices of matching predictions, using procedures described in Glass and Stanley (1971). The proportion of matches generated using probability and outcome values (.63) differed significantly from a chance expectation of .50 ($Z = .26, p = .05$). The proportion of matches generated using outcome direction (.56) did not differ significantly from chance expectations ($Z = 1.2, p = .05$).

While the analysis of proportions indicated a significant effect for predictions based on probabilities/payoffs, the absolute number of correct matches generated was only 7.5 of a possible 12 predictions. This less than perfect success of the prediction techniques led to a
decision to further examine the individual items. As in the above analyses, the following discussion is based on the choice patterns of the entire sample.

Across the majority of positive items, there seems to have been a tendency for subjects to choose certain rather than risky options (Table 5). This was particularly true when the certain option led to the highest expected gain. When the risky option was associated with the highest expected outcome, the certain option was still chosen close to 50% of the time.

Across the negative items, there was a tendency for subjects to choose risky options when they led to the lowest expected loss. However, this did not appear to be as strong as the tendency to choose certain options in gain situations when they led to the greatest gains. When the risky options were associated with the highest expected loss, people tended to prefer the certain alternative. However, a substantial number chose the risky option in these situations.
Table 5
Percent of Subjects Choosing Certain and Risky Options

<table>
<thead>
<tr>
<th>Item</th>
<th>Gain Situations</th>
<th></th>
<th></th>
<th>Loss Situations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Certain</td>
<td>Risky</td>
<td>Item</td>
<td>Certain</td>
</tr>
<tr>
<td>1</td>
<td>56%</td>
<td>44%*</td>
<td>7</td>
<td>16%</td>
</tr>
<tr>
<td>2</td>
<td>45%</td>
<td>55%*</td>
<td>8</td>
<td>52%</td>
</tr>
<tr>
<td>3</td>
<td>84%*</td>
<td>16%</td>
<td>9</td>
<td>73%**</td>
</tr>
<tr>
<td>4</td>
<td>55%*</td>
<td>45%</td>
<td>10</td>
<td>44%</td>
</tr>
<tr>
<td>5</td>
<td>46%</td>
<td>54%*</td>
<td>11</td>
<td>55%**</td>
</tr>
<tr>
<td>6</td>
<td>84%*</td>
<td>16%</td>
<td>12</td>
<td>60%**</td>
</tr>
</tbody>
</table>

* greatest expected gain
** lowest-expected loss
The data supported the position that adults of all ages treat decision situations similarly. The results of the two primary analyses indicated no statistically significant differences between age groups on any of the indices of risk taking. The elderly people chose certain options no more often than the younger people and, like the younger people, tended to choose more certain options in gain than in loss situations. The complete absence of between group differences suggests that formulations of age related risk aversion are incomplete.

The analysis of the certainty index revealed that there was no special tendency for the elderly to choose completely predictable alternatives. Although there were some differences between the groups, with the elderly receiving slightly higher scores, the differences were neither statistically significant nor of the magnitude reported in previous research (Botwinick, 1969).

The finding of similar choice preferences under such conditions for all age groups is directly contrary to Botwinick's report that the elderly prefer completely predictable over risky options and are also inconsistent with his position that the elderly employ risk avoiding strategies. In Botwinick's work, it was reported that a substantial number (Botwinick does not give an exact figure) of the elderly chose a completely predictable option when one was available. In the present study, subjects in each of four age groups tended to divide their choices between risky and certain options. The fact that the elderly did not choose a majority of completely predictable options
is difficult, if not impossible, to reconcile with the notion that the elderly are averse to risk. Since both risky and safe options were equally available, the elderly should have chosen the safe options if they were truly risk averse. That they did not exhibit a strong preference for the certain options can only indicate that they were not using special risk avoiding strategies.

One possible reason for the discrepancies between Botwinick's results and those reported by the author is that the quality and amount of information presented in the studies differed. One of the criticisms of the choice dilemma instrument mentioned earlier is that the situations were vague. Subjects may, consequently, have been put in the position of having to make a judgement based on vague and inadequate information. The behaviour patterns observed by Botwinick may have been caused by the manner in which each age group reacted to the structure of the choice item. As Basowitz and Korchin (1957) noted, elderly people may react negatively to ambiguous stimulus configurations. In the choice dilemma studies, if the elderly perceived the items as ambiguous, they could have chosen non-risky options not because they were cautious, but because they perceived that there was not enough information for them to make an adequate judgement. It is entirely possible that under such circumstances they may have adopted a strategy in which ambiguous but certain alternatives were given a higher value than alternatives that were both uncertain and risky.

This suggests that differences in responsiveness to the quality of stimulus materials, rather than risk aversion could have produced Botwinick's results. In the present study, in which all values of the
response options were explicitly stated, risk avoiding was not observed. The similarities in choice behaviour observed under these conditions may have occurred because the information was sufficiently clear to prevent subjects' responses to the decision situations from being confounded with their reaction to the quality of information in the situations.

My contention that elderly people respond differentially to situational information also receives some support from the studies of vocabulary test taking behaviour reported by Okum (1975, 1978), who studied choice behaviour when the expected outcome values of high and low risk options assumed several values. He found that behaviour which initially suggested that elderly people were more cautious than younger subjects was actually a function of the way that the two groups responded to the expected outcomes of the items. When the payoffs associated with low and high risk options were equal, the elderly chose more low risk options than the younger people, making them appear more cautious. But when the expected outcome of the high risk option was made greater than the outcome for the low risk option, the elderly people chose the high risk option as frequently as the younger people. The supposedly cautious behaviour of the elderly was actually due to the age groups' differential responses to the expected outcome of the options.

The analysis of subjects' response patterns across outcome types supported the notions that (a) people in all age cohorts tend to use similar strategies in evaluating risky situations, and (b) people's choices can be viewed to some extent as a function of the outcome
direction of the choice situation. In addition, the lack of significant between group differences on either measure again points out that age group membership is an irrelevant variable in simple decision tasks.

Of most interest was the finding that for all age groups, choice patterns shifted as a function of outcome direction, with the response distribution being comparable for each age group. Since the groups differed in age and other variables, it seems likely that these similarities in performance were due to the fact that people used similar strategies in evaluating the options.

The finding that people's preferences shifted as a function of outcome type is consistent with Okum's report (Okum, 1978) that choice behaviour shifts as a function of expected payoffs of the available choices. It is also consistent with Burkhill and Schaie's finding that situational contingencies influence the performance of the elderly. These studies provide evidence that the elderly are sensitive to situational information and seem to formulate decision or choice strategies on the basis of that information.

The findings of the two main analyses indicated that there was no evidence of cautious or risk avoiding behaviour on the part of the elderly. In addition, the elderly were shown to behave similarly to young, middle, and late adults. These results support the position that the elderly are not necessarily cautious, risk averse, and/or inefficient in risky choice situations.

Attempts to link people's choice patterns to a particular combination of situational parameters were less than totally successful. Predictions generated using the expected values of the items both
matched subjects' choices more closely than did predictions based on outcome direction and differed significantly from chance expectations. However, neither set of predictions matched the data very well.

In retrospect, this is not completely surprising. It seems likely that people, even in simplified situations such as the analogues of life events used in the present study, use more complex decision strategies than those used to generate predictions. In fact, the analyses suggested that people's responses may have been influenced by aspects of the situations incorporated into each of the predictive methods. It was found that when the expected payoff for a certain alternative in a gain situation was higher than the expected payoff for a risky option, people tended to choose the certain option. In cases where the risky option had the highest payoff, however, people's choices tended to be distributed between the risky and certain alternatives. A slightly weaker version of this phenomenon was observed in loss situations. People tended to choose the risky option if it led to the smallest expected loss. When the risky option led to the greatest expected loss, people preferred the certain option, although a substantial number still chose the risky option.

This finding suggests that people may simultaneously prefer particular types of response options and particular response values. People appear to prefer completely predictable options in gain situations, particularly when the expected outcomes of the options agree with their choices. The converse may hold true for loss situations, although the case is not nearly as clear, with people preferring risky options, particularly if they have the lowest expected values. The
splits between risky and certain options may have occurred because on
some of the items, people's preference for a specific type of alterna­
tive may have conflicted with their preference for a specific outcome
value.

In brief, the results of the present study provide additional evi­
dence that the elderly are neither more cautious nor risk averse than
younger adults. Thus the results stand beside an increasing array of
evidence that people of all ages perform similarly in many choice situ­
ations. The present results are also of particular value in that they
provide the first indication that the elderly do not necessarily choose
completely predictable options when such options are available to them.
This finding counters the claim of gerontological researchers that the
elderly use special risk avoiding strategies. The results of this and
other studies have indicated that older adults are neither cautious
in decision situations, nor particularly prone to use risk avoiding
strategies to extricate themselves from risky situations. Much of the
available evidence suggests that differences in choice behaviour, when
they are observed, are more likely to be a function of situational
variables than personality traits such as cautiousness. These findings
do not lead to the conclusion that differences in decision making
strategies or choice behaviour across age groups are non-existent. In
fact, as will presently be pointed out, such differences may exist.
The results do suggest that it is a mistake to attempt to measure in­
stances of cautiousness using decision making tasks. The present
research suggests that decision making is a multi-dimensional pheno­
menon, and that all dimensions must be considered if research is to
clarify the conditions under which performance differences may occur.

The results of this and other studies suggest that there may be some interesting differences in choice behaviour across age groups. For example, the findings of Okum (1976b, 1977) indicate that people of different ages may weight information differently when choosing between risky options. Since in his study, expected payoff was associated with differential patterns of performance across ages, it seems reasonable to suggest that one line of research could begin there. Systematically manipulating the expected payoffs of different types of choice options could yield information that could help paint a more accurate picture of the meaning of this variable to different age groups. Such a strategy has been successfully employed in a study of decision making, although not in a life span context. Slovic and Lichenstein (1967) devised a set of gambles that enabled them to assess people's preferences for probabilities and payoffs independently of each other. Their results helped to clarify the meaning of those values to people. There is a clear need for the application of similar strategies to the issue of choice behaviour across the life span. Only by applying such systematic strategies will we be able to understand the ways in which people treat decision situations at different points in their lives.
REFERENCES


APPENDIX A

Selection of the Age Groupings

The age ranges used in this study are based on theoretical conceptions of the life span. After reviewing the different conceptualizations of adult development (Buhler, 1968; Erikson, 1963; Kimmel, 1974; Peck, 1969), four developmental groups were defined. The groupings, while approximate, represent an integration of the adult life stages and associated time periods identified by these theorists. In keeping with the primary emphases of the theories, the groupings are based primarily on social markers identified with certain periods of adult life.

Each of the periods identified has its own particular context. Young adulthood is often a time for starting a career, marrying or establishing a permanent relationship, and settling into an adult role. This is the time that Buhler associates with self determination of goals and which Erikson relates to the need to establish a truly intimate relationship. Estimates of the age range of this category from age 15 to an end point somewhere between 20 and 30.

Middle adulthood has been a period largely ignored by life span researchers, but perhaps the most central characteristic of this period was captured by Shakespear who identified the age of the soldier. There seems to be a certain validity in conceptualization that the central characteristic of this period is a concern with adventure or power. In modern life, middle adulthood is often a time when one's attention is turned to furthering ambitions through career and family activities.
Late adulthood is often a time for assuming positions of career and life importance. During this period the person's power and influence are often at their zenith. Along with middle adulthood, this time is often associated with Erikson's notion of generativity, and with Buhler's idea of self assessment. Buhler suggested that the time boundaries for this period were approximately between ages 45 and 65.

Old age often means retiring from career and family activities and developing new activities or interests. Theorists typically view old age as a time for summing up and pronouncing judgement on one's life. Buhler has envisioned old age as a time to experience the feelings of either success or failure regarding life. Erikson has stated that the central problem of the elderly person is to make sense of his life and to accept it as a meaningful experience. Almost without exception, theorists have set the boundary for entry into old age at or near age 65.

It is recognized that these groupings and age ranges are somewhat arbitrary. This arbitrariness is inevitable, as there is no agreement on the most appropriate way to divide up the life span. The groupings have a degree of content validity, however, in that they reflect the speculations of leading life span theorists. In addition, the age ranges possess a certain face validity. People falling into each group can often be differentiated from members of other groups. Thus while one might confuse a 35 and a 40 year old, there is little likelihood that one would confuse a 35 year old with either a 25 year old or a 50 year old. In short, while these groupings are not
offered as definitive life stages, they are seen as a reasonable way to divide the life span into meaningful groups.

Defining the Age Ranges

To keep the periods as distinct as possible, it was decided to place 5 year buffer zones between the age groupings. This was done primarily for statistical reasons. In cases where the path of development is unknown and developmental periods cannot be clearly specified, allowing age groupings to border too closely upon each other may lead to distortions in the data analyses. If performance changes occurred near a boundary, the changes would be reflected in the performance of all people lying near the boundaries regardless of group membership. This would result in increased variability within groups and decreased variability between groups. Physically separating the groups helped to ensure that performance patterns could be more clearly seen as a function of group membership.
APPENDIX B

Subject Selection Procedures

Because of the problems involved in recruiting subjects from a variety of age groups, a specific rationale for selecting subjects was used in this study. It has long been recognized that cohort specific effects may affect subjects' performance on dependent measures in unpredictable ways and a considerable body of literature has accumulated analyzing experimental designs that separate age and cohort effects. There is a smaller amount of literature dealing with the problems of cohort differences in sampling procedures. Nunally (1976) has suggested that it is quite easy to obtain comparable samples for cross sectional studies as long as the researcher follows randomization or quasi-randomization procedures. While it may be true that randomization is the best procedure, at a theoretical level, it is nearly impossible to put into practice.

The logistical difficulties involved in implementing randomization procedures in life span research, and particularly in cross sectional studies, put it beyond the reach of most researchers. Stated most simply, adults seem to resist attempts to 'randomly sample' them. They are usually difficult to find and often unwilling to participate after contact has been made with them. Because recruitment then becomes limited to that very select subgroup of adults that is willing to put up with the psychological researcher, the basic tenets of randomization procedures are violated.

Gerontological researchers have often resorted to an alternative
strategy involving matching groups of adults of different ages on some variable of global importance, such as education or IQ. While this strategy may superficially appear to produce comparable groups, cohort effects operate directly against this. Mismatching actually occurs because the distribution of values for the matching variable often differs between cohort groups. For example, 12 years of education is the modal amount of education in the 20-30 year old cohort group, while 12 years of education in the 65 year old cohort is in the top of the distribution of educational achievement. If between group comparisons were done after matching on the basis of education, performance comparisons would actually be between the top performers in the elderly cohort and the modal performers in the younger cohort. A similar situation would occur if IQ, SES, or any other variable susceptible to historical forces were used as a matching variable. These problems rule out matching as a satisfactory way of achieving comparable groups in life span research.

For the reasons mentioned above, both randomization and matching were deemed inappropriate strategies for this study. Instead, another method of subject selection involving a quasi-matching procedure was used. Only subjects who had first self selected to participate in special educational or enrichment activities were asked to participate in the study. The assumption underlying this approach is that subjects seeking similar activities were more likely to occupy similar positions within their age cohorts. For example, people from each cohort who are interested in intellectual activities are more likely to fall into similar ability levels within their cohorts than people chosen by other
means. Recruiting subjects who might be expected to be similar with respect to their cohort distributions helped to ensure that between group comparisons would not be confounded by systematically mismatched variables.
APPENDIX C

INSTRUCTIONS

On the following pages are a number of stories about situations that might occur in life. In each situation a person is faced with two courses of action. The outcome of one course of action is completely predictable. The outcome of the other involves a certain amount of risk.

For each situation I would like you to read over the story and decide which course of action seems most appropriate for the situation.

When you have made a choice, please make a check mark on the line in front of your choice.

There are no right or wrong answers for these situations. We only wish to see what types of alternatives people choose.

Thank you very much for helping me with this study.
DEMOGRAPHIC INFORMATION

PLEASE ANSWER THE FOLLOWING QUESTIONS

AGE IN YEARS: 

SEX:     MALE     FEMALE

MARITAL STATUS:     MARRIED     SINGLE     SEPARATED
                     WIDOWED     DIVORCED     COMMON LAW

EDUCATION: PLEASE CHECK THE HIGHEST LEVEL OF EDUCATION YOU HAVE REACHED.

<table>
<thead>
<tr>
<th>Grade</th>
<th>University-Undergraduate 1 Year</th>
<th>University-Post Graduate 1 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 8</td>
<td>1 Year</td>
<td>1 Year</td>
</tr>
<tr>
<td>Grade 9</td>
<td>2 Years</td>
<td>2 Years</td>
</tr>
<tr>
<td>Grade 10</td>
<td>3 &quot;</td>
<td>3 &quot;</td>
</tr>
<tr>
<td>Grade 11</td>
<td>4 &quot;</td>
<td>4 &quot;</td>
</tr>
<tr>
<td>Grade 12</td>
<td>5 &quot;</td>
<td>5 &quot;</td>
</tr>
<tr>
<td>Grade 13</td>
<td>6 or more - Specify</td>
<td>6 or more - Specify</td>
</tr>
</tbody>
</table>

EMPLOYMENT:

WHAT IS YOUR PRESENT EMPLOYMENT STATUS?     IN TRAINING FOR EMPLOYMENT
                                          RETIRED     HOMEMAKER
                                          EMPLOYED     UNEMPLOYED

IF YOU ARE RETIRED, WHAT WAS YOUR PROFESSION DURING YOUR WORKING CAREER?

IF NOT RETIRED, WHAT IS YOUR PROFESSION?

IF YOU ARE, OR HAVE BEEN, MARRIED, WHAT IS (WAS) YOUR SPOUSE'S PROFESSION?
1. A man is considering investing in the grocery business, and is trying to decide which of two small stores to buy.
   ___ Store 1: There is a guaranteed annual return of $5000.
   ___ Store 2: There is a 60% chance of making $10,000. annually, and a 40% chance of making no profits.

2. A person has inherited a sum of money and wishes to invest it for a term of one year.
   ___ Plan 1: Purchase a blue chip stock with a guaranteed annual return of $1000.
   ___ Plan 2: Purchase stock in a company with 70% chance of making a profit of $2000. and a 30% chance of making no profit.

3. A person works in a travel agency and can vacation for free in one of two company owned places, provided that paying customers are not occupying the space.
   ___ Place 1: It is absolutely certain that he will be able to stay there for 8 days.
   ___ Place 2: There is a 60% chance of staying for 10 days, and a 40% chance the reservations will be cancelled.

4. A person is trying to decide which of two neighbourhoods to move to.
   ___ Place 1: It is absolutely certain that living expenses will be $700 less per year.
   ___ Place 2: There is a 70% chance that living expenses will be $900 less per year, and a 30% chance that they will remain the same.
5. A person has decided to attend university and must choose which of two schools to attend. Both schools are excellent and will lead to good careers.

   School 1: The school will provide a summer laboratory assistantship paying $1500.

   School 2: The school reports that there is an 80% chance of getting a summer assistantship worth $2500, and a 20% chance that there will be no assistantship available.

6. A person is playing a card game and is in danger of losing a certain amount of money. He is trying to decide which strategy to follow.

   Strategy 1: It is absolutely certain that this will result in losing $80.

   Strategy 2: With this strategy there is a 60% chance of losing $100 and a 40% chance of breaking even.

7. A person is being forced to relocate to a new place, and is trying to decide which of two places to move to.

   Place 1: It is absolutely certain that the cost of home maintenance will increase by $700.

   Place 2: There is a 70% chance that the cost of home maintenance will increase by $900, and a 30% chance that the costs will be the same as they are now.

8. A person has been offered a choice between a special lottery ticket and a sum of money.

   Choice 1: $900.

   Choice 2: A ticket with a 50% chance of winning $1500, and a 50% chance of being worthless.
9. A person has decided to attend a private school, and must decide which of two schools to attend.
___ School 1: It is certain that he/she will have to pay $1500. in tuition and fees.
___ School 2: There is an 80% chance of having to pay $2500. in tuition and a 20% chance of receiving a scholarship and not having to pay anything.

10. A person is trying to decide how to declare his income on a business form. There are two legal options open to him.
___ Option 1: It is absolutely certain that he will have to pay $900. in corporate fees.
___ Option 2: There is a 50% chance of having to pay $1500., and a 50% chance of not having to pay anything.

11. A man is trying to decide which of two equally priced cars to buy, and would like to make the best purchase. One is a standard model, and the other may become a collector's item.
___ Car 1: It is absolutely certain that the value of the car will decrease by $1000. a year.
___ Car 2: There is a 70% chance that the value of the car will decrease by $2000. a year, and a 30% chance its value will not decrease at all.

12. A person wishes to dissolve a business and is trying to decide when is the best time to do so.
___ Time 1: Dissolving the business now means a certain loss of $5000.
___ Time 2: Waiting for 6 months means there is a 60% chance of losing $10,000., and a 40% chance of breaking even.