INFORMATION SEEKING BEHAVIOR AMONG STUDENTS OF EDUCATIONAL ADMINISTRATION: A BAYESIAN NORMED STUDY

by

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ABSTRACT

The information seeking behaviour of decision makers is an important aspect of the rational decision making process. This study examined the information seeking behaviour of students of educational administration in an attempt to more fully understand the decision making process and thus provide a basis for improving rational decision making.

A statistical decision game was devised which utilized a Bayesian norm. The value of information to a decision maker was calculated from the game and then compared to the value defined by the Bayesian norm.

The sample consisted of twenty-nine part-time students enrolled in winter session courses in the University of British Columbia (U.B.C.) Department of Educational Administration. This sample included students with various amounts of completed class work and educational administrative experience.

Three independent variables were defined. The first variable, administrative experience had two levels. One level consisted of those with at least one year of administrative experience, the other consisted of those with no administrative experience. The second variable, graduate level training, had two levels. One level consisted of those who had completed at least three units of graduate level course work in educational administration. The other consisted of those who had not completed any coursework. The third variable, consisted of three divisions with two levels each and introduced varia-
tion across the eight games.

The dependent variable, information seeking bias, was defined as the difference between the quantified value of information to the decision maker and that value ascribed by the Bayesian norm.

The sample was tested in separate groups ranging in size from three to six. Each person in a group viewed the same sequence of eight games, corresponding to the eight treatment levels of factor C; however, each group had a different randomly determined sequence of games.

The following five research questions were examined:
(1) Do students of educational administration tend to seek the same amount of information as purely Bayesian players in a programmable decision situation?
(2) Do students of educational administration with administrative experience behave differently than students with no administrative experience in their tendency to seek information?
(3) Do students of educational administration who have completed three or more units of graduate level training in educational administration behave differently than students with no training in their tendency to seek information?
(4) Among students of educational administration does varying the prior probabilities and payoff parameters in the statistical decision game effect the tendency to seek information?
(5) Does information seeking bias change over the sequence of games? Does learning take place?

The experimental design was based on Winer's (1971) three factorial repeated measure design (case II). In research question four a Scheffe Test was to be employed if the previous analysis indicated certain combinations of treatment levels in factor C had resulted in significant findings. Research question five was analyzed by graphing the information seeking bias for the various subject groups over the sequence of games.

It was found that the group as a whole showed a strong tendency to seek more information than the Bayesian optimal. The hypothesis that the mean information seeking bias between the two levels of experience and training was the same could not be rejected. However, the interaction effects between factors A (experience) and C (repeated measures) and between factors B (training) and C were found to be significant at the .10 level. Finally, strong learning curves were noted for all subject groups. As the sequence of games progressed, the mean information seeking bias for all subject groups more closely approximated the Bayesian optimal strategy. It was noted, however, that experienced administrators tended to approach the Bayesian optimal strategy at a faster rate than the non-experienced group.

The study concluded by recommending that programme developers in educational administration should attend to
(1) the previous training and administrative experience of students and (2) the conditions under which decisions are made, when planning for future programs on decision making.
## TABLE OF CONTENTS

| LIST OF TABLES | ix |
| LIST OF FIGURES | x |

### CHAPTER

1. **INTRODUCTION**
   - DEFINITION OF CONCEPTS... 2
   - THE RATIONAL PROCESS... 5
   - REVIEW OF RESEARCH... 7
     - Analysis of Closed System Decisions... 8
     - The Bayesian Approach... 9
     - Information in Rational Decision Making... 11
   - STATEMENT OF THE PROBLEM... 12
     - General Problem Statement... 13
     - Expected Outcomes... 13

2. **DESIGN AND METHODOLOGY**
   - THE SAMPLE... 16
   - DEFINITION OF VARIABLES... 18
     - The Independent Variables... 18
       - Grouping factor A (experience)... 18
       - Grouping factor B (academic course work)... 19
     - Repeated measures factor C... 20
     - The Dependent Variable... 21
EXPERIMENTAL PROCEDURES ........................................ 26
Design of the Study ......................................... 29
Dimensions of factor C .................................. 29
Procedures .................................................. 31
Training of Umpires .................................... 33
Administration of Game ................................. 34
RESEARCH QUESTIONS AND ANALYSIS .................. 35
Research Question Number One ....................... 35
Research Question Number Two ....................... 36
Research Question Number Three ..................... 38
Research Question Number Four ....................... 38
Research Question Number Five ....................... 39

3. RESULTS .................................................. 41
Research Question Number One ....................... 41
Research Question Number Two ....................... 41
Research Question Number Three ..................... 44
Research Question Number Four ....................... 44
Research Question Number Five ....................... 50

4. INTERPRETATION OF RESULTS .......................... 55
LIMITATION OF THE STUDY .............................. 55
DISCUSSION OF RESULTS .................................. 56
Research Question Number One ....................... 57
Research Question Numbers Two and Three ......... 59
Research Question Number Four ....................... 60
Research Question Number Five ....................... 63
5. SUMMARY AND IMPLICATIONS OF THE STUDY .............. 65
   SUMMARY OF EXPERIMENTAL PROCEDURES, RESEARCH QUESTIONS AND FINDINGS .............. 65
   IMPLICATIONS FOR THEORY, FUTURE RESEARCH AND PRACTICE ........................................ 70

BIBLIOGRAPHY .............................................. 74

APPENDIXES ................................................. 78
   A. GAME INSTRUCTIONS AND RESPONSE FORMS .............. 78
   B. DERIVATION AND DISCUSSION OF BAYES' THEOREM .......... 86
   C. TRUE STATES FOR EACH CONDITION ....................... 88
   D. SUMMARY NOTES FOR UMPIRES ............................ 89
   E. SUMMARY OF GAME PROCEDURES ............................ 91
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Six Categories for Research Questions on Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>II. Sample Research Questions on the Behavior of Decision Makers</td>
<td>5</td>
</tr>
<tr>
<td>III. Payoff Matrix for Game Simulation: Entries in Dollars per Pupil</td>
<td>22</td>
</tr>
<tr>
<td>IV. Dimension Levels of Factor C</td>
<td>30</td>
</tr>
<tr>
<td>V. Dimension Combination Display</td>
<td>30</td>
</tr>
<tr>
<td>VI. Experimental Payoff Matrix by Condition</td>
<td>32</td>
</tr>
<tr>
<td>VII. Mean Information Seeking Bias for All Possible Combinations of Factor A (Experience) with Factor B (Training)</td>
<td>42</td>
</tr>
<tr>
<td>VIII. Analysis of Variance for the Dependent Variable, Information Seeking Bias</td>
<td>43</td>
</tr>
<tr>
<td>IX. Results of the Application of the Scheffe Test to the Two-way Interaction Between Levels of Both Factors A (Experience) and B (Training) under Specified Combinations of Factor C</td>
<td>49</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tree Diagram with Choice Probabilities for Payoff Matrix in Table Three: Given Perfect Information</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Mean Information Seeking Bias over the Treatment Levels of Factor C at Factor A (Experience)</td>
<td>46</td>
</tr>
<tr>
<td>3.</td>
<td>Mean Information Seeking Bias over the Treatment Levels of Factor C at Factor B (Training)</td>
<td>47</td>
</tr>
<tr>
<td>4.</td>
<td>Mean Information Seeking Bias over all Subjects over the Sequence in which the Games were Presented</td>
<td>51</td>
</tr>
<tr>
<td>5.</td>
<td>Mean Information Seeking Bias for Groups at Levels 1 and 2 of Factor B (Training) over the Sequence in which the Games were Presented</td>
<td>52</td>
</tr>
<tr>
<td>6.</td>
<td>Mean Information Seeking Bias for Groups at Levels 1 and 2 of Factor A (Experience) over the Sequence in which the Games were Presented</td>
<td>53</td>
</tr>
</tbody>
</table>
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A special word of appreciation is due to the thesis committee members, Dr. Jean Hills (Chairman), Dr. Graham Kelsey and Dr. Todd Rogers. It was in one of Dr. Hill's courses that the idea for the study was born and through many informal meetings was shaped into its present format. Dr. Kelsey's continued support often went beyond that of simply advising. During the data gathering he allowed class time, as well as his own time, to be used for training umpires and for administering the game. Dr. Roger's suggestions as to appropriate methodology made a direct contribution to the extent of the study's findings.
CHAPTER 1

INTRODUCTION

In British Columbia, as in most provinces, there is an increasing emphasis being placed on the masters degree qualification as a pre-requisite, or at least a co-requisite, to an administrative position in the public school system. Most universities are aware of this trend and have endeavoured, at least in part, to provide programs which will equip students of educational administration with the necessary practical skills. Hills (1977), in his informal analysis of the University of British Columbia (U.B.C.) Department of Educational Administration, recognized that despite the lack of explicit goals for the department there was at least a partial commitment to the goal of training for practice.

One aspect of the practicing administrator's behaviour which has been the subject of much interest (Singleton, 1972; Hoan, 1974; McCordic, 1974; Pedersen, 1975) is that of decision making. This is an extremely complex process. For this reason, researchers in the field have found it useful to categorize studies of decision making into specific areas of interest. Thus studies in educational administrative decision making may fall under various academic disciplines, most notably, the social sciences and mathematics.

In view of the importance of decision making behaviour in practicing administrators, the goal of training for practice might be expected to include a commitment to train educational administrators in decision making. In the case of
either an explicit or implicit commitment it is important to understand the factors influencing decision making behaviour, as well as the impact of present programs on such behaviour. By drawing on research techniques and findings from other disciplines, this study examined one aspect of decision making, specifically, information seeking behaviour among students of educational administration.

DEFINITION OF CONCEPTS

For the purpose of this study decision making was defined as the process of choosing among two or more alternatives. The literature on the subject tends to concentrate in three areas; the decision itself, the decision maker, and the decision process. Rubenstein and Hoberstroh (1966) point out that this literature has basically two orientations, normative and descriptive. Normative studies assume certain criteria relating to the decision process and then using these criteria define what ought to occur. Having defined the norm, comparison with the actual processes can be made. Descriptive studies do not make any normative assumptions about the process, but rather, attempt to describe in an objective fashion what actually does take place. Thus most research questions on decision making can be placed into one of the six categories displayed in Table 1. The present study focused on research questions which fell within category 3.
Table I
Six Categories for Research Questions on Decision Making

<table>
<thead>
<tr>
<th></th>
<th>Normative</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Decision Maker</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Decision Process</td>
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<td>6</td>
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</tbody>
</table>

Studies which examine the behaviour of decision makers must also consider the nature of the decision and the decision process (Kast and Rosenzweig, 1970). The context in which the decision maker operates can vary along a continuum from a relatively closed system to an open system. By seeking information inputs from various sources the decision maker tends to move the process towards the open end of the continuum. For example if an educational administrator is trying to determine school policy he/she could move the process towards the open end of the continuum by seeking information from a number of sources, such as, parents, teachers and students. If the decision maker does not seek further information, he/she tends to move the process towards the closed end of the continuum. In this case there is little or no interaction with the environment. An educational administrator who produces the teaching timetable by taking only the legal requirements into consideration would be making decisions in a
relatively closed system.

Because the amount of interaction is small, decisions which are made in closed systems tend to be repetitive and routine. The procedures for dealing with a decision have usually been well worked out and are said to be programmable. As the contextual system becomes increasingly open, the decision process becomes increasingly non-programmable. Thus the programmable - nonprogrammable continuum tends to parallel the closed - open continuum.

This distinction between closed and open system decision processes and between programmable and non-programmable decisions will, given the parallelism between the continua, add one new dimension with two levels to the six categories of research questions dealing with the decision maker. Table 2 presents four sample research questions for various decisions and decision processes. The questions correspond to cells 3 and 4 in Table 1.

The present study compared closed - programmable decision making behaviour with a predefined norm in an effort to describe information seeking behaviour. Therefore, although the ultimate purpose of the study was to describe one aspect of decision making behaviour, the methodology employed would require that the study be placed in the category normative-closed-programmable.
### TABLE II

Sample Research Questions on the Behaviour of Decision Makers

<table>
<thead>
<tr>
<th>Normative</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Nonprogramable</td>
<td>Pro-gramable</td>
</tr>
</tbody>
</table>

| How can an Educational Administrator be most effective in participatory decision making? | How should a rational educational administrator deal with routine problems? | Do younger administrators seek wider participation in decision making than older educational administrators? | Is there a correlation between the personal characteristics of the educational administrator and the number of routine decisions made daily? |

## THE RATIONAL PROCESS

The category of normative studies on decision making behaviour in closed-programable situations has received much attention, particularly in the last forty years. The problem of defining standards has been approached in various ways (Kast and Rosenzweig, 1970). The approach most generally accepted today is the adoption of the "scientific method" or the rational model. This model was first made explicit by Dewey (1910) and later expanded by Simon (1960). Today, the rational decision making model is generally characterized by five simplified steps.
1. Recognition that a problem exists.
2. Definition of alternatives.
3. An understanding of the probable effects of each alternative.
4. Application of some value function which produces a preference ordering of the alternatives.
5. The actual choice.

The decision making process is much more complicated than is indicated by the above five steps. Simon (1957), in his study of the administrative decision making process, defined the rational process and then states that it was impossible for an individual to reach any high degree of rationality. The rational process requires the generation of such a large number of alternatives and the processing of such huge amounts of information that it is difficult to conceive of anyone even approximating it. The result, according to Simon, is a form of "bounded rationality" in which the decision maker attempts to make the best choice possible given the limits to rationality.

Despite this problem, in closed system decision situations, the concept of purely rational behaviour can be closely approximated. The literature dealing with closed system decision making is extensive and demonstrates that the rational model has been successfully employed in normative studies (Ugalde, 1973; Morris, 1964; Dawes and Corrigan, 1974).
The present study will define both a closed system decision situation and a corresponding norm for rational decision making behaviour. This design will then be used to examine one dimension of decision making behaviour, namely, the manner in which information is accommodated.

Information for the purposes of this study is defined to mean knowledge (facts understood by the decision maker) deemed to be relevant to the decision under consideration. It has been pointed out that by not seeking information, a decision maker closes the contextual system in which he/she operates. Because the research questions and analytic techniques employed in studying decision making depend on the system in which the decision is made, it is important to understand the information seeking behaviour of the decision maker. Hence the present study will examine the tendency of the decision maker to seek information, that is, open the contextual system in a contrived closed system decision situation.

REVIEW OF RESEARCH

The literature relevant to this study will be reviewed under three general headings: (1) studies on closed system decision making, (2) use of Bayesian statistics in defining a rational norm, and (3) studies examining information in decision making.
This section begins with a brief outline of the development of the static model in statistical decision theory. The evolution of the rather limited static model into the more realistic and useful dynamic model will then be shown to have resulted from the application of Bayesian statistical techniques to the static model. Finally, a number of studies will be discussed which have successfully employed the dynamic model in examining information seeking behaviour in decision situations.

**Analysis of Closed System Decisions**

Various techniques have been developed to simplify and analyze closed system decision making (Kast and Rosenzweig, 1970). Few, if any, real-life decisions can be handled by any one of these techniques, however, of these models the payoff matrix in statistical decision theory has proved to be particularly useful. Its usefulness stems from three sources. First, it is applicable to a wide range of managerial and administrative decisions (Green et al., 1967; Morris, 1974). Second, the concepts of statistical decision theory are based on the rational decision making model (McGee, 1971). Third, the payoff matrix can be easily incorporated into dynamic models of decision making (Edwards, 1962).
A payoff matrix presents the decision maker with a choice between at least two alternatives. The payoff associated with each alternative is dependent upon the state of conditions influencing the decision situation. Each state may be assigned an objective probability of occurrence, (an example of a payoff matrix is given in Table 3, page 18, and will be described in greater detail in Chapter 2). Once the decision maker makes his/her choice the decision process ends. This use of the payoff matrix is referred to as the static model because there is no opportunity for revising decision strategies in the light of past decisions or acquired information.

The Bayesian Approach

For many years the static model, applied under very narrowly defined conditions, was the only one available. The complicated mathematics involved in extending the model to account for strategy changes as new information became available in the decision making situation, provided an effective barrier to further, more meaningful, studies. In the 1940's experimenters rediscovered the work of Thomas Bayes, an eighteenth century mathematician. They found that by applying Bayes' theorem to the static model it was possible to extend the process to allow for possible changes in strategy as a result of acquired information (Edwards 1962). Thus
the static model was transformed into a dynamic model. Because of the closer correspondence with real life decision making, the Bayesian-normed dynamic model was found to be a much more accurate representation of the way rational people behave when faced with programmable decisions.

In his review of the development of Bayesian statistics, Anascombe (1964) reported the findings of 'man-in-the-street' studies which indicated that man does not behave rationally, particularly in gambling situations. He goes on to say that these results should not deter experimenters who are interested in understanding the decision making behaviour of a scientifically minded administrator. A theory of consistent preferences, as defined by Bayesian statistics, should be thought of as a means for specifying rational behaviour. Edwards (1962) in his taxonomy of decision tasks also stresses the dynamic decision model as a normative instrument.

Confidence in Bayes' theorem as a normative instrument rests on its basis in the scientific method and the rational process mentioned earlier. Using just four criteria: unambiguity, universal comparability, consistency, and correspondence with common sense, McGee (1971) developed a model for plausible reasoning which is unique, comprehensive and flexible. That model is, in effect, an adaptation of Bayes' theorem and consequently McGee refers to it as the Bayesian approach. This approach has proved particularly useful in studying information seeking behaviour among decision makers (Green et al., 1967).
Information in Rational Decision Making

Information plays a central role in the rational decision making process (Allison, 1971; David, 1961; Thurston, 1962; Ott et al., 1973). A rational decision maker may seek information at several stages in Simon's model. He/She may seek information while recognizing that a problem exists, in defining alternatives, and in understanding the probable affects of each alternative. In attempting to account for this information seeking behaviour in decision making it was found that dynamic decision models were particularly useful (Green et al., 1964 and 1967; Morris, 1974). These models allowed for the results of previous decisions and acquired information to be considered in each subsequent analysis. By keeping other dimensions as constant as possible and then varying the cost or reliability of the relevant information, the information seeking behaviour of decision makers could be studied.

Edwards (1962) outlined three advantages in using dynamic decision models to study information seeking behaviour. First, decision making does involve the concept of bounded rationality, whereby inconsistent values are traded off according to some value function. Second, people, either consciously or not, do ascribe probabilities to events. Third, the mathematical concept of expected value does represent, to some extent, the way in which people combine probabilities and payoffs.
As a result of Shannon's (1949) work in Communication Theory, information has become a quantifiable item. Several researchers (Taylor 1975; Green, et al., 1967; Morris, 1974) studying decision making have quantified information in terms of the subjective value placed upon it by the decision maker. Edwards (1962) recognized the importance of dynamic decision models as a means by which subjective value may be ascribed to specific information, or as it is more commonly termed, calculation of information seeking bias.

To calculate information seeking bias it is first necessary to define a norm. In the present study a Bayesian norm was employed. This norm represents the value to the purely rational decision maker of the information presented. Then, through experimental techniques, the value of the information to the real decision maker can be determined. The difference between the value placed on the information by the real decision maker and the value ascribed by the norm is termed the information seeking bias. This measure may be positive or negative. A negative number would represent a tendency to seek less information and a positive number would represent a tendency to seek more information relative to the defined norm.
STATEMENT OF THE PROBLEM

Educational administrators are decision makers who work in a relatively open system. However, not all of the decisions dealt with are nonprogrammable (Hoan, 1974), as the educational administrator often has the option to open the decision process. This option in turn results in what Simon refers to as "Greshams Law of Planning" whereby programmed activity tends to drive out nonprogrammed activity when both are present in an administrative position. Thus the practicing educational administrator is often involved with closed system programmable decision making.

The tendency to open or close the decision process has been shown above to depend upon the educational administrator's tendency to seek information. That tendency to seek information is measured by the information seeking bias. Therefore, in trying to understand decision making behaviour among educational administrators it is important to study information seeking bias. Similarly, if programs of instruction in educational administration are based upon a commitment to train for practice then the information seeking behaviour of students of educational administration might usefully be studied by those offering such programs.
General Problem Statement

This study used the dynamic Bayesian approach as a model of rational decision making. Then by using this model as a norm, the decision strategies of students of educational administration who were confronted with programmable decisions were compared.

The general question raised earlier may now be formulated into the more specific questions:

1. Do part-time masters students of Educational Administration behave as Bayesians in their search for information in closed system decision situations?

2. Are there differences in information seeking bias between groups with varying amounts of formal training in Educational Administration.

3. Are there differences in information seeking bias between groups with varying amounts of Educational Administrative experience?

4. What is the effect of varying payoff parameters and prior probabilities on the amount of information purchased?

Expected Outcomes

Studies using Bayesian experimental games to examine information seeking biases have tended to show consistent results (Edwards, 1962; Green et al., 1964 and 1967; Morris, 1974). Based on these previous studies it was expected that subjects would generally tend to overvalue information, relative to a Bayesian norm. Also it was expected that infor-
Information seeking bias would be sensitive to differences in prior probabilities but not to variation in payoffs. Finally the study reported by Green et al. (1967) suggested that administrative experience would be found to be a determining factor in information seeking behavior.
CHAPTER 2

DESIGN AND METHODOLOGY

The design and methodology used in this study to answer the questions posed at the end of the previous chapter will be discussed under the following major headings, (1) The Sample, (2) Definition of Variables (3) Experimental Procedures and (4) Research Questions and Analysis.

THE SAMPLE

The population for this study consisted of all students enrolled on the masters program in the U.B.C. Department of Educational Administration during the academic year 1977 - 1978. At that time there were approximately 180 full-time and part-time masters candidates, with the great majority, approximately ninety-five percent, enrolled on the part-time program. For part-time students at least three years is usually required to complete the fifteen units and major paper necessary for graduation. Most full-time students complete the program in one calendar year.

From this population a sample of twenty-nine students was obtained. This sample consisted entirely of part-time students. It was felt that full-time students, many of whom had given up the security of a tenured teaching position and
the financial security of a regular income, would be more prone to risk taking. For this reason the population for the study was changed to include all students enrolled in the part-time masters program.

All part-time students registered in winter session evening courses were approached in class and asked to participate in the study. In classes which had both full-time and part-time students, both groups were asked to participate. This was done in an effort to simplify data gathering procedures and in the event of insufficient response by part-time students, to provide a possible alternate sample group. Forty-three students were tested. Thirteen students were not considered in the analysis because they were either full-time students or they were not registered in the Department of Educational Administration. One part-time student was rejected because he indicated that he was familiar with statistical decision theory and it was felt that this would influence his playing strategy.

The sample consisted of twenty-one males and eight females with a mean of 6.0 years teaching experience. Eleven of the subjects were experienced administrators with a mean of 3.4 years in educational administrative positions. Nine of the students had completed at least three units of course work within the U.B.C. Department of Educational Administration, the mean for the nine students being 8.3 units. No one in the sample indicated that they had completed graduate level course work in educational administration at a University.
other than the University of British Columbia.

DEFINITION OF VARIABLES

The Independent Variables

This study employed three independent variables. Two of the variables were grouping factors with two levels each. The third factor involved repeated measures with eight treatment levels. Thus the study may be classified as a $2 \times 2 \times 8$ factorial experiment with repeated measures on the last factor. This design was similar to that defined by Winer (1971: 559) as "a repeated measures three factor experiment, case II".

Grouping factor A (experience). Taylor (1975:79) in his study of managerial decision making found that, "the amount of experience in making decisions was positively related to accuracy in judging the value of information". This would appear to indicate that differences in information seeking bias would also be found between subject groups with educational administrative experience and those without such experience. Also because practical experience is an important consideration in hiring practices, it would be useful to ascertain through empirical study the influence of experience on this aspect of the educational administrators job.
For the purpose of this study, educational administrative experience was defined as at least one year as a practicing administrator at the department head level or above. This included, school board or department of education officials, as well as, vice-principals, principals, department heads and program co-ordinators. As the responsibilities of department heads and program co-ordinators varied greatly, job descriptions, presented by the students, were examined to ensure that the job that they were doing was in fact administrative. Evidence of administrative experience would be, for example, budget allocation, time tabelling and program development.

Two levels were defined under factor A. Level one included those with at least one year of educational administrative experience and level two included those with no educational administrative experience.

Grouping factor B (academic course work) Many studies (Husen, 1972; Averch et al., 1972; Hyman et al., 1975) have been conducted to determine the effects of schooling on pupil achievement. Because of the large number of interfering variables and problems with data collection, the results of such studies have often been contradictory. The Gross and Herriot (1965) study into the "Executive Professional Leadership" (E.P.L.) of educational administrators dealt, in part, with the effects of graduate studies in educational administration. They found that the greater the number of semester
hours of graduate studies in educational administration the lower the administrator's EPL scores. Leadership is one dimension of administration, decision making is another. An extensive review of the literature has indicated that to date, no research into the possible effects of graduate training in educational administration on decision making behaviour has been undertaken.

For the purpose of this study, training in educational administration was defined as the completion of at least three units of graduate level course work in the department of educational administration at U.B.C. The course Education 460, Introduction to Educational Administration, was considered as a graduate level course, if it was taken as a prerequisite for further study within the Department of Educational Administration and not merely as a final year undergraduate elective.

There were two levels in the sample defined under factor B. Level one included students with at least 3 units of course work in educational administration and level two included students with no graduate level training.

Repeated measures, factor C. The repeated measures factor for this study was based upon that used by Green et al. (1967) in their study of perfect information as a function of prior probabilities and payoff parameters. In the present study factor C was considered to have three dimensions. The first dimension was concerned with the prior probabilities. The second and third dimensions were concerned with the pay-
off parameters and represented two ways, namely, multiplicative and additive constants, by which the payoffs were varied. As the treatment levels of this factor depend upon the nature of the simulation game, further discussion of this independent variable will be deferred until after a discussion of the simulation game and dependent variable (see page 28).

The Dependent Variable

The dependent variable, information seeking bias, was defined as the difference between the value placed on information by a decision maker and the value ascribed by a predetermined norm. This study employed a Bayesian norm and utilized a payoff matrix to ascribe value to a specific unit of information. An example will be used to illustrate the Bayesian approach as employed in this experimental game.

Each participant in this experiment was asked to pretend that he/she was the principal of a large public school and responsible for deciding which of two academic programs was to be implemented. The players objective was to maximize the per pupil budget allotment from the Secretary-Treasurer. This allotment was dependent on which of two states prevailed in the office of the Secretary-Treasurer. Each state consisted of all the factors which could influence the Secretary-Treasurer in his decision to fund the program. For example there may be political and economic factors, as
well as, personality factors. Each state represented a different combination of factors. Each state was assigned a probability or likelihood of occurring. A detailed explanation of the experimental game is to be found in 'Game Instructions and Response Forms' in Appendix A. An example of a simulation situation is illustrated in Table III.

Table III
Payoff Matrix for Game Simulation:
Entries in Dollars per Pupil

<table>
<thead>
<tr>
<th>Program (Act) 1</th>
<th>State 1</th>
<th>State 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program (Act) 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability of state</td>
<td>.8</td>
<td>.2</td>
</tr>
</tbody>
</table>

To help simplify the discussion, the following notation will be employed.

Let:
- \( A_i \) denote the \( i^{th} \) act on program \( (i = 1,2) \)
- \( S_j \) denote the \( j^{th} \) state \( (j = 1,2) \)
- \( O_{ij} \) denote the outcome of the \( i^{th} \) act and the \( j^{th} \) state
- \( P_j \) denote the probability of the occurrence of the \( j^{th} \) state
Let $Z_j$ denote that the results of the study conducted indicated that state $j$ will prevail.

$P(S_j/Z_i)$ denote the probability (posterior) of state $J$ occurring given that the study indicator state $i$ will occur.

$E(.)$ denote mathematical expectation.

If the player chose program 1 and state 1 was found to prevail, the average student subsidy would be $450, while if state 2 had occurred the average student subsidy would be $100. State 1 is assigned a probability of .8 and state 2 a probability of .2.

The experiment as described thus far is a static, statistical decision problem. In order to determine the long term payoff of choosing a particular act, the expected value ($E(A_i)$) is calculated. The expected value involves the weighting of the payoff from each state by the probability of the occurrence of that state. For example:

$E(A_1) = \sum_{j} P(S_j) \cdot .0_{ij}$

$E(A_1) = P(S_1) \cdot .0_{11} + P(S_2) \cdot .0_{12} = .8 \times 450 + .2 \times 100 = 380$

$E(A_2) = P(S_2) \cdot .0_{21} + P(S_2) \cdot .0_{22} = .8 \times 310 + .2 \times 200 = 288$

In the absence of any further information the decision maker, who wished to maximize the payoff, would choose the program (act) with the highest mathematical expectation. In the above example it would be program 1.

More realistically the decision maker may decide to delay implementing the program in order to allow a study of
the prevailing state in the office of the Secretary-Treasurer to be conducted. The reliability, or degree to which the information given in this study may be accepted as true, could vary from zero percent to one hundred percent. For this thesis the reliability of the study was assumed to be one hundred percent, that is, the study indicated with certainty which state would prevail.

However, by conducting the study, the implementation of the program would be delayed resulting in a reduction in the average student subsidy. In the above example, suppose that conducting the survey resulted in a reduction of $27 in the per pupil subsidy. This could be said to represent the 'cost of the information'. The players must now decide whether the information as to which state will prevail is worth purchasing.

In order to determine how the purely rational decision maker would choose, it is necessary to determine the probabilities of each state occurring, given the results of the study. These probabilities are known as posterior probabilities and can be calculated using Bayes' Theorem. For a brief discussion of Bayes' theorem, which can be employed regardless of the reliability of the study, refer to Appendix B.

Because the information is assumed to be one hundred percent reliable, the derivation of the Bayesian norm is considerably simplified. Suppose that the study indicated that
state 1 would prevail. Then \( P(S_1|Z_1) = 1 \) and \( P(S_2|Z_1) = 0 \).

The mathematical expectation can now be calculated using posterior probabilities.

\[
E(A_1) = P(S_1|Z_1) \cdot 0_{11} + P(S_2|Z_1) \cdot 0_{12} = 450 \times 1 + 100 \times 0 = 450
\]

\[
E(A_2) = P(S_1|Z_1) \cdot 0_{21} + P(S_2|Z_1) \cdot 0_{22} = 310 \times 1 + 200 \times 0 = 310
\]

The Bayesian decision maker would choose the act with the greatest expected value.

\[
\max_i E(A_i) = \max_i \sum_j P(S_j|Z_i) \cdot 0_{ij} = 450
\]

Notice that in this special case of a perfect study:

\[
\max_i E(A_i) = \max_{-i} 0_{ij}, j = 1.
\]

The same procedure may be followed assuming that state 2 will prevail. Figure 1 summarizes the results.

But each state is assigned a prior probability. That is, state 1 could have occurred with probability .8, state 2 with probability .2. The mathematical expectation \( E^1(.) \) can now be applied to the results of the above analysis.

\[
E^1 = \sum_i \max_i E(A_i) \cdot P_j = \sum_i \left[ \max_{-i} 0_{ij} \right] P_j \text{ substituting } \max_{-i} 0_{ij} = \max_i E(A_i)
\]

\[
= .8 \times 450 + .2 \times 200 = 360 + 40 = 400
\]

The process of choosing a terminal act on the basis of prior probabilities and experimental information, combined by the use of Bayes' theorem, is known as posterior analysis. Prior analysis refers to the process of choosing a final act on the basis of the prior probabilities alone. The subjective value of the information can be computed by subtracting
Figure 1

Tree Diagram with Choice Probabilities For Payoff Matrix in Table 3: Given Perfect Information
the expected payoff associated with the prior analysis from the payoff expected from the posterior analysis. The expected value of the perfect information (EVPI) can be expressed:

$$EVPI = E \left[ 1 - \max_i E(A_i) \right]$$

$$= \sum_j (\max_i 0_{ij}) \cdot P_j - \max_i \sum_j P_j \cdot 0_{ij}$$

$$= 400 - 380$$

$$= 20$$

The Bayesian decision maker would be expected to pay up to $20 for the perfect information. This represents the value of the information to the decision maker, or similarly, the cost of prior uncertainty. Thus if the player had paid $27 for the perfect information, for which the Bayesian player would have paid no more than $20, the information seeking bias would be $27 - $20 = $7.

**EXPERIMENTAL PROCEDURES**

Each subject was presented with eight unique games similar to the one described above. For each game the player was presented with six different studies ranging in cost from $1 to $210.

The study costs were chosen such that (a) half of the surveys would cost more than the EVPI, and half less, and (b) a wide dispersion of costs was effected. For odd numbered conditions the EVPI=20. The study costs for all the odd numbered conditions were as follows:
They were presented to the subjects in the random sequence:

200, 5, 27, 13, 70, 1

For even numbered conditions, the EVPI = 30. The study costs for all the even numbered conditions were as follows:

10, 15, 23, 37, 80, 210

They were presented to the students in the random sequence:

210, 15, 37, 23, 80, 10

The player had to decide which studies to purchase and having made that decision the player then had to choose one of the two programs for each situation.

The game was administered in small groups ranging in size from three to six subjects under the supervision of one umpire. Members of the class being sampled were randomly assigned to a group. Umpires were specially trained students from the doctoral program in educational administration (see page 33). Each person in the group worked on the same sequence of games, so that after each game the players could compare their scores and the person with the highest score was declared the winner of that game. This initiated competition and stimulated interest in the game.

After the completion of all eight games, one player was chosen at random and asked, in private, to describe how he/she "came to decide which surveys were worth purchasing in
games one, two, and six." The comments were recorded by the umpires.

In order to introduce variety across the eight games, various parameters in the payoff matrix were adjusted. This was done systematically and represented the repeated measures of factor C.

Design of the Study

Dimensions of factor C. There were three dimensions under factor C. Each dimension was divided into two levels resulting in $2^3$ or eight unique treatment levels.

Dimension represented the prior probabilities and was divided into two levels. At level one, the prior probabilities were (.8, .2) and at level two they were (.5, .5).

Dimension B represented the constant by which the payoffs were multiplied. At level one the constant was one, at level two it was 1.5.

This particular multiplicative constant was chosen because it provided variation in the EVPI without inducing excessively wide variation in the game payoffs.

The only criterion for choosing these dimension levels was that there was a distinct variation between the two levels. Dimension represented the constant to which the payoffs were added. At level one the constant was zero, at level two it was 300.
Table IV summarizes the dimensions of factor C. Table V displays all the possible combinations of the three dimensions of factor C.

Table IV
Dimension Levels of Factor C

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Identification</th>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>Prior probabilities</td>
<td>$a_1=0.8, 0.2$</td>
<td>$a_2=0.5, 0.5$</td>
</tr>
<tr>
<td>β</td>
<td>Multiplicative constant</td>
<td>$B_1=1$</td>
<td>$B_2=1.5$</td>
</tr>
<tr>
<td>γ</td>
<td>Additive Constant</td>
<td>$\gamma_1=0$</td>
<td>$\gamma_2=300$</td>
</tr>
</tbody>
</table>

Table V
Dimension Combination Display

<table>
<thead>
<tr>
<th>$a_1=0.8, 0.2$</th>
<th>$a_2=0.5, 0.5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B=1$</td>
<td>$B=1.5$</td>
</tr>
<tr>
<td>$\gamma_1=0$</td>
<td>$\gamma_2=300$</td>
</tr>
<tr>
<td>Condition 1</td>
<td>Condition 2</td>
</tr>
<tr>
<td>Condition 3</td>
<td>Condition 4</td>
</tr>
<tr>
<td>Condition 5</td>
<td>Condition 6</td>
</tr>
<tr>
<td>Condition 7</td>
<td>Condition 8</td>
</tr>
</tbody>
</table>

There were two base payoff matrices, one for each of the two levels in dimension $\alpha$. The payoffs in each of these two base matrices, conditions 2 and 3 in Table V, were adjusted so that the EVPI was equal to twenty. Thus conditions
conditions 1 and 3, given in Table V, would have an EVPI of twenty, even though the actual payoffs in each matrix were quite different.

Table 6 displays the eight conditions used in this study. Note that conditions 1 and 3 are the base matrices, all the others can be obtained from them by applying the appropriate dimension level operations indicated in Table V.

**Procedures.** Each group received a different sequence of conditions. Each condition was in the first position (e.g., Game 1) at least once. Once game 1 was fixed the sequence in which the remaining conditions were presented was determined from a sequence of random numbers. For a description of how the true states were chosen, as well as, a list of those states for each condition refer to Appendix D.

As was mentioned above, the payoffs in conditions 1 and 3 were adjusted so that the EVPI was the same regardless of prior probabilities. An additive constant, such as $\gamma_2$, will not affect the EVPI; however, a multiplicative constant, such as $B_2 = 1.5$, will increase the EVPI by a factor of .5.

Thus:  
EVPI (for conditions 1, 3, 5, 7) = 20  
EVPI (for conditions 2, 4, 6, 8) = 30

A Bayesian player would be expected to:
1. Conduct all studies which cost less than $20 on odd numbered conditions and less than $30 on even numbered conditions.
<table>
<thead>
<tr>
<th>Condition</th>
<th>(A_1)</th>
<th>(A_2)</th>
<th>(P(S_i))</th>
<th>(A_1)</th>
<th>(A_2)</th>
<th>(P(S_i))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>450</td>
<td>100</td>
<td>.8</td>
<td>750</td>
<td>400</td>
<td>.8</td>
</tr>
<tr>
<td>2</td>
<td>675</td>
<td>150</td>
<td>.8</td>
<td>975</td>
<td>450</td>
<td>.8</td>
</tr>
<tr>
<td>3</td>
<td>450</td>
<td>100</td>
<td>.5</td>
<td>750</td>
<td>400</td>
<td>.5</td>
</tr>
<tr>
<td>4</td>
<td>675</td>
<td>150</td>
<td>.5</td>
<td>975</td>
<td>450</td>
<td>.5</td>
</tr>
</tbody>
</table>
2. Choose program 1 if the study is not conducted. Program 1 always maximizes the expected payoff.

3. Choose program 1 if the study indicates state 1 will prevail and choose program 2 if the study indicates state 2 will prevail.

Training of Umpires

During July, 1977 a pilot study for this experiment was administered to four full-time and part-time masters candidates at the U.B.C. Department of Educational Administration. As a result of this pilot study a number of changes were indicated.

It was discovered that the maximum group size under one umpire should not exceed six. Confusing portions of the game instructions were reworded. Response forms were redesigned to facilitate calculation of scores. The game procedures were revised slightly in an effort to increase player participation. Finally, a number of minor administrative recommendations were made which facilitated the playing of the game.

Some of the classes approached held over thirty students. Therefore, in order to maintain the small group size recommended by the pilot study, it was decided that the experimenter would train umpires in administering the simulation game. In this way, an entire class could be sampled at one time. The procedure had three advantages, (1) there was a
minimum of disruption in regular academic classwork, (2) there was no possibility of contamination of the sample by the interaction of an untested group with a group that had already played the game, and (3) the short testing period, early in the winter session, minimized the influence of present course work on grouping factor B (training).

The class instructor and seven members of the U.B.C. department of educational administration first year doctoral seminar were trained as umpires. Training took place during a regularly scheduled three hour class session. Trainees were asked to play the game, then questions concerning the administration of the game were discussed. Finally, the trainees were broken into groups and asked to administer the game to each other. As a further control, prior to each testing session, the experimenter reviewed the game procedures with the umpires. Each umpire received a copy of summary notes (Appendix D) and a summary of the game procedures (Appendix E) as well as, the materials presented to the subjects.

Administration of Game

Testing took place between September 28 and October 4, 1977. Nine groups from three classes were tested. Students in each class were randomly assigned to a group. No information concerning the nature of the study was given to the
students other than their being asked to participate in a study which would involve them in playing a game. Each group, ranging in size from three to six, was tested in a separate room. During the administration of the game the experimenter moved from group to group to ensure that proper and uniform test procedures were maintained.

RESEARCH QUESTIONS AND ANALYSIS

The following is a specification of the general research questions outlined earlier, with a description of the analysis procedures employed.

Research Question Number One

Do U.B.C. students of educational administration tend to seek the same amount of information as a purely Bayesian player, in a programable decision situation?

The BMD: P2V - repeated measures analysis of variance with covariates - Program of the Health Sciences Computing Facility, University of California was used to analyze the data. This computer program was based upon the analysis of the repeated measures three factor experiment (case II) performed by Winer (1971). A repeated measures design was employed because of the rather small sample and the uneven cell sizes. Winer (1971:517) has pointed out that in the
repeated measures design, "by having each subject serve as his own control, the experimenter attempts to work with a smaller sample size." The grand mean, over all subjects and all conditions, was taken as a measure of the information seeking bias of the sample as a whole.

In an attempt to relate numerical response patterns with underlying strategies, a post-game interview was conducted with one randomly chosen member of each group. During the interview, the subject was asked to describe how he/she, came to decide which surveys were worth purchasing in game 1, game 2, and game 6". The responses were recorded in as much detail as possible. No preconceived framework for categorizing the strategies was employed. The information obtained was intended to be descriptive, and to aid in the interpretation of the study results.

Research Question Number Two

Do U.B.C. students of educational administration with educational administrative experience behave differently than students with no administrative experience in their tendency to seek information?

Using the BMD: P2V program the main effect of the two levels of grouping factor A (experience) was tested.

This problem may also be expressed in the form of the statistical hypothesis:
Where $i$ is that portion of the players score attributable to the main effects of grouping factor $A$. Due to the complexity of stating the statistical hypothesis for the interaction effects using this notation, Winer's (1971:561) equivalent notation will be adopted in this study. Thus the statistical hypothesis for Research Questions Two, Three and Four may be stated as follows:

1. Main effects of factor $A$ (experience)
   
   $H_0: \sigma_i^2 = 0$
   
   $H_1: \sigma_i^2 > 0$

2. Main effects of factor $B$ (training)
   
   $H_0: \sigma^2 = 0$
   
   $H_1: \sigma^2 > 0$

3. Main effect of factor $C$ (conditions)
   
   $H_0: \gamma^2 = 0$
   
   $H_1: \gamma^2 > 0$

4. Interaction effect between factors $A$ and $C$
   
   $H_0: \sigma\gamma^2 = 0$
   
   $H_1: \sigma\gamma^2 > 0$

5. Interaction effect between factors $B$ and $C$
   
   $H_0: \delta\gamma^2 = 0$
   
   $H_1: \delta\gamma^2 > 0$

Where $\sigma_i$ represents that portion of the variance attributable to grouping factor $A$. 
To test these hypothesis a 2 x 2 x 8 (experience x training x conditions) analysis of variance with repeated measures was performed.

Research Question Number Three

Do U.B.C. students of educational administration, who have completed three or more units of graduate level training in educational administration behave differently than students with no training in educational administration, in their tendency to seek information?

Using the BMD: P2V program the main effect of the two levels of grouping factor B (training) was tested.

Research Question Number Four

Among U.B.C. students of educational administration, does varying the prior probabilities and payoff parameters in the statistical decision game, effect the tendency to seek information?

Using the BMD: P2V program the main effect of factor C, as well as, the interaction effects of factors A and B with C were tested. An omnibus F statistic was calculated to test for a difference in information seeking bias among all possible combinations of the treatment levels of factor C. Also omnibus F statistics were calculated to test for differences
in information seeking bias between the two levels of grouping factors A and B and all possible combinations of treatment levels of factor C.

If the analysis of variance revealed significant differences then the Scheffe procedure for multiple comparisons was to be performed to ascertain the particular combinations of the factor levels leading to significance where the number of combinations was greater than two. The Scheffe test was chosen because of the conservative nature of the test and because non-pairwise combinations of treatment levels were of particular interest. As well, significant interactions were graphed to aid in interpreting such interactions.

Research Question Number Five

Does information seeking bias change over the sequence of games? Does learning take place?

Each of the nine groups received a different randomly ordered sequence of games with each of the eight conditions in the first place (i.e. game 1) at least once. For each level of the two grouping factors the mean information seeking bias was graphed over the sequence of games. For example,

1. This question, although not mentioned under the general problem statement, was included because of the repeated measures research design adopted and the possibility that learning could occur over the sequence of games.
the mean information seeking bias for game one included subject responses over a random sample, with replacement, of all eight conditions. Trends in information seeking bias over the sequence of games were observed from the graphs.
CHAPTER 3

RESULTS

The results of the analysis will be discussed separately under each research question.

Research Question Number One

Table VII summarizes marginal means for all four possible combinations of experience and training. A complete listing of the cell means, marginal means and standard deviations for each treatment level of factor C is presented in Appendix F.

Overall subjects and all games the mean information seeking bias of the sample group was 43.86, while the Bayesian optimal was 0. This indicated a positive information seeking bias.

Selected results of the post game interview will be referred to during the discussion of the study findings in Chapter 4.

Research Question Number Two

Table VIII summarizes the analysis of variance produced by the computer program BMD: P2V.
### Table VII

Mean Information Seeking Bias for All Possible Combinations of Factor A (Experience) with Factor B (Training)

<table>
<thead>
<tr>
<th>Factor A</th>
<th>Factor B</th>
<th>Mean Information Seeking Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative Experience</td>
<td>Graduate Level Training</td>
<td>36.44</td>
</tr>
<tr>
<td>(level 1)</td>
<td>(level 1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Graduate Level Training</td>
<td>38.64</td>
</tr>
<tr>
<td></td>
<td>(level 2)</td>
<td></td>
</tr>
<tr>
<td>No Administrative Experience</td>
<td>Graduate Training</td>
<td>56.88</td>
</tr>
<tr>
<td>(level 2)</td>
<td>(level 1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Graduate Level Training</td>
<td>41.19</td>
</tr>
<tr>
<td></td>
<td>(level 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand Mean</td>
<td>43.86</td>
</tr>
</tbody>
</table>
### Table VIII

Analysis of Variance for the Dependent Variable, Information Seeking Bias

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom(df)</th>
<th>Mean Square</th>
<th>F</th>
<th>Probability of F Exceeded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>283865.563</td>
<td>1</td>
<td>283865.56</td>
<td>47.551</td>
<td>0.000</td>
</tr>
<tr>
<td>Experience(A)</td>
<td>5005.437</td>
<td>1</td>
<td>5005.437</td>
<td>0.838</td>
<td>0.369</td>
</tr>
<tr>
<td>Training(B)</td>
<td>1720.625</td>
<td>1</td>
<td>1720.625</td>
<td>0.288</td>
<td>0.596</td>
</tr>
<tr>
<td>AxB</td>
<td>3028.188</td>
<td>1</td>
<td>3028.188</td>
<td>0.507</td>
<td>0.483</td>
</tr>
<tr>
<td>Error</td>
<td>149244.188</td>
<td>25</td>
<td>5969.766</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Game Parameters(c)</td>
<td>47990.563</td>
<td>7</td>
<td>6855.793</td>
<td>1.608</td>
<td>0.136</td>
</tr>
<tr>
<td>CxA</td>
<td>61260.063</td>
<td>7</td>
<td>8751.438</td>
<td>2.053</td>
<td>0.051</td>
</tr>
<tr>
<td>CxB</td>
<td>65240.688</td>
<td>7</td>
<td>9320.098</td>
<td>2.186</td>
<td>0.038</td>
</tr>
<tr>
<td>CxAxB</td>
<td>50741.250</td>
<td>7</td>
<td>7248.750</td>
<td>1.701</td>
<td>0.112</td>
</tr>
<tr>
<td>Error</td>
<td>745969.313</td>
<td>175</td>
<td>4262.680</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p < .10
The portion of the analysis testing the relationship between the two levels of factor A (experience) resulted in an F statistic of .84. The probability of obtaining that number or greater was .37. Therefore the hypothesis that there was no difference in the mean information seeking bias between the two levels of factor A (experience) could not be rejected.

Research Question Number Three

The portion of the analysis testing the relationship between the two levels of factor B (training) resulted in the F statistic .29, (see Table 8). The probability of obtaining that number or greater was .596. Therefore the contention that there was no difference in the mean information seeking bias between the two levels of factor B could not be rejected.

Research Question Number Four

The portion of the analysis testing the relationship of the mean information seeking bias over all subjects and in all possible combinations of the treatment levels of factor C resulted in the F statistic 1.61. The probability of obtaining that number or greater was .136. Therefore the hypothesis that there was no difference in the mean information seeking bias over all subjects for various combinations of game para-
meters (factor C) could not be rejected.

The test of interaction effects between each of the two levels of grouping factors A and B with the treatment levels of factor C resulted in F statistics of 2.05 and 2.19 respectively. The probability of obtaining 2.05 or greater was .051. And the probability of obtaining 2.19 or greater was .038. Therefore the hypothesis that there was no difference in mean information seeking bias between each of the two levels of factors A and B and specific combinations of treatment levels in factor C could be rejected at p < .10.

Figure 2 presents a graphical representation of the mean information seeking bias over the eight treatment levels of factor C, at each level of factor A. In Figure 2 there is a noticeable difference in information seeking bias between the levels of factor A at specific treatment levels of factor C. Figure 3 presents the same information for factor B. In figure 3 there is also a very noticeable difference in information seeking bias between the levels of factor B at specific treatment levels of factor C. For example, in Figure 3, the group at level 1, those with training in educational administration, tended to seek less information under those conditions in which the group at level 2, those with no training in educational administration, tended to seek more information.

The relationships identified in Figures 2 and 3 indicated that an a posteriori application of the Scheffe test to
A Comparison of Level 1 (Experienced) and Level 2 (Not Experienced) of Factor A (Administrative Experience)

Figure 2

Mean Information Seeking Bias Over the Treatment Levels of Factor C at Factor A (Experience)
A Comparison of Level 1 (Trained and Level 2 (Not Trained) of Factor B (Training in Educational Administration)

Figure 3

Mean Information Seeking Bias over the Treatment Levels of Factor C at Factor B (Training)
specific combinations of factor C(conditions) could prove useful. Table IX summarizes the results of this analysis for grouping factors A and B.

The results indicated that none of the pairwise comparisons between levels of factor A under singular conditions resulted in significant F statistics. However, significant differences were noted for certain combinations of conditions. Significant differences in the mean information seeking bias between levels 1 and 2, of those with administrative experience and those without, of factor A occurred when (1) the EVPI was low and the study costs were low, i.e., conditions 1, 3, 5, 7; (2) the prior probabilities were diverse (.8, .2), i.e., conditions 1, 2, 5, 6 and (3) the payoffs were low not having been increased by the additive constant, i.e., conditions 1, 2, 3, 4.

The results of the Scheffe Test, summarized in Table IX, also indicated that a significant difference in the mean information seeking bias between levels 1 and 2 of factor B occurred under conditions 1 and 8. No common game parameters could be recognized between conditions 1 and 8 to explain this result. However significant differences were also noted for certain combinations of conditions. Significant differences in mean information seeking bias for groups at level 1 and level 2 occurred when (1) the EVPI was low and the study costs were low, i.e., conditions 1, 3, 5, 7; (2) the prior probabilities were diverse (.8, .2), i.e., conditions 1, 2, 5,
Table IX

Results of the Application of the Scheffe Test to the Two-Way Interaction Between Levels of Both Factors A (Experience) and B (Training) Under Specified Combinations of Factor C

<table>
<thead>
<tr>
<th>Combinations of Factor C</th>
<th>Factor A F Statistic</th>
<th>Factor B F Statistic</th>
<th>.90 F critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pairwise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition 1</td>
<td>2.21</td>
<td>2.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.90</td>
</tr>
<tr>
<td>2</td>
<td>.08</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.05</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1.81</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>.40</td>
<td>1.11</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>.24</td>
<td>.82</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>.44</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1.70</td>
<td>4.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Combination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition 1, 3, 5, 7</td>
<td>25.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>34.68&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.60</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>.24</td>
<td>2.52</td>
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</tr>
<tr>
<td>1, 2, 5, 6</td>
<td>20.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>3, 4, 7, 8</td>
<td>.89</td>
<td>14.78&lt;sup&gt;a&lt;/sup&gt;</td>
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</tr>
<tr>
<td>1, 2, 3, 4</td>
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<td>5, 6, 7, 8</td>
<td>.89</td>
<td>38.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at the .10 level
6; (3) the prior probabilities were equal (.5, .5), i.e., conditions 3, 4, 7, 8 and (4) the payoffs were high having been increased by the additive constant, i.e., conditions 5, 6, 7, 8.

Research Question Number Five

Figure 4 presents a graph of the mean information seeking bias for all subjects over the sequence of games. As the sequence of games progressed the mean information seeking bias decreased from 90 to 28. The sharpest decline in information seeking bias occurred between games one and three, with a gradual rather uneven decline occurring after game three.

Figure 5 presents the mean information seeking bias for each level of factor B (training) over the sequence of games. A learning pattern similar to that described above was noted for both levels of factor B after game three both groups appeared to adopt strategies which resulted in similar information seeking behaviour.

This was not the case for groups at levels 1 and 2 of factor A (experience) graphed in Figure 6. Although the level 1 group began the series of games by seeking more information than the level 2 group they were, by game six, more closely approaching the Bayesian optimal. The level 2 group began by purchasing less information than the group
Figure 4

Mean Information Seeking Bias over all Subjects over the Sequence in Which the Games were Presented
Figure 5

Mean Information Seeking Bias for Groups at Levels 1 and 2 of Factor B (Training) over the Sequence in which the Games were Presented
Figure 6

Mean Information Seeking Bias for Groups at Levels 1 and 2 of Factor A (Experience) over the Sequence in which the Games were Presented
at level 1, but maintained a fairly high (approximately 40) tendency to seek information.
CHAPTER 4

INTERPRETATION OF RESULTS

Before the results of this study are discussed, three limitations as to the generalizability of the findings should be noted.

LIMITATIONS OF THE STUDY

Because of difficulty in contacting part-time masters students, the sample size for this study was small. The population for the study consisted of all part-time masters students. Most of these students are residents outside the vicinity of Vancouver and can attend U.B.C. only during the summer session. Had the game simulation been administered during the summer session a much larger and more representative sample of part-time masters students could have been obtained.

Second, because of the small sample size, it was necessary to allow unequal cell sizes. In the case of experienced administrators who had completed more than three units of graduate training the cell size was only two. Although analysis was still possible with such a small cell size, the possibility of obtaining significant results was diminished. The repeated measures design employed in this study partly compensated for the above limitations.
Finally, the study results indicated that learning occurred over the sequence of games. As the sequence of conditions was not randomized for each individual subject, but rather, on a group basis, the possibility that learning confounded the results of the analysis of information seeking bias cannot be ignored. Winer (1971:518) warns that a repeated measures design is to be avoided "...where primary interest lies in evaluation of the effect of individual treatments in the absence of possible sequence effects." However, in the present study each of the eight conditions was in the first place at least once with the remaining positions randomly distributed in each group. As a result of using this experimental design it is believed that the effects of learning over the sequence of games did not unduly influence the mean information seeking bias over all subjects and subject groups. Studies in this area should, by means of appropriate methodology, be separated into those which study information seeking behaviour and control for learning as in the present study, and those which examine learning patterns.

DISCUSSION OF RESULTS

The results of the analysis will be discussed separately for each of the individual research questions.
Research Question Number One

The analysis presented in Chapter 3 indicated that the subject group as a whole showed a positive information seeking bias. This confirmed the findings of previous studies (Green, et al., 1967 and Edwards, 1962) into information seeking bias.

Green, et al., (1967) reported on two explanations which had been advanced to try and explain this phenomenon. First, a number of researchers believe that motivational, ie. the need-to-be-sure, considerations could be contributing to the positive bias. These motivators are, in turn, rooted in the individuals personality and, to date, studies in the area have generally been inconclusive. This explanation, that a need-to-be-sure was a motivator in seeking information, was re-inforced during the post game interviews. Comments such as "I looked at how much I would lose", "I felt my luck runs in streaks", and "If there is a big difference in payoffs then the studies are worth purchasing" were recorded. These comments seemed to indicate an underlying need for certainty which, in the above cases at least, did affect information seeking behaviour.

The second explanation maintains that cognitive limitations affect the subjects ability to perform, either implicitly or explicitely, the calculations necessary to arrive at the Bayesian optimal solution. Each individual has a subjective
'cost of thinking' which limits his/her efforts to maximize the game score. Post game interviews in the present study also supported this explanation. Comments such as, "In game one I was just getting the feel of the game", and "I just took a chance I had no particular strategy" indicated that players were searching for the optimal strategy without attempting to figure it out according to a preconceived rational plan.

Post game interviews were not detailed enough to indicate with certainty the application of particular (i.e., Bayesian) strategies. However, the desire to reduce the expected loss in a particular game appeared to influence the information seeking behaviour of many of those interviewed. Statements such as, "I looked at how much I would lose, what the payoff was as opposed to the cost of the study", "If there is a big difference in payoffs the studies are worth purchasing", and "The difference at state B was $70 therefore why pay $60 to buy the knowledge of the true state" were common to many of those interviewed. Green et al. (1967:35) recognized similar strategies stating that players "...were willing to pay up to and including the total regret-loss which could be incurred..." in choosing the wrong program.

As far as could be ascertained from the results of the study, none of those interviewed adopted a consistant Bayesian strategy, although at least one player appeared to have adopted such a strategy by game six. When interviewed, few players
could be specific about their game strategy. Comments such as, "I just bought the cheapest ones (studies)", and "I chose these (studies) because the others were too expensive", appeared to indicate that many players had assumed a strategy without being cognizant of the fact.

Research Questions Numbers Two and Three

The repeated measures analysis failed to show any significant differences in the information seeking bias between the two levels of factors A (administrative experience) and B (graduate level training). Green's et al. (1967) study of marketing executives appeared to indicate that experience was a factor in determining information seeking bias. However, Green tested for differences between a group of experienced executives and a group of graduate level marketing students. He found a significant difference in information seeking bias between the two groups and attributed that difference to experience, ignoring the possibility that training could also have been an influencing factor. The present study separated the two factors of training and experience and analyzed each separately, finding no significant difference in either case.

The lack of significant results in the present study could have been due in part to the rather small sample size. But until further studies confirm that training does not in-
fluence information seeking bias, studies which examine other possible determinants of information seeking bias should insure that training is a controlled variable.

Research Question Number Four

The analysis presented in Chapter 3 indicated that overall subjects no particular sensitivity in information seeking bias was noted with respect to prior probability differences in payoff or the cost of information in the decision game. Green (1967) has noted that in past experiments, primarily using students as subjects, information seeking bias has shown sensitivity to prior probability but not to differences in payoff. The results reported in Green's work can be applied to the present study only with great care, because the present sample consisted of just part-time students and of those sampled, approximately 67 percent had completed no graduate level courses.

The interaction effects between each of training and experience and combinations of conditions were found to be significant. The Scheffe test confirmed that certain combinations of conditions for both factors did lead to significant differences. Under factor B (training) it was noted that a significant difference in information seeking behaviour between levels did occur for both diverse (.8, .2) and equal (.5, .5) prior probabilities. In the case of both diverse
(.8, .2) and equal (.5, .5) prior probabilities those with different levels of training tended to have different mean information seeking biases. Although the groups differed, neither group scored consistently higher or lower than the other.

This result emphasized the point made earlier that training must be controlled in statistical decision studies of information seeking bias. Post-game interviews indicated that a number of subjects did consider payoffs and prior probabilities in their game playing. Whether these were applied in a consistent manner was not apparent from the study results.

For both Factor A (experience) and factor B (training) significant differences between levels were found to occur when the EVPI was twenty and the study costs were low. This indicated that both factors were sensitive to study costs, that is, low study cost was a good discriminator between the two levels of both experience and training. In the case of factor A (experience) those with no educational administrative experience tended to seek more information than experienced administrators. Under factor B (training) those with training in educational administration tended to seek more information than those with no such training.

In the case of training, higher payoff was found to be a good discriminator while for the experience factor lower payoffs was found to be a good discriminator. It was sus-
pected that those with extensive training would have a tendency to seek more information than those with no training. This bias could have been carried over from the subjects course work and the fact that the study was conducted during a regularly scheduled class period. Thus with the higher payoffs, ie., when more was at stake, the group with more training would have been more inclined to seek information. While at lower payoffs, students may have felt less of a need to purchase information.

The greatest discrepancy between experienced and non-experienced groups occurred when the payoffs were lower. This appeared to indicate that when the stakes are high experience makes less difference in information seeking behaviour than when payoffs were lower. Experienced administrators tended to seek less information in low payoff situations. Thus experienced administrators appeared to be more prone to risk taking than those with no experience when the payoffs are low; but when the stakes are high, they behave much like the non-experienced group in their information seeking. This result points out the interesting possibility that experience, as an indicator of job performance, should not universally be accepted, but rather, be dependent on the degree of responsibility of the position.
Research Question Number Five

The graphs of mean information seeking bias over the sequence of games will be referred to as learning curves. The decreasing shape of the learning curve for all subjects indicated that as the games progressed the players were adjusting their strategies toward the Bayesian optimal. On the first game, subjects purchased far too much information; however by the third game the mean amount of information purchased had fallen by over 45 percent. After the third game there was a gradual but uneven approach to the Bayesian optimal of zero bias. Post game interviews confirmed this changing pattern in information seeking. Comments such as "I chose all studies in games one and two, they were exploratory" and "by game 6 (six) I was choosing only the lowest costing studies" tend to confirm the pattern indicated by the learning curves.

Both levels of factor B (training) indicated similar learning curves, particularly after the third game. This indicated that graduate level training in educational administration had little effect on learning patterns in this type of experiment. By game three both groups had adopted similar strategies.

Levels of factor A (experience) did differ in their learning curves. The group with educational administrative experience tended to 'play it safe' early in the experiment but by
the fourth game, they began to very quickly approach the Bayesian optimal. The group with little experience was not as cautious initially, but failed to approach the Bayesian optimal as the games progressed. It appeared that experienced administrators, although initially cautious, were sufficiently attuned to the game that they recognized, if only implicitly, the optimizing strategy. Perhaps the nature of the administrators job requires him/her to recognize quickly, optimizing strategies. For example not wasting money or purchasing unnecessary information, that is, playing it safe.
CHAPTER 5

SUMMARY AND IMPLICATIONS OF THE STUDY

Summary of Experimental Procedures, Research Questions and Findings

In rational models of the decision making process, information relevant to the decision under consideration can be sought by decision makers at various stages. Educational Administrators are decision makers. Therefore, to understand and, hopefully, improve rational decision making among educational administrators, it would be useful to study their information seeking behaviour.

In recent years university departments of educational administration have been assuming a greater portion of the task of training administrators for practise. Because decision making is such a central part of the administrators function, it is important that training institutions understand all aspects of this phenomenon in an effort to advance theoretical knowledge and prepare a base for practical application.

The present study adopted a technique for studying information seeking behaviour which had been successfully employed in other disciplines. This technique utilized a Bayesian norm to define purely rational behaviour in a statistical decision game. Subjects were asked to play a game which
facilitated the quantification of the value of certain information to the player. This amount could then be compared to the value derived from the Bayesian norm.

The sample for the present study was drawn from the set of part-time students enrolled in the winter session courses in the U.B.C. Department of Educational Administration. Participation was on a voluntary basis; twenty-nine students were included in the final analysis. Of these, eleven were experienced administrators, nine had completed at least three units of graduate level course work with the department and the group as a whole had a mean of 6.0 years teaching experience.

The present study employed three independent variables and may be classed as a $2 \times 2 \times 3$ (experience-by-training-by-Treatment Design) factorial experiment with repeated measures on the last factor.

Level one of grouping factor A included those subjects with at least one year of educational administrative experience and level two included those with no administrative experience. Level one of grouping factor B included those subjects who had completed at least three units of graduate level coursework in educational administration and level two included those with no graduate level training. The factor C had three dimensions, each of which had two levels. The three dimensions were (1) prior probabilities (2) an additive constant and a (3) multiplicative constant, to be applied to
the game payoffs. This factor introduced variation across the games.

The dependent variable, information seeking bias, was defined as the difference between the actual quantified value of certain information to the decision maker and that value ascribed by the Bayesian norm.

The simulation game presented the decision maker with a choice between two or more alternatives. The payoff associated with each alternative was dependent upon the state which existed at the time of the decision. Before choosing one alternative the player was given the opportunity to purchase information as to which state would occur. By determining the amount of information purchased under known game conditions and comparing that to the Bayesian optimal, the information seeking bias was determined.

The game was administered in groups ranging in size from three to six subjects, each under the direction of a specially trained umpire. Each person in a group received the same sequence of eight games corresponding to the eight treatment levels of factor C, however, each group had a different randomly determined sequence of games.

The following five research questions were examined.

(1) Do students of educational administration tend to seek the same amount of information as purely Bayesian players, in a programable decision situation?
(2) Do students of educational administration with administrative experience behave differently than students with no administrative experience in their tendency to seek information?

(3) Do students of educational administration, who have completed three or more units of graduate level training in educational administration behave differently than students with no training in their tendency to seek information?

(4) Among students of educational administration does varying the prior probabilities and payoff parameters in the statistical decision game, effect the tendency to seek information?

(5) Does information seeking bias change over the sequence of games? Does learning take place?

The analysis of research questions one through four was performed by the BMD: P2V computer program which was based on Winer's three factorial repeated measures design (case II). Research question one was examined by using the grand mean, over all subjects and all conditions, as a measure of the information seeking bias of the sample as a whole. The results of the analysis indicated that the sample showed a strong tendency to seek more information than the rationally derived Bayesian optimal.

To answer research question two the main effects of the two levels of factor A (experience) was tested. The F statis-
tic which was calculated indicated that at $p < .10$ the null hypothesis that there was no difference in mean information seeking bias between the two levels of factor A could not be rejected.

Research question three involved testing the null hypothesis that there was no difference in mean information seeking bias between the two levels of factor B (training). The F statistic which was calculated indicated that at $p < .10$ the null hypothesis could not be rejected.

Research question four required an examination of the main effects of factor C, as well as the interaction effects between factors A (experience) and C and between factor B (training) and C. The F statistic determined from the analysis of the main effects of factor C indicated that the hypothesis that there was no difference in the mean information seeking bias over all subjects for various combinations of game parameters (factor C) could not be rejected. However, the interaction effects between factors A and C and between factors B and C were found to be significant at $p < .10$. To determine what specific combinations of treatment levels in factor C contributed to the significant results a Scheffe test was applied. This test indicated that significant differences in mean information seeking bias between the levels of factor A (experience) occurred when, (1) the study costs were low (2) the prior probabilities were diverse and (3) the game matrix payoffs were low. Also significant
differences in mean information seeking bias occurred between the levels of factor B (training) when (1) the study costs were low (2) the prior probabilities were diverse (3) the prior probabilities were equal and (4) the payoffs were high.

Research question five was examined by graphing the mean information seeking bias of the various subject groups over the sequence in which the conditions were presented. A strong learning curve for all groups was noted. As the games progressed the information seeking bias more closely approximated the Bayesian optimal. The two levels of factor B (training) showed similar learning curves, however, under factor A (experience) experienced administrators tended to approach the Bayesian optimal strategy at a faster rate than the non-experienced group.

The implications of these results will now be presented.

IMPLICATIONS FOR THEORY, FUTURE RESEARCH AND PRACTICE

The present study confirms some of the findings of previous research and indicates their applicability to the study of educational administration. The fact that significant interaction effects were found between training and experience points out the importance of controlling for training when student groups are used. Also the fact that strong learning curves were noted indicates that future studies should adopt
methodologies which either control for across sequence learning or permit it to occur as a phenomena for study.

The fact that interaction effects between the grouping factors, experience and training, and various combinations of the repeated measures factor, game parameters, were found to be significant indicates that future studies could usefully examine the effects of game parameters on the subject group as a whole. This effect was found to be not significant in the present study. However, the low F statistic 1.61 with a probability of being exceeded of .14, indicated that perhaps future studies with larger sample sizes would discover significant differences across treatment levels of the game parameters.

It was shown earlier that under certain game conditions training and administrative experience does have some effect on information seeking bias. For instance when the study costs were low those with educational administrative experience tended to seek less information than those without administrative experience has an effect, under certain conditions, on the rate at which new strategies are adopted. For those responsible for developing programs and courses in educational administrative decision making, the need for consideration of (1) the conditions under which decisions are made and (2) the experience and training of the students has been emphasized. No firm recommendations to practitioners will be made on the basis of this study alone. However, the
results of this study confirm the need for future research and also serve as a caution to program developers who are tempted to ignore administrative experience and previous training among masters students.

As well as having immediate findings, the present study raises a number of questions which could prove worthy of future investigation. In Chapter Four it was postulated that the reduction of uncertainty was a factor in the over purchasing of information in games 1 and 2. Since this information seeking bias diminished over the sequence of games, the question arises as to the relationship between the reduction of uncertainty as a motivator and the need-to-win or succeed as a motivator.

Another question is raised by the fact that in the present study it was not possible to state with certainty that the information seeking bias of the groups approached the Bayesian optimal. This raises the possibility that the Bayesian model does not give an accurate representation of the information seeking behavior of educational administration. Further studies which expand the present experimental design to include a longer sequence of games would help to clarify this point. If such studies show an approach to some number other than the Bayesian optimal, the question would then arise as to the reason why this should occur.

Finally, the possibility of expanding the model of rational behavior to include dimensions rationality other
than the purely economic could prove useful. This would be a difficult task for two reasons, first, the human relations aspect of an administrators job would be hard to quantify and second, the definition of a suitable utility function is most difficult when dealing with human values. However difficult these problems may be they must be addressed if the concept of rational behavior is to be expanded into the other, equally important, dimensions of administrator behavior.
BIBLIOGRAPHY

Allison, Graham T.  
1971  

Anscombe, Francis J.  
1964  

Averch, Harvey; Stephen Carroll; Theodore Donaldson; Hubert Kushing and John Pincer.  
1972  

BMD:P2V  
1973  
"Repeated Measures Analysis of Variance with Covariates", Program of the Health Sciences Computing Facility, University of California, Los Angeles.

Coleman, James S.; Ernest Campbell; Carol Hudson; James McPortland; Alexander Mood; Frederick Weinfield and Robert York.  
1966  

Daniel, Ronald D.  
1961  

Dames, Robyn and Bernard Carrigan.  
1974  

Dewey, John  
1910  

Edwards, Ward  
1962  

Feldman, Kenneth  
1969  
Glass, Gene V. and Julian C. Stanley.  

Glenny, Lyman A.  

Gorn, Saul  

Green, Paul E; Michael Halbert, and Minas Sayer.  

Green, Paul E; Patrick Robinson and Peter Fitzroy  

Gross, Neal and Robert Harriot  

Hills, Jean  


Hoen, Robert  

Husen, Torsten  

Hyman, Hubert; Charles Wright and John Reed.  
Jencks, Christopher

Kant, Fremont and James Rosenzweig

Lindblom, Charles E.

McCordic, W. J.

McGee, Victor E.

Meyer, Donald L.

Morris, Peter A.

O.E.C.D.

Ott, Jack: Sheila Fletcher and Donald Turner.

Petersen, George.

Rubenstein, Albert and Chadwick Haberstrokh (eds.)

Shannon, C.E. and W. Weaver
Simon, Herbert
1957
1960

Singleton, J. W.
1972
"Decision Making." Education Canada, 12:45-50.

Taylor, Ronald N.
1975

Thurston, Philip H.
1962

Ugalde, Antonio
1973
"A Decision Model for the Study of Public Bureaucracies." Policy Sciences, 4:75-84.

Winer, B. J.
1971
APPENDIX A

GAME INSTRUCTIONS AND RESPONSE FORM

GAME INSTRUCTIONS

Your cooperation is requested on an experiment designed to determine how people value information. Please read carefully the following game instructions.

Assume that you are the principal of a large school. You are responsible for deciding which of two academic programs are to be implemented. Your objective is to maximize the per pupil budget allotment from the Secretary-Treasurer.

The Two academic programs are called program 1 and program 2. For each of these programs there are two possible states. Each state consists of all the factors which could influence the Secretary-Treasurer in his decision to fund the program. For example, there may be political and economic factors, as well as personality factors. Each state represents a different combination of factors. Although you do not know which state will prevail, you are given the probability or likelihood of that state occurring.

You, as principal, may devote time to ascertaining which state actually does prevail. However, the time and goodwill lost in this process will reflect itself in lower per pupil subsidies.
Here is an example to help clarify the problem:

\[\begin{array}{cc}
\text{EXAMPLE} & \text{state A} & \text{state B} \\
\text{program 1} & 350 & 130 \\
\text{program 2} & 275 & 190 \\
\text{probability of state} & .8 & .2
\end{array}\]

If program 1 is chosen and state A occurs, then the average subsidy per pupil is $350. However, if state B had prevailed, then the average student subsidy would be $130. If program 2 is chosen and state A occurs, then the average student subsidy will be $275, while if state B occurs the average student subsidy would be $190.

It is given that the probability of state A occurring is .8, while the probability of state B occurring is .2. This means that, in the long run, state A will occur 8 times out of 10 and state B will occur 2 times out of 10.

Before choosing program 1 or program 2 you may decide to conduct a survey which will determine with certainty which state will prevail. However, this survey will cause delays in implementing the program which in turn will result in the lowering of the average per pupil subsidy. This lowering or 'cost' will range from $1 to $210.

Your problem is to determine (1) whether you will, or will not, conduct the study and (2) having made that decision, which program (1 or 2) you will choose.
There will be six situations in each game and there are eight games. The six situations represent six independent studies. Each study costs a specified amount. In each study you will receive the same information; namely, what state is going to occur for that situation.

Look at game one on your response sheets. Suppose that conducting the study will result in the lowering of the subsidy by $210, and you decide that it is better not to conduct the study. If so, you will check the 'Not Conduct Study' column of your response sheet.

Suppose that you do decide to conduct the study. Check the column headed 'Conduct Study'. When you have indicated on your response sheet which of the six studies you wish to purchase, raise your hand. The umpire will then come to your seat and write on your response form, under the column headed 'True State', the results of the studies which you have decided to conduct. Remember the umpire will tell you which state will prevail only for those situations in which you purchased a study.

You then choose program 1 or program 2 for each situation. Remember that if you decide to conduct the study, the net student subsidy will reflect the reduction caused by conducting the study. Enter the program you choose P1 or P2 under the column headed 'Program'.

When everyone has finished the first game, the umpire will call out the true state for all six situations. You en-
ter these under the column headed 'True State'. The gross scores can now be determined. The net score for those cases where no information was sought is the same as the gross score. The net score for those cases where the study was conducted is obtained by subtracting the cost of the study from the payoff indicated in the matrix.

Bear in mind that the survey results reflect the long term probabilities for each state. However, the individual results have been chosen from a table of random numbers, so it is impossible to predict the outcome of a study from previous results.

After the net scores have been determined for all six situations, you total this column to obtain the total score. You will be asked to call out your total score. The person in the group with the highest score will be declared the winner for that game. The person who wins the most games will be declared the winner overall.

When you complete game 8, you will be asked to hand in the game instructions, and response forms, then you will be asked to fill in a personal information sheet.

Before beginning, the umpire will review, in step form, the rules and procedures to be followed. You may now ask any procedural questions before beginning.
PERSONAL RESPONSE FORM

Please fill in the personal information requested below. All information will be confidential and reported only as group statistics.

(1) Name ________________________________ (2) Sex: _____

(3) Teaching Experience: ________________ years.

(4) Have you had any practical experience in educational administration at the department head level or beyond (ie. vice-principal, principal, central office position):

    yes    no

If yes, (a) Please give (1) the title of the position(s), (2) number of years occupied and (3) a brief description of the responsibilities assumed:

(1) Job Title (2) Number of Years Occupied (3) Brief Job Description

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

(5) How many GRADUATE level course units in the U.B.C. Department of Educational Administration have you COMPLETED: __________ units

Note: The course Ed. 460 may be included as a graduate
course if it was taken as a prerequisite for the masters program; otherwise only 500 level courses may be included.

(6) How many GRADUATE level course units in educational administration have you completed at an institution other than U.B.C.: _________ units

__________________________________________University

NOTE: If courses were not assigned units, please indicate course weighting (ie. full-course, 2 semesters):

(7) Have you ever studied Statistical Decision Theory:

___________ yes ___________ no

If yes (a) Please indicate at what level (ie. undergraduate, graduate, independent study):

__________________________________________

(b) Briefly describe the nature of the course (ie. mathematical, applied statistics, computer science):

__________________________________________

__________________________________________
SAMPLE GAME RESPONSE FORMS

[For Umpire - Cond. 1]

GAME

<table>
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<td>PROBABILITY OF STATE</td>
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<th>CONDUCT STUDY</th>
<th>NOT CONDUCT STUDY</th>
<th>TRUE STATE</th>
<th>PROGRAM GROSS SCORES</th>
<th>COST OF STUDIES PURCHASED</th>
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Total Score
SAMPLE GAME RESPONSE FORMS

[For Umpire - Cond. 2]

GAME

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PROBABILITY OF STATE

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<th>NOT CONDUCT STUDY</th>
<th>TRUE STATE</th>
<th>PROGRAM</th>
<th>GROSS SCORES</th>
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</table>

Total Score

Total Score
In this derivation of Bayes Theorem the following notation will be used.

Let $P(A)$ denote the probability of event A occurring

$P(AB)$ denote the probability of the joint occurrence of events A and B

$P(A/B)$ denote the probability of event A occurring given that event B has occurred

Define: $P(A/B) = \frac{P(AB)}{P(B)}$ and $P(B/A) = \frac{P(AB)}{P(A)}$

Notice that with these definitions, in the special case where A and B are mutually exclusive $P(AB) = P(A).P(B)$

substituting $P(A/B) = \frac{P(A).P(B)}{P(B)}$ and $P(B/A) = \frac{P(A).P(B)}{P(A)}$

$P(A/B) = P(A)$ and $P(B/A) = P(B)$

Thus the probability of event A occurring, given that event B has occurred is exactly the same as if the outcome of event B was unknown.

The defining equations may be rearranged to give:

$P(AB) = P(B).P(A/B)$ and $P(AB) = P(A).P(B/A)$

$P(B).P(A/B) = P(A).P(B/A)$

$P(A/B) = P(A).\frac{P(B/A)}{P(B)}$
This last equation is known as Bayes Theorem. For an example of how this theorem is often used by experimenters, let event A be some hypothesis H1 which is to be tested. Before conducting any experiment suppose that the experimenter has decided that the probability of hypothesis H1 being true is .5, ie. P(H1) = .5. The experiment is conducted, and data is gathered. The experimenter wants to know how the data gathered affects the probability of the hypothesis, ie. P(H1/D). This can be obtained by using Bayes Theorem.

\[
P(H1/D) = \frac{P(H1).P(D/H1)}{P(D)} \quad (\text{McGee, 1971})
\]

Posterior = Prior Likelihood

Probability Probability Ratio

In the likelihood ratio, P(D/H1) represents the probability of obtaining the data given that H1 is true, while P(D) represents the probability of getting the data anyway.

The main criticism of the Bayesian approach has appeared to centre on the assignment of prior probabilities. McGee (1971) argues that both Bayesian and traditional statistics make arbitrary assumptions about the population being studied. In the case of traditional statistics, statistical models are presented as adequate representations of the real world.

McGee goes on to specify techniques for assigning prior probabilities. In this experiment such techniques were not necessary, as the prior probabilities were arbitrarily assigned and constituted one factor in the experimental design.
## APPENDIX C

### TRUE STATES FOR EACH CONDITION

#### ANSWER SHEET FOR UMPIRES

The existing (true) states for each condition are given below:

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>SITUATION 1</th>
<th>SITUATION 2</th>
<th>SITUATION 3</th>
<th>SITUATION 4</th>
<th>SITUATION 5</th>
<th>SITUATION 6</th>
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</thead>
<tbody>
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</table>
APPENDIX D

SUMMARY NOTES FOR UMPIRES

(1) Introductions

(2) Hand out game instructions and response forms to each player

(3) Allow 10 - 15 minutes for players to read the game instructions

(4) Answer any Procedural Questions

(5) Read through the summary of game instructions

(6) Answer any procedural questions

(7) Begin game 1

(8) Upon completion of game 1 have the players call out their total scores

(9) Acknowledge the winner by saying 'very good X won that game'

(10) Repeat for all 8 games

(11) Declare the overall winner, i.e., the person who has won the most games

(12) Hand out the personal information sheet

(13) Choose, at random, one member of the group. From the others collect all forms. They may then be dismissed.

(14) To the remaining player ask the following question:

"Please describe, as clearly as possible, how you came to decide which games were worth purchasing in game 1, game 2, and game 6?"
(15) Record the answer to the question in note (14) in as much detail as possible.

(16) Return personal information sheets, game instructions, response forms and the answer to the descriptive question to Fred Angus, Room 16, SSOB.
APPENDIX E

SUMMARY OF GAME PROCEDURES

To be read by umpire after players have read game instructions

(1) Carefully study the matrix for each game. Some games may appear to be similar, but they are all different.

(2) Look at the six situations for each game and the cost of conducting the six studies.

(3) Choose which studies you feel are worth purchasing.

(4) Indicate with a check mark on your response sheet which studies you will conduct and which you will not conduct.

(5) Raise your hand, the umpire will indicate under the column headed 'true state' which state will occur for those studies which you have decided to conduct.

(6) For each situation indicate which program you wish to implement.

(7) When everyone has finished, the umpire will call out the true state for all six situations. Enter these under the column headed 'true state'. Note that if you have purchased a survey you already know the true state for that situation.

(8) With the program you have chosen and the true state, find the per pupil budget allotment from the game matrix and enter it under the column headed 'gross
scores'.

(9) For those studies which you purchased, enter the cost under the column headed 'cost of studies purchased'.

(10) Calculate the net score by subtracting the cost of studies purchased from the gross scores.

(11) Total the net score column to obtain the 'total score'.

(12) The umpire will then ask you to call out your total score. The player with the highest score will win the game.

(13) The same procedure is followed for each game until all eight games are completed. You will then be asked to hand in your information sheet response sheet, and game instructions.