Introduction

Decision behaviour forms much of the basis for general standards of accounting and auditing practice. Consider, for example, such questions as the following:

1. What changes in the income statement and balance sheet accounts would alter a user’s decision?
2. How are decisions affected by changes in accounting principles?
3. What internal control attributes affect the auditor’s reliance on the overall system?
4. When will standardized procedures improve audit decisions?
5. Will traditional auditing methods be cost effective in detecting fraud?
6. Do “Big 8” accounting firms dominate the decisions of accounting policy boards?
7. Which changes in accounting report format will affect performance evaluations by managers?

The first two questions are of major concern to the Financial Accounting Standards Board (FASB) in its attempts to develop materiality standards and to eliminate accounting alternatives. Questions 3 and 4 are being examined by numerous public accounting firms attempting to improve their audit programs. Questions 5 and 6 form the basis for regulatory action being considered by both Congress and the Securities and Exchange Commission. The answer to the last question has a major impact on the designers of management information systems.

Answers to these questions have traditionally been supported by an informal consensus of practitioners’ experience. It is only in recent years that accounting researchers have endeavoured to provide systematic evidence which bears on these basic issues. Researchers have discovered that similar questions have been examined in other disciplines, such as economics, finance and psychology. Those who attempt to answer questions which require descriptions of individual behaviour have turned to a branch of psychology called behavioural decision theory, which has its roots in cognitive psychology, economics and statistics.

Given the importance of decision-making in all phases of human endeavour, it is not surprising that a vital literature in psychology has developed. Further, decision-making is being studied in
the context of a variety of applied disciplines, such as engineering, law, medicine, marketing and accounting. The goal of much of this work is to describe actual decision behaviour, evaluate its quality, and develop and test theories of the underlying psychological processes which produce the behaviour. In addition, these descriptions reveal flaws in the behaviour and often suggest remedies for these deficiencies.

**General framework for analyzing decision-making**

The purpose of this chapter is to demonstrate what research in judgment and decision-making offers to accountants. To meet this goal, a very basic question must first be addressed: Why should accountants be interested in individual judgment and decision-making? The general answer is that decision-making is an intrinsic part of the current practice of accounting. Decision-making is the basis for the demand for accountants’ services and is involved in many of their more difficult duties. First, the demand for the accountant’s product, information, is generated by those who believe the accounting information will aid them in their decision-making. Investors, lenders, employees, government and the management of a firm are affected by the information choices accountants make. For example, when reports are developed for a manager who makes production-planning decisions, the choice of level of data aggregation, number of periods, report format and accuracy of the information might all affect the decision maker’s performance. Since the impact of the accountant’s choice will be, in part, a function of how the information is processed by the decision maker, the accountant must learn how users’ decisions are made.

Second, accountants themselves are called upon to make countless complex decisions. For example, the accountant must (a) determine the content of reports provided to decision makers, (b) estimate, in the context of giving tax and accounting advice, how different regulations will be interpreted by authorities, (c) decide how to combine the results of various parts of an audit to produce an appropriate audit report and (d) predict the demand for audit services in order to plan personnel needs. The quality of these decisions, among others, will determine the accountant’s success in the marketplace. Whether accountants are concerned with their own or others’ decisions, the focus of their concern is on the improvement of decisions.

**Improving decisions**

What, then, are the available options for improving decisions? Figure 3.1 illustrates three basic options:

1. Changing the information (area A).
2. Educating the decision maker to change the way he or she processes information (area B).
3. Replacing the decision maker with a model (area C).

In addition, some combination of these three options might be employed. In Figure 3.1, these combinations are represented by areas D, E, F and G.

Accountants have traditionally tended toward the first approach, changing the information. However, the impact of this option is not unaffected by decisions regarding the other choices. The impact of a change in information will be determined, at least in part, by how the information is used. Further, the characteristics of the information will in turn affect the way the
information is processed. Stated more simply, the information set and the method chosen to process the information have an interactive effect on the quality of decisions.

Some would argue that there is no need to understand how information is being used, but on the optimal way different sets of information can be processed and the best combination of information and processing methods. However, before one can decide that a change is necessary, a baseline is needed to measure the incremental benefits of the change. This calls for an understanding of how decisions are currently being made and a measure of current decision performance. Perhaps more important is that knowledge of how decisions are being made highlights flaws and inconsistencies in the process, which are clues to specific methods of improving decisions. Our first step toward this ultimate goal of improving decisions is to study a general framework for describing how decisions are made.

**A structure for representing decision situations**

In most decision-making situations, judgments about the environment must be made in the absence of direct contact with the object or event to be judged. In such circumstances, “most likely” judgments are formed on the basis of information or cues whose relationships to the object or event of interest are imperfect or probabilistic. That is, judgments and decisions are made under conditions of uncertainty about the relationships between cues and events. For example, bankers evaluating a loan application must predict whether or not the customer will default on loan payments in the future. They must make this judgment on the basis of such indicators as financial statements, interviews, plant visits and loan history, which both individually and collectively are imperfectly related to the future default-nondefault.

Let us examine a situation of decision-making under uncertainty with which most readers should be familiar – the graduate business school admissions decision. Figure 3.2 presents...
a general structure which highlights the important features of this situation. When making this decision, the admissions committee (decision maker) attempts to predict an applicant’s future success as a student and in the job market. Future success will be represented by $. However, the committee cannot judge this future event directly, as it has yet to take place. As in most situations, the decision maker is separated from the event of interest by space or time.

On what basis, then, can this judgment of future success be made? The applicant usually provides a number of cues, including GMAT scores, grade point average (GPA), quality of the undergraduate school attended, recommendations, participation in extracurricular activities and answers to subjective questions. None of these individual cues or combinations are perfect indicators of future success. Some of them, however, may be probabilistically related to this event. In Figure 3.2, these imperfect relationships are denoted by broken lines.

One would also expect that in most cases these cues will come in related bundles; that is, some of the cues will contain information redundant with that provided by other cues. For example, one could speculate that the school quality index will be negatively related to GPA and that GMAT scores will be positively related to both GPA and school quality. In Figure 3.2 the relationships between cues are expressed with broken lines.

On the basis of these cues, the committee will make a rating which indicates their most likely estimate of the candidate’s success. The cues will be used to varying degrees, and the relative reliance on different cues is likely to change over time as a result of fatigue, special circumstances, learning and so on. The resulting probabilistic relationship between each cue and the judgment is also represented in Figure 3.2 by broken lines.

The final relationship in Figure 3.2, which will be called judgmental achievement, is the focus of our schematic representation of decision-making under uncertainty. The achievement measure comprises two factors: (a) measurement of the accuracy of the judgments and (b)
determination of the consequences of any error. The accuracy of the judgments can be measured after the student has completed his or her education by comparing estimated and actual performance. The consequences of the error will be a function of the action or choice which results from the judgment and the decision maker’s preferences for outcomes.

To review, the model in Figure 3.2, which is an adaptation of Brunswick’s (1952) lens model, portrays the decision maker as (a) being separated from the event of interest by time or space, (b) faced with multiple overlapping cues which are imperfect predictors of the environmental state and (c) probabilistically combining these cues to form a judgment. In effect, the environment is observed through a “lens” of imperfect cues.

The focus of the model is on judgmental achievement. The model suggests that judgmental achievement will be a function of both the environment (the model’s left side) and the decision maker (the right side). This dual effect implies that a complete understanding of decision-making requires that the decision maker and the environment be studied jointly.

This structure is very general and can be applied to almost any decision-making scheme. Again, consider a simplified commercial lending decision in which the principle task of the loan officer is to predict loan default. Loan default–nondefault is mainly a function of the future cash flows which will be available to the customer to service the debt. The customer provides a number of cues, some of which are probabilistically related to future cash flows. These include indicators of liquidity, leverage and profitability drawn from financial statements, management evaluations resulting from interviews, plant visits, discussions with other knowledgeable parties and outside credit ratings. No individual cue or combination of cues is a perfect predictor of future cash flows, and there is overlap in the information (e.g., credit ratings are closely associated with profitability and liquidity measures). In making this judgment, the loan officer combines these cues into a prediction of future cash flows. Even if the banker’s judgmental policy is highly stable over time, some inconsistencies are likely to arise, which will result in a probabilistic relationship between the cues and the final judgment. At the end of the term of each loan, the officer’s prediction of cash flows can be compared with the actual event, and any resulting losses can be computed to measure achievement. While this example is highly simplified, it illustrates the generality of the framework and its importance for accountants. The model’s principal concern with information-processing achievement in an uncertain world coincides both with accountants’ interest in improving the decisions made by users of accounting information and their more recent attention to the quality of their own decisions.

**Basic questions about decision-making**

This simplified lens model portrays the individual interacting with the uncertain environment. The relationships in the model suggest the following research questions, which are fundamental to an understanding of decision-making:

1. What information about the event is available to decision makers?
2. How accurate is the information?
3. How is the information combined in forming judgments?
4. How accurate are the judgments?
5. What attributes of the information set, the context and the decision maker affect the quality of the judgment?
6. How might the quality of judgments be improved?
INPUT PROCESS OUTPUT

I. Information set (cues)  

Variables of interest  
A. Scaling  
   1. Level of measurement (nominal, ordinal, etc.)  
   2. Discrete or continuous  
   3. Deterministic or probabilistic  
B. Statistical properties of the information set  
   1. Number of cues  
   2. Distributional characteristics  
   3. Interrelationships of cues  
   4. Underlying dimensionality  
C. Information content (predictive significance)  
   1. Bias (systematic error)  
   2. Reliability (random error)  
   3. Form of relationship to criterion  
D. Method of presentation  
   1. Format (numerical, graphical, verbal)  
   2. Sequence  
   3. Aggregated or disaggregated (precombination of data)  
E. Context  
   1. Physical viewing conditions  
   2. Instructions  
      a) Objective  
      b) Costs and rewards  
      c) Information about cue attributes  
   3. Task characteristics  
      a) Type  
      b) Response modes  
      c) Social influences  
      d) Uniformity of information cues  
   4. Feedback

II. Judge (decision maker)  

Variables of interest  
A. Judge characteristics  
   1. Human-mechanical  
   2. Number of judges  
   3. Personal characteristics  
      a) Intellectual ability  
      b) Personality  
      c) Cognitive structure  
      d) Attitudes  
      e) Demographics (e.g., age, sex)  
   4. Task-related characteristics  
      a) Prior experience-stored information  
      b) Interest and involvement  
   B. Characteristics of decision rule  
      1. Form (linear, configural, compensatory, etc.)  
      2. Cue usage (weighting)  
      3. Stability (change-learning)  
      4. Heuristics

III. Judgment-prediction-decision  

Variables of interest  
A. Qualities of judgment  
   1. Accuracy (validity)  
   2. Speed  
   3. Reliability  
      a) Consistency  
      b) Consensus  
      c) Convergence  
   4. Response bias  
   5. Predictability  
   B. Self-insight  
      1. Subjective cue usage  
      2. Perceived decision quality  
      3. Perceptions of characteristics of information set

Figure 3.3 Classification of information-processing variables

Source: Libby and Lewis (1977, Figure 1)
The first two questions address the nature of the decision environment. Questions 3 and 4 pertain to a particular decision maker’s process. Question 5 asks how characteristics of the environment and decision process interact in affecting the decisions. Finally, the last question suggests the goal of applied decision research—improvement in the quality of judgments. The general model presented therefore provides both a method of integrating these questions and a systematic method for structuring decision-related accounting issues.

Each of the preceding questions is composed of subparts, which are presented in Figure 3.3 under the headings of the information set, the decision maker and his or her judgments. Although this listing is not exhaustive, these are many of the subparts or attributes which make up the substance of most accounting research questions. Accountants addressed many questions about decision-making before they began applying behavioural decision theory, but they did not look upon these “accounting problems” as being composed of a series of underlying information-processing variables. Viewing the problem of interest in terms of the underlying variables leads the research to the appropriate psychological theory and evidence which can help to set expectations about what might be found in the accounting situation. Methodologies which have proved useful in similar situations may also be discovered.

Fortunately, psychologists have studied many of the variables in which we are interested, situations very similar to those which characterize the practice of accounting. For example, a number of studies of individual accounting behaviour have examined the impact on decisions of adding supplementary inflation-adjusted information to traditional financial statement presentations (see Dyckman 1975, for a review). Not one of these studies made any prediction about the potential effects of this change. This deficiency can probably be attributed to the failure of the researchers to analyze the alterations in the underlying information environment caused by the accounting change. Had they done so, they might have examined the change in potentially important variables, such as the number of cues, their interrelationships and their predictive ability. Further, the literature suggests that the effects of the change might be mediated by the decision maker’s lack of experience with this type of data. These issues have been studied extensively in the multiple-cue probability learning literature. The findings of the psychological research could have helped set the early accounting researchers’ expectations, which would have guided them in their conceptualization of the problem and in their experimental design. Further, methodologies which are more suitable for addressing these issues than those used in the early studies have since been developed.

Before the specific approaches to the study of judgment and decision-making are examined, we will make a small investment in discussing the experimental approach to hypothesis testing to illustrate how it relates to other research approaches. This section is of principal interest to more advanced readers. The discussion will aid in an understanding of the strengths and weaknesses of the specific research studies we will later evaluate. In keeping with the purpose of this book, the discussion will be in summary form. Those requiring a more detailed presentation are referred to standard methodology texts, such as that by Kerlinger (1973).

**Theory validation**

A general framework for theory validation will help to illustrate the research process. This framework is usually called the *predictive validity* model. In its simplest form, a theory specifies relationships between concepts. For example, concept A, intelligence, is assumed to affect concept B, academic achievement. Researchers who might attempt to test this theory are faced with a problem. Neither of these two concepts, intelligence and academic achievement, can be
directly measured, because concepts themselves are not observable. The researcher must therefore develop operational or observable definitions of these concepts. For example, scores on an IQ test might be used as the operational definition of intelligence, and school grades might be used as the operational definition of academic achievement. In addition, the researcher must be concerned with other factors, such as social background, that could affect or moderate the relationship.

Accounting researchers who attempt to test theoretical relationships are faced with the same problems. Figure 3.4 illustrates the conceptual network implicit in a study by Ashton (1976). Ashton hypothesized that decision rules (concept B) would be insufficiently adjusted in response to changes in accounting rules (concept A). He studied this question in a product pricing decision context. The independent variable, change in accounting rule, was operationally defined as a change from full to direct cost inventory accounting, or vice versa. The change in decision rule, the dependent variable, was operationally defined as a change in a certain statistical indicator called “cross-temporal model validity”. Ashton also controlled for two moderating variables: information about the change in accounting rules and the importance of the change.

Again, because a researcher can never directly test the relationship between two concepts (Link 1 in Figure 3.4), the theory must be tested by assessing the relationship between the operational definitions of the independent and dependent variables (Link 4 in Figure 3.4). Implicit in this framework are the assumptions that Links 2 and 3, which relate the concepts to the operational definitions, are valid, and that other factors that might affect the dependent variable (Link 5) either have been controlled for or have no effect.

The evaluation of the validity of a study will then be a function of the appraisal of Links 1, 2, 3, and 5. Once it has been determined that a logically consistent theoretical framework is being employed (Link 1), the evaluator should look closely at the ways in which variables are operationalized (Links 2 and 3) and other factors are controlled for (Link 5). If there is a major flaw in the theoretical relationship, or if the operationalization and control are not appropriate, the results of the study are of little value no matter how clever the procedures or how sophisticated the analysis.

Figure 3.4 Conceptual framework
Experimental design

Next, the design of the experiment must be considered. The major purpose of experimental design is to arrange observations of effects and causes or treatments so that we can be sure that observed effects are the result of our treatments, thereby producing what is called internal validity. In the example in Figure 3.4, the researcher would attempt to arrange observations of decision rule changes and accounting changes to ensure that any changes in the former were caused by changes in the latter. A second important goal of experimental design is external validity, or the ability to generalize results beyond the specific tasks, measurement methods and actors of a specific study. Both internal and external validity are affected by how the variables in a study are treated. In any research study, the principal variables of interest can be treated in the following ways:

\[ X = \text{independent variable or treatment.} \] The values of independent variables are established prior to execution of the study. They can either be systematically manipulated, as they normally are in experiments, or they can be measured in natural settings, as they normally are in econometric studies.

\[ O = \text{dependent variable or observation.} \] The dependent variable, which is allowed to vary freely in response to the independent variable, is measured. This is the place in the study where new information is gathered.

The remaining variables in the study can be treated by the following:

\[ K = \text{holding constant.} \] The variable is held constant at one value across all values of the independent variables.

\[ M = \text{matching.} \] Matching assures that the distribution of the variable is equal across levels of the independent variables.

\[ R = \text{randomizing.} \] Randomizing ensures that the distribution of the variable is unbiased or is equally probable across levels of the independent variables.

\[ Z = \text{ignoring (intentionally or unintentionally).} \] Variables are ignored intentionally if we have thought about them and have decided they logically should have no effect.

These six modes of treatment of variables can be used to compare two often-used accounting research approaches: econometric studies and experimental studies. Our framework for

| No. 1: Static group comparison: | X O₁ |
| No. 2: One-group pretest-posttest design: | O₂ |
| No. 3: Posttest only control group design: | O₁ X O₂ |
| R | X O₁ |
| O₂ |

Figure 3.5 Some experimental and quasi-experimental designs

Adapted from Campbell et al. (1963)
comparing different experimental designs is based on Campbell et al.'s (1963) scheme. Three of these designs are presented in Figure 3.5.

Most studies of stock-price reactions to actual accounting changes (“efficient markets” studies) use either designs 1 or 2 (see Dyckman, Downes and Magee 1975, for a review). We will first examine design 1, the static-group comparison design as presented in Figure 3.6. In this design, the effect of the treatment variable, the accounting change, is determined by comparing certain attributes of security returns between a group of companies exhibiting one level of the independent variable and a group exhibiting a second level of the independent variable. Note that the measured independent variable (X) and the observation (O) are not the only modes of treatment used in these studies. A re-examination of the predictive validity framework depicted in Figure 3.4 will indicate that, while the independent and dependent variables have been specified, we have yet to consider the other potential moderating factors which might affect the dependent variable. How can these remaining variables be treated in a stock-price study? Some may be held constant (K); for example, we can decide to consider only firms with certain characteristics (e.g., New York Stock Exchange firms only). The two groups can also be matched (M) on certain variables (e.g., size or industry). The remaining variables are treated by Z; they are ignored. Often, the decision to consciously ignore certain variables is based upon the results of prior research. Other times, these variables are assumed to be randomly distributed across levels of the independent variables. Because it is impractical to hold constant or match many variables, a large number of potentially relevant factors must be ignored in stock-price studies.

Accounting studies using the static-group comparison design face two major problems in determining the effect of the treatment. Each problem creates a competing hypothesis which could explain observed differences in behaviour. First, even before receiving the treatment, the groups may be systematically different on some variables which were ignored or ineffectively matched. This results in what are called selection biases. Second, even if the groups are assumed from the beginning to be equivalent, they may experience differential mortality; that is, the dropout rate may be different between the two experimental groups. For example, more of the firms using one accounting method may drop out of a sample as a result of failure or merger.

Many efficient market studies employ a second design, the one-group pretest-posttest design (Figure 3.5, design 2). In this design, the same dependent variable (relating to stock returns) is observed both before and after receipt of the treatment (accounting change) to determine its effect. The variable observed is usually some measure of portfolio returns which is “preobserved” when the portfolio is formulated. This design faces different threats to internal validity, the most important of which, to accountants, is history. History becomes a rival hypothesis when other change-producing events occur between the pretest and posttest observations. For example, a change in government regulations may take place contemporaneously with the accounting

![Figure 3.6 Design 1: Static group comparison](image-url)
event of interest. This design would not allow the effect of the accounting change to be disentangled from the effect of the change in government regulation. Other threats to internal validity intrinsic to these designs are discussed by Campbell et al. (1963).

In contrast, laboratory and field experiments investigating individual decisions use a different design. In this case, design 3, the posttest-only control group design presented in Figure 3.7 is commonly used. Note that this design is very similar to design 1, except that variables which are not held constant or matched are not ignored, but are randomized. Instead of assuming that other important variables are randomly distributed, such a distribution is assured by randomly assigning participants to the experimental groups. This design eliminates the remaining threats to internal validity. Experiments based on this design also tend to use more of mode $K$, holding moderating variables constant, to simplify the experimental task.

Note the major differences between designs 1 and 2, which are employed in stock-price studies, and design 3, which is used in experimental studies. In stock-price studies, by necessity, a number of variables are treated with mode $Z$; they are ignored. Treating variables in this fashion threatens the internal validity of the study. Recent studies of the effects of the new oil and gas accounting standards on drilling companies illustrate these problems. In most stock-price studies, the effects of other potentially relevant events are assumed to be distributed randomly across levels of our independent variable (whether the company used full-cost or successful-efforts accounting before the change). However, mode $Z$ does not assure this distribution. In the oil and gas case, there is some evidence that companies with different economic characteristics choose different accounting methods. This produces potential selection biases. Events relevant to drillers’ stock prices, such as the issue of a new government regulation or a change in oil prices, may have also occurred contemporaneously with the issue of the new accounting standard. In instances where accounting choices and economic attributes may be related, one cannot expect that the effects of these other events will be randomly distributed. As a result, there will be no method for discriminating between the effects on stock prices of our independent variable, the accounting-policy change, and these contemporaneous events. In capital-market studies, however, the treatment variable ($X$) is measured in the real world, the actors and context are also observed in the real world and diverse populations are usually sampled (little $K$ is used). All these factors minimize threats to external validity.

Alternatively, experimental studies treat many variables by holding them constant and employ a manipulated independent variable, which, by its nature, is in part contrived. These practices and questions about the representativeness of contexts and subjects create important threats to external validity for experimental studies. However, since variables which are not matched, held
constant or treated as independent variables are controlled for through randomization, most threats to the internal validity of these studies are eliminated.

A likely question to arise at this point is “Must all potential sources of invalidity, both internal and external, be eliminated for a study to make a contribution?” The answer is “Definitely not.” However, given the different strengths and weaknesses of the two research approaches that have been discussed, it should be clear that they are complementary. This complementarity supports the view of research as an interactive process of evidence gathering in which the use of various methodologies with different strengths and weaknesses increases the diagnostic value of the findings.

Notes

1 Originally appeared as Chapter 1 of Accounting and Human Information Processing: Theory and Applications (Libby 1981). Reprinted with permission.
2 Hogarth (1980) and Nisbett and Ross (1980) illustrate the breadth of this literature.
3 The terms judgment and decision-making are often used interchangeably. When distinguished, judgment usually refers to the process of estimating outcomes and their consequences, while decision-making involves an evaluation of these consequences which leads to a choice among the alternatives. Judgment, as well as tastes and preferences, provides the input for decisions. The differences in meaning become more evident as we progress through the book.
4 See Newell (1968) for a more extensive set of questions.
5 This statistic measured the change in a linear representation of the subject’s decision process.
6 Campbell et al. (1963) is the primary reference on this subject.
7 Stock-prices studies and individual-decision studies also differ greatly in their goals, as the relationship between individual and aggregate market behaviour is quite complex. This example was chosen only to illustrate the different experimental design problems faced by the two types of research.

References
