

DECISION ANALYSIS AND RATIONAL JUDGMENT: Structuring Knowledge, Values And Choice

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PREFACE

This is a primary text for a self-sufficient course on decision analysis technique applied to public and private practical choices. The major intended user is the professional decision-maker, who wishes to make—or to recommend—sound decisions, and to communicate them effectively (say, as a middle manager or support staff.). This course can also be readily adapted to improve the personal decision skills of lay individuals (say, liberal arts majors).

Decision analysis is an increasingly sought-after skill, especially among administrators in training who are headed for higher decision authority. Book/course introduces decision analysis tools, in the context of a consultant's experience helping policy makers to make and defend choices. Typical issues are:

- Should a regulator close down a nuclear plant?
- Should Congress abolish the death penalty?
- Is the Clean Air Act worth its cost?

The tools structure reasoning on perplexing or controversial choices, and on the factual and value judgments underlying them. Issues include conflicting objectives, direct and indirect assessment of uncertainty and combining different perspectives on the same problem

The technical approach is to model a decider's thinking and his/her current or potential knowledge in a way that assures logical consistency. The models are quantitative (based on statistical decision theory), but involve no mathematics beyond arithmetic. Specific techniques include multi-attribute utility, decision trees, influence diagrams, mean utility, and plural evaluation.

The critical intellectual challenge is to integrate relatively simple models into how the decider *really* thinks about his live choices, in all their complexity and ambiguity. Thus, nothing of value is lost from that thinking, but logical rigor is gained. The student must have an aptitude for understanding how people currently make decisions, as well as for quantitative analysis.

The course focuses initially on personal decisions, before grafting on the distinctive features of professional decisions in an institutional and political context. Teaching technique alternates with illustrative application, involving real (not hypothetical) private and public dilemmas, including policy-consulting cases. For term project, students develop their own judgment on a current public policy issue, singly or in groups. Grading is based on the project, tests, homework and class participation.

The course was developed by instructor Brown, based on thirty years consulting to policy makers, interleaved with methodology research. He was trained as a statistician and social scientist at Harvard and Cambridge, and taught at Harvard Business School and the London School of Economics and Political Science.

A BASE OF PERSONAL DECISION SKILLS

Effective executive decision-making is best developed, I believe, on decisions that are real to the decider; and that reproduce, as closely as possible, the state of mind and knowledge-gathering processes that he (or she) will have in the profession he is preparing for. Unless he is currently in a decision-making job, this largely limits him to personal choices (such as a career move). Decision-aiding technique is therefore exercised heavily in this course, at least initially, on personal choices.

A special case is where the student takes a position, as a citizen, on some public policy issue (say, welfare reform). This expands the considerations he addresses beyond the strictly private, while still relating to a real personal choice.

DISTINCTIVE PROFESSIONAL DECISIONS

Professional decision skills build on personal skills, but they have distinctive features (such as responsiveness to institutional pressure). These features are addressed here, somewhat passively, by referring to professional applications of concepts and techniques, including full accounts of past consulting case studies.

Professional decisions typically justify greater effort and more advanced technique than personal decisions. The degree of effort and level of technique, however, may vary. Although a citizen may find it beneficial to spend only hours deciding whether to personally favor the death penalty, using only the simplest analytic tools, a congressional staffer may need to spend weeks evaluating death penalty legislation, and have to call upon more specialized analytic help. His (or her) analysis may also need to withstand critical review.

An instructor may structure a course from material presented here to emphasize either personal or professional needs. A personally oriented course, for example, could omit some chapters, such as chapter 12 [?] (Professional issues) and could have students exercise tools on a private decision that is revisited throughout the course. A professionally oriented course would draw on all the material in the course and prepare the student to develop more advanced technique beyond this course. The course could use a public policy running exercise and focus more on the consulting case studies.

Course material could be extended by use of traditional case studies, available elsewhere¹, where students analyze a real or hypothetical institutional decision, based only on a written description of the problem and its background.

DECISION SKILLS

Whether for professional or personal purposes, the course teaches skill in making up one's mind on any perplexing (or controversial) choice—and the subsequent need to communicate it to others. It is mainly concerned with drawing on a single decider's existing judgments of fact and value and guiding him/her on handling new information. Furthermore, it provides a framework for more impersonal analysis, and for managing the judgment of several people interested in the same decision.

Decision analysis can assist individuals in making choices by:

- Resolving conflicting objectives;
- Accounting for uncertainty in outcomes;
- Assessing uncertainty directly and indirectly;
- Gathering information before a decision and updating uncertainty in the light of it;
- Combining alternative ways of making a judgment.

TEACHING APPROACH

Students develop and exercise thinking skills in the context of real (not hypothetical) issues that they could already have opinions on. These issues tend to be familiar personal or public issues, where improving one's choice has clear some meaning. Skills should be transferable to professional issues when they arise naturally in students' careers. Past consulting cases demonstrate the management potential of the tools. [REPET?]

¹ For example from the Case Clearing House at Harvard Business School.

Graduating students should be able to put skills to immediate use—at least to enhance their informal grasp of how to broach a difficult or major decision.

ROLE OF MODELS

Although much of the course is devoted to mastering the essentials of quantitative modeling, the main end product desired is sound *informal* reasoning. The models develop an appreciation of the implicit structure underlying sound reasoning. Indeed, the first few chapters are devoted solely to the qualitative elements of deciding.

Structurally simple decision analysis models (such as multiattribute utility, expected utility and decision trees) constitute a basic tool-kit. Students master essential model mechanics as soon as possible so that the main effort can be devoted to integrating them *usefully* into students' normal reasoning. This is the critical and challenging skill.

The analytic demands are, in fact, considerable, but they are logical rather than technical. Key concepts include:

- Equivalent substitution—producing models that the decider accepts as having the same action implications as his/her real thinking on a problem;
- External validation—reconciling the output of models with practical feedback from “common sense” and the real world of application.
- Plural evaluation—addressing at a problem several different ways and resolving any inconsistencies.

A central theme to the course is to avoid spending an extensive amount of time creating a perfect model, only to have it result in a not-so-perfect decision. This particularly common failing in decision science is best expressed by the by a doctor who states, “The operation was a great success but the patient died.” Combating this problem requires an understanding the human and institutional setting of decisions, as well as the logic of making them better. I.e. it draws on both behavioral and normative disciplines.

STRUCTURE OF COURSE

This book is designed as the sole or principal text for a 30-40 session course, depending on how advanced the students are and the desired scope of the course.

A professionally oriented course, for example, would include the environmental regulation case study at chapter 11, but probably early in the course and chapter 12 on professional issues. Assignments would be chosen with a professional orientation and in particular the term project (e.g. a public policy issue).

Course oriented toward developing personal thinking skills, on the other hand, would omit specifically professional material and could be somewhat shorter.

METHOD OF INSTRUCTION.

The course alternates technical exposition with application, interspersed liberally with exercises. Course projects include students modeling their own judgments on a personal choice (for a term paper), and evaluating a live public policy issue (for group presentation). Consulting case studies (such as whether to close down a nuclear plant) are also described.

Practice material. The primary emphasis is on teaching students to integrate technique into their real—not hypothetical—thinking. They exercise tools on issues that they have—or can form—a real opinion on. Judgments will thus be based on the usual everyday amalgam of personal experience and messy information absorbed over time. They are not hypothetical judgments based on second hand knowledge (say from written case studies or contrived experiments).

In practice, this favors the use of live personal choices, or familiar public policy controversies (which the whole class can participate in). Some students may already have real professional (e.g. managerial) choices to make, but this is not common. Even where professional preparation is the motivation for the course, starter skills may be best developed in the context of familiar problems. The skills should be transferable to professional situations that students are preparing to face, but on which they cannot yet have judgments worth modeling. Professional (e.g. public administration) case studies are presented, but more for illustrative than training purposes.

Complementary text recommended: Hammond J, Keeney RL, Raiffa H. *Smart Choices*. Harvard Business School Press. Boston, Mass. 1999. Good additional texts: Clemen RT *Making Hard Decisions* Duxbury, 1996; Behn RD, Vaupel JW. *Quick Analysis for Busy Decision Makers*. Basic, 1982.

STRUCTURE OF TEXT.

The early chapters develop basic, but practical, decision aiding competence. They focus largely on conflicting criteria problems addressed with a multi-attribute utility model:

- Motivational case illustration
- Informal exploration of considerations in a choice;
- Applied student projects;
- Decision aids and models of rational judgment;
- Characterizing consequences of options;
- Conflicting value models (with consulting case study);
- Analytic strategy: putting tools to use.

Later chapters enrich the above topics and add other models (and corresponding decision processes) to the “tool-kit”:

- Choice under uncertainty (with consulting case study);
- Eliciting model content;
- Indirect probability assessment;

- Organizational professional issues;
- Where to go next.

Appendices. A number of chapters have appendices, some of them substantial. Generally their role is to provide more advanced or optional material that can be omitted in an elementary course.

Evaluation of student performance. Student grades can be based on multiple indicators of course comprehension: final and interim technical tests, term paper, oral presentation, periodic homework and classroom participation.

A *glossary* of key terms is organized by chapter and can serve as a compact review of course concepts.

DEMANDS ON STUDENTS.

No course prerequisites are needed and no explicit mathematics is used, but some quantitative aptitude is desirable.

Although the models are simple, integrating them into realistic judgment in real situations is intellectually demanding and requires substantial logical and interdisciplinary aptitude. Improving on our normal time-tested informal decision skills with formal tools is exceedingly hard. Much of what passes for decision science fails that challenge (Brown, 1999).

The motivational material introducing this course—the illustrative “before” reasoning of “before and after”—may be deceptively digestible. Students have been known to complain of “bait and switch”; in one case a student wryly comment “My other courses are 80% absorption and 20% thinking. This is just the other way round”. In fact, students tend to either breeze successfully through the course without trouble—those with a keen analytic flair—or they struggle throughout.

INSTRUCTOR PREPARATION

The instructor should be well versed in the concepts, and if possible the practice, of decision analysis, as represented, for example, by Keeney and Raiffa (1976). Teaching this course presents some distinctive challenges, due to its unconventional pedagogical strategy. Most student assignments do not have a “school solution”, but allow for great discretion in how course material is used to solve live practical problems. The instructor must be able to respond to, and give guidance on, free-form student analyses that may not follow a familiar pattern.

Teaching notes. If the instructor does not have great practical decision-aiding experience (say, as a consultant in the field) he or she may want to draw heavily on available assignment teaching notes. These also include suggestions on teaching strategy, sample schedules, exercise solutions, exam questions, classroom handouts, etc.

WHERE COURSE MIGHT BE USED

This could be the primary text for a one- or two-term graduate professional course, or possibly an advanced undergraduate course. Variants of the course have been taught to students of Psychology, Business, Public Policy, Government, Environmental Science, and Operations Research (at London School of Economics, George Mason U. and U. Mich.). Other host programs might include Medicine, Law, Engineering, Liberal Arts and General Studies. The course could complement other decision support subjects (such as operations research, risk analysis, statistics for empirical research, and mathematical decision theory).

AUTHOR.

Rex Brown has had both academic and consulting careers, devoted largely to helping professionals make and justify decisions. He was trained as a social scientist and statistician (received the Applied Statistics Award of the British Institute of Statisticians). He has taught decision analysis in statistics, psychology and management programs at Harvard Business School, Cambridge University and the London School of Economics, as well as to Junior High School students. He spent twenty years as a decision-aiding consultant to senior executives in business and government, including environmental, energy and defense agencies.

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