Scientific Knowledge, Risk and Decision-Making

Spring Semester, 2006
Maxine Goodman Levin College of Urban Affairs
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Wednesday 6:00 – 9:50

Course Description and Objectives

Risk is a ubiquitous feature of human life. It is presented to us in the form of terrorism, nuclear power, environmental pollution, habitat loss, global warming, airplane and automobile crashes, carcinogens and endocrine disruptors, to name but a few. This is an interdisciplinary survey of a range of literature in philosophy, psychology, decision-theory, economics, cognitive science, operations research and public policy, all of which is related to the theory and practice of making decisions under risk and uncertainty. Reference is made to the philosophy literature because it contains clarification of many of the fundamental principles and concepts. Reference is made to the psychology literature because, realistically, the subjective judgmental dimension of risk assessment means that the psychology of the individual assessor is an inescapable fact of risk analysis, regardless of one’s level of expertise. Reference is made to the decision-theoretic literature because the theory of risk evaluation and management is a department of a wider theory of decision-making. Reference is made to the economics literature because of the long history of the formal theory of choice under risk and uncertainty found in economics. Reference is made to the cognitive science literature because cognitive processes distinguish the beliefs and judgments of experts from those of laymen, and because this distinction is pivotal in much risk-based decision-making, as well as in the rhetoric of public policy. Reference is made to the operations research literature because in it is found much of the mathematical basis of the normative decision-making models developed in the twentieth century. Finally, reference is made to the public policy literature because when one turns from the level of individual risk-based decision making to the collective level of planning and public policy formulation in the society as a whole, risk-related considerations can be decided only through the operation of the political process.

The course is neither a comprehensive treatise on risk, nor a practitioners’ guide that offers a survey of the tricks of the trade of risk assessment and/or risk management. Instead it aims to develop core themes and conceptual structure that synthesize and integrate subject matter related to scientific knowledge, risk evaluation, risk-management, and decision-making across and between the aforementioned disciplines. The idea is to bring these themes and this conceptual structure meaningfully within the purview of the minds of course participants. A primary goal is to enhance the capability of course participants to make fully conceptualized and informed decisions about key issues that affect the world today. The course seeks to achieve this goal largely by elucidating the difficulties and obstacles that must be overcome to render a coherent understanding of the process of decision-making under risk and uncertainty, the
contributions of scientific knowledge to risk-based decision-making, and the role of risk-based decision-making in planning and public policy. Class participants will be given wide latitude in framing these themes and structures, in discovering and pursuing their multiple constituent dimensions, and in making these dimensions a part of their articulate repertoire. They will also be encouraged to make connections between their frames and the accumulated body of knowledge in the disciplines. This will make it clear that a whole host of conceptual and evaluative issues must be decided before any systematic design methodology can be specified and used intelligibly to compensate for limitations on the unaided human cognitive potentials in the process of risk-based decision making. It will also illuminate just how thin the egg shells upon which one walks are when one uses the risk assessor practitioner’s usual tools.

**Selected Sources of Course Readings**


**Course Format, Requirements and Grading**

This is not a course in which the instructor lectures, the students memorize the content of the lecture, and grades are based upon regurgitating the content of the lectures on exams. The format will be seminar style. Each week in class, the instructor will introduce the material, and then with the help of the next week’s assigned discussion co-leader, the entire class will discuss the material. Thus it is expected that students will read all materials, prepare to ask questions about them and to discuss and argue about them, and will be fully ready to actively participate in class. Grades will be based 60% upon class participation and 40% upon a course research paper.
**Tentative Schedule**

**Part I. Preliminaries**

This section provides a general introduction to risk-based decision-making.

**A Seemingly Plausible Model of the Risk-Based Decision-Making Process** (January 18)


Beach and Connolly, Chapter 1. Preliminaries
Beach and Connolly, Chapter 2. Framing
Beach and Connolly, Chapter 3. Policy
Beach and Connolly, Chapter 4. Choice


**Elements of Risk Evaluation** (January 25)

Rescher. Chapter 3. Probability and its Ramifications
Rescher. Chapter 4. Risk Evaluation and Comparison: The Orthodox Theory


Fundamentals of Risk Management: (February 1)

Read: Rescher. Chapter 5. Disparate Risks, Catastrophes, and the Limitations of Expected Value Analysis
Rescher. Chapter 6. Insurance Against Catastrophe
Rescher. Chapter 7. Risk Dilemmas
Rescher. Chapter 8. Uncertainty


Part II. Rationality and Risk: Normative and Descriptive Camps

This section introduces the formal mathematical foundations of the concept of rational choice, reviews some of the research that demonstrates the differences between the demands on choice established by these foundations and the actual performance of human beings making choices, and in doing so makes elementary distinctions between the normative and descriptive views of risk and rationality.

The Normative Camp: Linear Programming, von Neumann-Morgenstern Expected Utility Theory, Objections to its Ostensibly Objective Foundations, and Subjective Expected Utility (February 8)


Beach and Connolly, Chapter 5. Subjective Probability and Utility
http://cepa.newschool.edu/het/essays/uncert/uncerthome.htm

The Descriptive Camp: Psychological Studies of Judgment Under Uncertainty
(February 15)

Read: Beach and Connolly, Chapter 6. Heuristics and Biases and Prospect Theory


Part III. Scientific Knowledge and Value Judgment in Decision Processes

This section focuses upon the distinction between the risk assessments of experts, on one hand, and lay people on the other. It considers the hypothesis that the difference between them is found in the degree to which it is assumed that the two groups employ fallible cognitive processes in making the assessments.
The Informational and Predictive Basis of Risk-Based Decisions (February 22)


The Normative-Affective Aspects of Risk-Based Decisions (March 1)

In this session we consider values, emotions, passions and habits of mind and their influences upon risk-based decision-making.

Read: Beach and Connolly, Chapter 7. Emotions

Part IV. Integrating Information, Knowledge, and Values in Risk-Based Decisions

This section examines a couple of the prominent ways that people have thought about how the informational and evaluative aspects of decisions are integrated into a choice of action in situations characterized by risk and uncertainty.

Multiattribute Utility Analysis (March 8)


The Analytical Hierarchy Process (March 29)

Psychologically Oriented Models of Judgment and Decision (April 5)


Part V. Risk, Uncertainty, Decision-Making and Public Policy

Earlier sections have focused upon specific elements of the thought processes in which individuals facing a risky situation, the ways they are organized more or less logically and systematically, deliberated upon, and utilized in making a choice between actions. The point has been clearly made that risk-based decision-making requires more than just a set of analytical tools rationally applied. It demands a new way of looking at technological and environmental uncertainty. In this section, the focus is instead upon the interaction between the information, preferences and values held by individuals as members of groups and organizations, including especially the aggregation of information, preferences and values from individual level manifestation and their transformation to collective outcomes. While efforts to intelligently pursue appropriate objectives in the face of risk and uncertainty are almost invariably implemented through collective human action, the notion of which is both intuitive and entirely coherent, there is no sense whatsoever in the notion of joint thoughts. Thus, risk management must incorporate the competing interests, values and rationalities of those involved and find a balance of trust and acceptable risk. In the presence of risk and uncertainty, the success of plans and public policies depends not only upon improvements in the quality of thought of individuals making decisions, but also upon the prevailing characteristics of the cultures, organizations, and institutions through which individual level thoughts are made manifest and aggregated into collective outcomes.
Politics, Risk, and Collective Decisions (April 12)


Beach and Connolly, Chapter 8. Interpersonal, Organizational, and Group Decisions.

Beach and Connolly, Chapter 9. Alternatives to Gambling.


Rescher Chapter 12, The Politics of Risk

Resolving Risk-Based Conflict (April 19)


Risk, Uncertainty, and Terrorism (May 3)


