

This document contains sketches of three projects that I prepared recently.

The first two projects form part of a collaborative proposal for earthquake mitigation research that has been submitted to the NSF by a multidisciplinary group from Columbia University, with collaborators at the University of Pennsylvania and Bogazici University (Turkey). While the focus here is earthquakes, much of the material has more general application. At any rate, it illustrates some of my recent thinking.

The third project is an attempt to formulate some reasonable norms for decision making and to examine the extent to which these norms are incorporated in actual decision processes. This project was sketched in a recent internal proposal for study of climate-related decision making, submitted by Jennifer Phillips (IRI, Columbia University) and me. It represents my attempt to formulate norms that are much weaker than the usual ones of behavioral decision theory.

Project A

Psychology of Mitigation Planning

Plan is a central concept that serves as a bridge between individual psychology, engineering design, and social and economic policy. A mental plan may be difficult to observe, sometimes even unconscious, while engineering and economic plans are often spelled out in writing; yet the plan concept can be used to link these different domains, because of the requirement that social and engineering plans be *compatible* both with one another and with the mental plans that govern behavior.

Planning takes place on many levels. Though there may be some deep differences between the plans of a household, an engineering firm, or a government bureaucracy, it is worth studying the planning process at multiple levels, both in Turkey and in the United States. Comparisons may be illuminating.

We will study (i) planning horizons, (ii) resources available in planning, (iii) guides or designs used in planning, and (iv) categories of events and event probabilities that are embedded within the plans.

Methods: In pilot studies, data will be gathered through interviews with individuals or small groups of people, including heads of household, construction engineers, and government officials, both in Turkey and in the United States. Followup studies will involve more systematic surveys, using questions designed in light of the preliminary findings from the interviews.

Research Issues:

(i) Planning horizons

It is a truism that horizons are limited, but there may be several different mechanisms underlying this. It is important to disentangle the limitations. To begin, uncertainty

limits planning horizons in three ways: people are uncertain about future events, e.g., whether an earthquake will occur nearby, or whether a scheduled future payment will actually be made; they are also uncertain about their own future goals; and finally, they are uncertain about future means that may be available to attain present or future goals. Such uncertainties have always been part of the human condition, but the latter two have become more prominent across a century of rapid technological and social change.

Secondly, it is widely assumed (in economic analyses) that horizons are limited, quite apart from the above effects of uncertainty: people supposedly care less about outcomes that will be realized later than about corresponding outcomes expected earlier. The extent to which people actually do downweight the future is poorly understood, however, and may vary considerably depending on context.

Earthquake-mitigation planning provides a marvelous concrete context for studying these four possible sources of horizon limitation (uncertain events, goals, and means, and discounting of future outcomes). One can ask decision makers about their uncertainties, and one can then ask about hypothetical situations, in which it is clearly stipulated that some of the uncertainties have been resolved.

The factors limiting horizons may or may not differ between householders and construction engineers; or between the latter and government officials; and may or may not differ between Turkey and the United States. The practical need to understand planning horizons for earthquake mitigation offers a nearly unique opportunity for basic research on people's future-oriented decision processes.

(ii) Resources

The resources available for earthquake planning include: financial resources (savings, credit, and fungible wealth); personal resources (skills and available time); group resources (favors one is owed, obligations of relatives, friends, co-religionists, etc.); and finally, expectations of government assistance. This list is oriented to the household and firm levels; analogous distinctions at the government level need to be examined. Societies may differ considerably in some of these resources, e.g., availability of bank credit, expected help from relatives, or expected government interventions. In planning interventions to promote earthquake mitigation, it is important to understand the mix of possible resources is considered by decision makers.

(iii) Guides or Designs

People use a wide variety of simple and complex designs to make decisions, ranging from "ask your neighbor what she did" or "follow your father's advice" to complex mathematical calculations to optimize some formally defined objective function. In order to intervene effectively, or devise good decision aids, the intervenor (who may be a government agency, a NGO, or a private company) must understand what sorts of guides or designs are trusted and followed. One of the principal goals of the initial set of interviews is to get a good catalog of the most common guides or designs used in

planning in the context of earthquakes.

(iv) Categories used in Adoption and Implementation of Plans

For government officials, engineers, and householders to understand one another, it is important that categories used in plans at different levels be compatible, if not quite the same. For example, a statement of probability of ground motion exceeding some threshold within the next century may not be usable by a person who categorizes the important event as unlivability of a house during the time her family occupies it. The event category and the time category simply do not match. Research is needed to understand how people in different places and different roles categorize events and time periods related to earthquakes, in order to devise a language that makes the answers given compatible with the questions asked.

Project B:

Organization and Training for Disaster Response

This project grows out of the NSF-sponsored conference on extreme events held in Boulder, Colorado (June 2000). One of the striking points about extreme events is that, by definition, the people who have deal with them have only a little or possibly no first-hand experience with such an event. Another important feature of the Boulder conference was the important contributions by people with field experience in emergency response, and their dialog with the scientists present.

In peacetime, military staff face the problem of preparing soldiers and young officers for combat, a truly extreme event. Partially successful preparation requires both extensive training and carefully chosen organizational structures. In the case of natural disasters, the emergency response cadres and the general public are all deeply involved, and so quite elaborate organizational structures may be needed for partially successful preparation. Both specialized training of cadres and successful public communication are needed as well.

The possibility of short-term, partially valid earthquake prediction (from changes in seismicity patterns, as outlined by Seeber) provides a particularly good rationale for research in this area. One point that immediately becomes clear in this context is that good organization, training and communication may not help much if there are no good options for action. Warnings that produce full- scale pre-emergency response, and which turn out to be false alarms, may be disasterous, no matter how well prepared people are for the possibility of a false alarm. A hurricane that does not strike one community does strike another one nearby, so people can see clearly what might have happened; an earthquake in Gujarat or California is much more remote to a resident of Istanbul.

The need to devise useful partial responses to short-term warnings is also an opportunity to experiment in communication between people with a wide variety of

roles: scientists, engineers, government officials, journalists, and members of the public.

Methods: We will organize and observe a small number of privately held discussion groups, in which people with different roles come together to discuss possible plans for local/regional response to short-term warnings. A research result, from such discussions, would be to observe the extent to which initial ideas and concepts undergo change in the course of the discussion.

As a followup to such discussions, we hope to learn more about the different roles and divisions of responsibility involved in emergency response, and to develop recommendations for new roles, for new types of training, and for communication with the public.

Project C

Norms for Individual/Cooperative Decision Making

Standard norms for decision making assume that people have a preference ordering that can be represented by a utility function. Research showing that preferences are constructed in context suggests that no such general preference ordering exists. My conclusion is that the standard norms are irrelevant: not only are they useless for the description of actual human decision processes, they also have limited use as a general framework for prescription or for building decision aids. At best, prescriptions based on utility theory can be viewed as specialized designs applicable to a limited range of decisions.

Decision analysis, and its accompanying array of decision aids can nonetheless be quite useful, because the implementation of utility-based aids supports adherence to a set of much weaker norms, ones that are more compatible with the structure of actual human decision processes.

The set of weak norms listed below is merely illustrative; the list is undoubtedly incomplete and it contains some redundancies. Note also that the list is oriented toward individual or cooperative decision making. Norms for a competitive situation are more complicated, and beyond the scope of what I will discuss here.

The immediate research goal is to determine the extent to which people spontaneously use such norms (or closely related heuristics) and the extent to which they find such norms acceptable.

1. **Make goals explicit.** Usually, any action is chosen with several goals in view at once; thinking about options can be improved if all the goals are laid out.
2. **Make event trees explicit.** Represent uncertain events and choice in a tree form and try to lay out the possible sequences.
3. **Search for options.** If you have a choice between two alternatives, it may be wise to look for a third one.
4. **Consider multiple solutions .** If you are doing something to deal with a risk, consider doing other things as well.
5. **Evaluate opportunity costs.** Before investing (additional) resources in pursuing some goal, consider how else those resources (including your own labor) might be used.
6. **Consider tradeoffs.** If you avoid one risk, you may increase another.
7. **Don't learn too much from outcomes.** A wise decision can sometimes produce a bad outcome, or a foolish decision can produce a good outcome. Ask whether you could realistically have obtained more information or found additional options? If not, the decision may have been a good one, even if the outcome is bad.

Methods: In a pilot project, we have formulated a series of decision vignettes in which one or more of the preceding principles may be violated. We are coding both open-ended written responses and open-ended oral discussions of the vignettes, asking two questions: Are these principles used spontaneously to justify decisions? Are they accepted as proper principles, when suggested directly?

Our initial data collection took place with the cooperation of climate-forecast user groups at a recent Climate Outlook Forum (Tanzania, February 12-16, 2001).