RISK-DEFUSING BEHAVIOR

Oswald Huber
University of Fribourg, Switzerland

Keywords: cognitive bias, control, cost of risk-defusing operators, decision making, effect of risk-defusing operators, lottery, outcome compensation, outcome prevention, probability, probability judgment, risky decisions, risk-defusing operators, structuring the decision situation, worst-case plan

Contents

Summary

This article deals with risk-defusing behavior. It is argued that this forms a central part in decision processes.

First, the results of various experiments are summarized: these clearly show that naïve decision makers generally do *not* represent realistic non-lottery decision problems in lottery form spontaneously. The main observed differences are that:

- in most non-lottery decision problems, most decision makers do not seem actively interested in probability information, and
- risk-defusing behavior usually plays a central role.

Most decision makers actively seek to influence the risk involved in a decision problem by trying to employ *risk-defusing operators*. A risk-defusing operator (RDO) is an action to be performed additionally to a specific decision alternative, and is intended to decrease an identified risk inherent in that alternative. Different types of RDO are distinguished according to the outcome an RDO attempts to modify, and whether its application is dependent on the occurrence of a specific negative event. The results of several experiments investigating different aspects of RDOs are summarized. In the section that follows the role of probability in the context of defusing risk, and the probability of the negative outcome occurring, are discussed.

In the final section, the inclusion of risk-defusing strategies into decision analysis is considered. The role of RDOs in the context of structuring decision tasks is discussed. When deciding whether an RDO should be included, both the likely effect and the cost of doing so must be estimated. Finally, the article reviews potential cognitive biases and errors that may also be relevant when evaluating an RDO. Three types of cognitive biases are considered: biases in probability judgments, biased evaluation of a favored alternative, and biases stemming from the decision maker's control beliefs.

1. Introduction

Decision analysis lies at the interface between two different approaches to decision making: normative decision theory and psychological decision theory. *Normative decision theory* develops the formal principles that we should follow when we want to make an optimal decision. *Psychological (descriptive) decision theory* investigates how (naïve) decision makers *really* make their decisions. Decision analysis aims to improve our decision behavior, and indicates the optimal behavior prescribed by normative theory. For this purpose it is necessary to know what people normally do when making a decision, where they have difficulties, and where they are prone to making errors: in general terms, where their behavior departs from the optimal.

The present article deals with "risky" decisions. It focuses mainly on *descriptive* (psychological) decision theory and the consequences of its use in aiding decision making, and on *individual* decisions made by *non-expert (naïve)* decision makers in *non-routine* situations.

In a risky decision situation it is uncertain which of the possible outcomes (at least one of which is negative) will occur when a specific alternative is chosen. A patient, for example, has to decide whether or not to take a medicine that *may* bring about dangerous side-effects, but does not know in advance whether he or she belongs to the group of patients prone to side-effects. Other examples include investment decisions, where success or failure depends on the uncertainties of future economic trends. Particularly well-known types of risky decisions are gambling activities, like roulette, and betting. Gambles and bets together are termed *lotteries*.

In classical decision theory, lotteries are considered *the* paradigm for risky decisions. This paradigm has also been the core of psychological research on decision behavior in the face of risk and uncertainty for decades. Theories rooted in the lottery paradigm have made powerful contributions to research and dominate the field. However, recent

psychological research on risky decisions questions the validity of lotteries as a paradigm for *all* risky decision situations.

2. Decision Behavior: Are Lottery Tasks and Quasi-Realistic Tasks Comparable?

Risky decision making has been investigated experimentally almost exclusively with lotteries or with tasks that are prestructured like a lottery by an experimenter. In a typical experiment, the participant is presented with two lotteries, for example:

Lottery 1: win of \$10 with probability $p = 0.6$; loss of \$12 with probability $1–p = 0.4$.
Lottery 2: win of \$40 with probability $q = 0.2$; loss of \$5 with probability $1–q = 0.8$.

The participant must decide which of the two lotteries to play.

In such experiments with lotteries, decision behavior is usually influenced by the utilities of the outcomes, as well as by their respective probabilities. Everyday risky decisions usually do not have such a clear-cut structure, however, at least initially. An example is the situation of a person who has to decide whether or not to make a business trip to a country where a deadly infectious disease currently rages.

Psychological experiments with non-lottery tasks form a relatively new theme in decision research. Such experiments use quasi-realistic tasks or scenarios that describe a decision situation. An example is the following *ticks task*:

- The experiment participant acts as the director of a center for allergic children. It is uncertain whether the center can stay in its rented location because the owners may sell the building. If this sale occurs the center has to move out, and the director has to find another location that meets the requirements for treating allergies.
- At this moment, the foundation "Children for the Future" offers to give the center a home: a big house in a forest. All the necessary adaptations for the allergic children would be financed by the Foundation. The problem is that the forester's house stands in a wood that is contaminated with a specific kind of tick. A bite from such a tick can cause meningitis, with grave consequences for health.
- The participant is informed that he or she can accept the donation (alternative 1), or can decline the donation and stay in the present building instead (alternative 2).

In contrast to lotteries, more realistic tasks like these can be characterized as having an ill-defined problem structure and as being embedded into a knowledge-rich domain where causal structures, and especially potential control actions, are often important. The potential for changing the original causal structure by means of planned *defusing actions* is an essential aspect of constructing a representation of the situation.

It is seldom difficult to reformulate quasi-realistic tasks in the form of a lottery. However, it is not clear whether naïve decision makers make this kind of reformulation themselves. Thus, a first (and by no means trivial) question for research into quasi-realistic tasks is deciding whether the *subjective* representation of any risky decision task is equivalent to a lottery representation.

Classical decision theory represents risky decision tasks by lotteries, that is by a system consisting of the following components: alternatives, events (states of nature), outcomes, subjective values (utilities) of outcomes, and subjective probabilities. A subjective representation of a decision task is equivalent to this lottery representation if these components, but no others, occur in the subjective representation. Therefore, it is not necessary for a specific component (for example, the set of events) to consist of the same elements in both representations. It seems remarkable, despite about a half century of research on risky decision behavior, that the question of equivalence could not be answered until recently.

In order to test empirically whether subjective representations of decision tasks are equivalent to lottery representations, two issues have to be observed in experiment design:

- In experiments involving quasi-realistic tasks or scenarios, a methodology has to be employed which requires the decision maker to search for information actively. Therefore, unlike in experiments with lotteries, not all the relevant information may be forced upon the participant. The reason for this condition is that the experimenter wants to find out which information the decision maker is genuinely interested in, in order to be able to analyze information-gathering behavior. The *method of active information search* has been developed in order to attain this objective. Here the participant is first given a short description of the decision situation. Then, he or she can ask questions in order to obtain more information from the experimenter. Note that the *participant* asks the questions, not the experimenter.
- In experiments with quasi-realistic tasks, the experimenter should not pre-structure the task for the participant like a lottery. Rather, developing a "structure" for the situation must form part of the decision process to help find out which information is relevant and which is not, and so on.

In recent years, a number of experiments have been performed according to these principles. Their result is clear and allows an unambiguous answer: subjective representations of quasi-realistic risky decision tasks are generally *not* equivalent to lottery representations. The main observed differences are:

- In most of the quasi-realistic risky tasks investigated so far, most decision makers do not seem actively interested in probability information.
- What is usually termed "risk-defusing behavior" plays a central role in the decision process.

These main results are discussed in more detail in the following sections.

3. An Outline of the Decision Process in Quasi-Realistic Risky Decision Tasks

In quasi-realistic task situations, most decision makers seem to proceed in the following manner. Using available information and background knowledge, the decision maker constructs the simplest possible representation of the decision situation, which includes the alternatives and the outcomes. The following principles seem to govern the decision process:

- Initially the alternatives are evaluated mainly in respect to their outcomes, and on a coarse scale only.
- In constructing the representation, decision makers aim at a quasi-deterministic causal path leading from one alternative to the desired outcome. Uncertainty connected with outcomes is evaluated on a coarse scale only (e.g. *practically impossible*, *practically certain*, *possible*).
- As soon as decision makers realize that an otherwise-positive alternative may lead to a negative outcome, they attempt to reduce this risk by planning to apply what is called a "risk-defusing operator." Risk-defusing operators are dealt with in more detail in Section 4 of this article.
- If, with the help of a risk-defusing operator, the causal paths from one alternative choice lead only to positive outcomes, the alternative is chosen.
- Construction of the representation itself and evaluation of an alternative do not take place in distinct phases of the decision process, but instead are intermingled. Typically, more elaborate representations are constructed for alternatives that are more desirable.

Decision behavior as outlined above differs distinctly from that in making choices between simple gambles. People do not appear only to evaluate passively the risk they are exposed to, but in fact they actively attempt to influence it.

-
-
-

Bibliography

Buehler R., Griffin D., and Ross M. (1994). Exploring the "planning fallacy": why people underestimate their task completion times. *Journal of Personality and Social Psychology* **67**, pp. 366–381. [This paper reports empirical results on control biases.]

Försterling F. (2001). *Attribution: An Introduction to Theories, Research, and Applications*, 242 pp. Hove, UK: Taylor and Francis. [This book offers an introduction into attribution research, and also gives a summary of cognitive attribution biases.]

Huber O. (1997). Beyond gambles and lotteries: naturalistic risky decisions. *Decision Making: Cognitive Models and Explanations* (eds. R. Ranyard, W.R. Crozier, and O. Svenson), pp. 145–162. London:

Routledge. [This paper discusses the shortcomings of adopting gambles as the main research topic for psychological research on risky decision making.]

Huber, O. and Huber, O.W. (2003). Detectability of the negative event: effect on the acceptance of pre- or post-event risk-defusing actions. *Acta Psychologica **113***, 1-21. [This paper reports an experiment showing that decision makers generally prefer an event-dependent RDO (worst-case plan) but prefer an event-*in*dependent RDO if the detection of the negative event is not certain.]

Huber O., Beutter C., Montoya J., and Huber O.W. (2001). Risk defusing behavior: towards an understanding of risky decision making. *The European Journal of Cognitive Psychology* **13**, pp. 409–426. [This paper reports on an experiment with two variations of the Active Information Search method with realistic decision tasks.]

Huber O. and Macho S. (2001). Probabilistic set-up and the search for probability information in quasi-naturalistic decision tasks. *Risk Decision and Policy* **6**, pp. 1–16. [This paper investigates experimentally the influence of formal aspects of the probability information presented, and of the task domain on the active search for probability information. Furthermore, it is shown that people in a risky decision situation do not routinely introduce probability information from internal sources (background knowledge, inferences from available knowledge.]

Huber O., Wider R., and Huber O.W. (1997). Active information search and complete information presentation in naturalistic risky decision tasks. *Acta Psychologica* **95**, pp. 15–29. [This paper reports on an experiment using the method known as Active Information Search with realistic decision tasks.]

Kahneman D., Slovic P., and Tversky A. (eds.) (1982). *Judgment Under Uncertainty: Heuristics and Biases*, 555 pp. Cambridge, MA: Cambridge University Press. [This book contains a representative collection of original papers on heuristics and bias.]

Lefcourt H.M. (ed.) (1981, 1983, 1984). *Research with the Locus Of Control Construct*, Vols 1–3 (391 pp., 286 pp., 410 pp.) New York: Academic Press. [These three volumes give a broad overview of the theoretical concepts of control and empirical research.]

Lopes L.L. (1995). Algebra and process in the modeling of risky choice. *Decision Making from a Cognitive Perspective*, 426 pp. (eds. J. Busemeyer, R. Hastie, and D.L. Medin), pp. 177–220. San Diego, CA: Academic Press. [This paper gives an overview of theoretically risky decision models and empirical results in psychological decision research.]

Plous S. (1993). *The Psychology of Judgment and Decision Making*, 302 pp. New York: McGraw-Hill. [An introductory text dealing with different types of biases and heuristics in probability judgments.]

Ranyard R., Crozier W.R., and Svenson O. (eds.) (1997). *Decision Making: Cognitive Models and Explanations*, 257 pp. London: Routledge. [In this book several authors deal with different aspects of decision making within the cognitive process models approach.]

Shiloh, S., Gerad, L. and Goldman B. (2006). Patients' information needs and decision-making processes: What can be learned from genetic counseling? *Health Psychology* **25**, 211-219. [This paper applies the Method of Active Information Search in a real decision situation outside the laboratory. The pricipal results are the same: Decision makers are not so much interested in probability information but very interested in RDOs.]

Williamson J., Ranyard R, and Cuthbert L. (2000). Risk management in everyday insurance decisions: evidence from a process tracing study. *Risk, Decision and Policy* **5**, pp. 19–38. [Reports an experiment with decision makers showing risk-defusing behavior adopted when approaching realistic risky tasks.]

Biographical Sketch

Oswald Huber is Professor at the Department of Psychology at the University of Fribourg (Switzerland) and holds the Chair of General Psychology. He received his doctoral degree at the University of Salzburg (Austria). He has done extensive research in different areas of psychological decision theory, including multi-dimensional choices, multi-stage decision making, taking risky decisions, and the simulation of individuals' decision behavior.