# Risk Perception and Risk Communication

## Perceived Risk

Risk perception is the subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences.

The level of risk we perceive is usually different from the actual risk in any given situation.

## Measuring Perceived Risk

Fischhoff et al (1978) designed a 9 dimension psychometric paradigm for assessing risk.

1. Voluntary / Involuntary
2. Immediate / Delayed
3. Known / Unknown (Personally)
4. Chronic / Catastrophic
5. Commonplace / Dreaded
6. Minor / Fatal
7. Known / Unknown (To Experts)
8. Passive / Controlled
9. Familiar / Novel

## Risk Acceptability

Individuals appear to have an "acceptable level of risk" across all domains.

**An Evolutionary Set Point Hypothesis**: Environment of Evolutionary Adaptedness (EEA) was more hostile and dangerous than the modern environment. An optimal risk acceptance level in EEA should be higher than that in modern time. Thus, people with an EEA optimal risk acceptance would be sensation and risk seeking to achieve homeostasis (e.g., why bungee jumping).

# Risk Perception and Risk Dimensions

In the management literature, risk is most commonly conceived as reflecting variation in the distribution of possible outcomes, their likelihoods, and their subjective values (March & Shapira, 1987).

In general, decision makers are assumed to prefer smaller risks to larger ones, provided other factors (e.g., expected value) are constant.

Uncertainty avoidance and discount of future events:

When budget crises hit an organization, a common response is to cut out expenditures that are not expected to increase immediate productivity (such as management training).

Risk avoidance ≠ Uncertainty avoidance.

One may take risks to reduce uncertainty, or vice versa.

## Dimensions of Risk (I)

Slovic and Lichtenstein Model:

When evaluating the attractiveness of a gamble, people are likely to consider four risk dimensions with equal or different weights.

The four risk dimensions are

the probability of winning ($P_W$),
the amount of a win ($V_W$),
the probability of losing ($P_L$), and
the amount of a loss ($V_L$).

Expected value model assumes that when a person chooses among two or more alternative gambles, he maximizes EV.

$$EV = P_W \cdot V_W + P_L \cdot V_L.$$

$$SEU = S(P_W) \cdot U(V_W) + S(P_L) \cdot U(V_L).$$

A duplex gamble requires that the decision maker spin two spinners. The first spinner determines the probability and the amount of a win, and the second spinner determines the probability and the amount of a loss. This is not possible in a standard gamble (represented by only one spinner) because the probability of winning is equal to 1 minus the probability of losing. It is not possible to determine whether people are more influenced by the probability of winning or the probability of losing if the two probabilities cannot be varied independently.

The authors correlated the judged attractiveness of the gambles with the four risk dimensions in their analyses. The correlations should be approximately equal if people were placing an equal emphasis on all four dimensions. The results indicated that there was a large difference in the correlations.

$$A(G) = \mu + w1P_W + w2V_W + w3P_L + w4V_L$$

where A(G) is the attractiveness of a gamble and the w's are weights reflecting the relative importance of each risk dimension.

**Risk Dimensions (II):**

(1) Outcome uncertainty:

Variability of outcomes, lack of knowledge of distribution of potential outcomes, and the uncontrollability of outcome attainment.

(2) Outcome Distribution:

Extremeness of outcomes, Mean, Variance, and the Shape of Distribution of Expected Outcomes.

(3) Distances between References:

Goal (G) –to- Minimum Requirement (MR),

G-to-Mean (M) of Expected Outcomes ± Variance (V),

MR-to-M ± V.

Risk defined in decision-making:

Thus we may define decisions as riskier to the extent that (a) their expected outcomes are more uncertain, (b) decision goals are more difficult to achieve, (c) the potential outcome set includes some extreme consequences, or (d) the mean of expected value is below the minimum requirement.

**How Do Professional Managers and Executives Look at Risks and Risk Taking**

MacCrimmon and Wehrung (1986) study with 509 high level executives in Canadian and American firms

Shapira (1986) study with 50 American and Israeli executives.

<u>The Definition of Risk.</u>

The managers see risk in ways that are both less precise and different from risk as it appears in decision theory.

First, most managers do not treat uncertainty about positive outcomes as important aspect of risk. For them, "risk" is seen as associated with the negative outcomes.

Second, for these managers, risk is not primarily a probability concept but an amount concept.

Third, although managers seek precision in estimating risk, most show little desire to reduce risk to a single quantifiable construct.

Violations of Expected Utility Axioms:

When MacCrimmon and Wehrung (1986) asked executives to rank nine investment alternatives, the ranks matched an ordering based on expected value in only 11% of the respondents. Even fewer executives ranked the alternatives strictly in terms of maximizing major gain, breaking even, minimizing major loss, or minimizing variation.

<u>Attitude Towards Risk</u>

Managerial risk taking propensities vary across individuals and across contexts.

Higher level executives scored higher on their risk taking measures than did lower level executives who reviewed the high level executives as less risk taking.

Managers at all levels generally picture organizational life as inhibiting risk taking on the part of managers.

Managers tended to believe that they were greater risk takers than they were and that they were greater risk takers than their colleagues.

Managers are inclined to show greater propensity toward risk taking when questions are framed as business decisions than when they are framed as personal decisions.

Managers recognize the emotional pleasure and pains of risk taking, the affective delights and thrills of dangers.

<u>Dealing with Risks</u>

In cases in which a given alternative promises a good enough return but presents an unacceptable danger, managers focus on ways to reduce the danger while retaining the gain.

Only two of the 50 executives interviewed by Shapira (1986) said they accept risk estimates as given to them. In most cases, rejection is supplemented by efforts to revise estimates. Seventy-four percent of the managers said they tried to modify the risk descriptions. They try to change odds.

Managers see themselves as taking risks, but only after modifying and working on the dangers so that they can be confident of success.

Surveys of professional investment managers' risk perceptions and investment preferences (Olsen, 1997)

Risk is most highly related to the possibility of obtaining an outcome which is below some reference or target level.

The most highly rated risk attributes are "large loss relative to what is expected" and "less than minimum needed to meet the clients needs."

Conversely, the least important attribute is the "large gain relative to what is expected."

"Overall variability in asset return" is rated equal to "asset will earn less than what is expected."

March and Shapira (1987): Risk is most commonly conceived as reflecting variation in the distribution of possible outcomes, their likelihoods, and their subjective values.

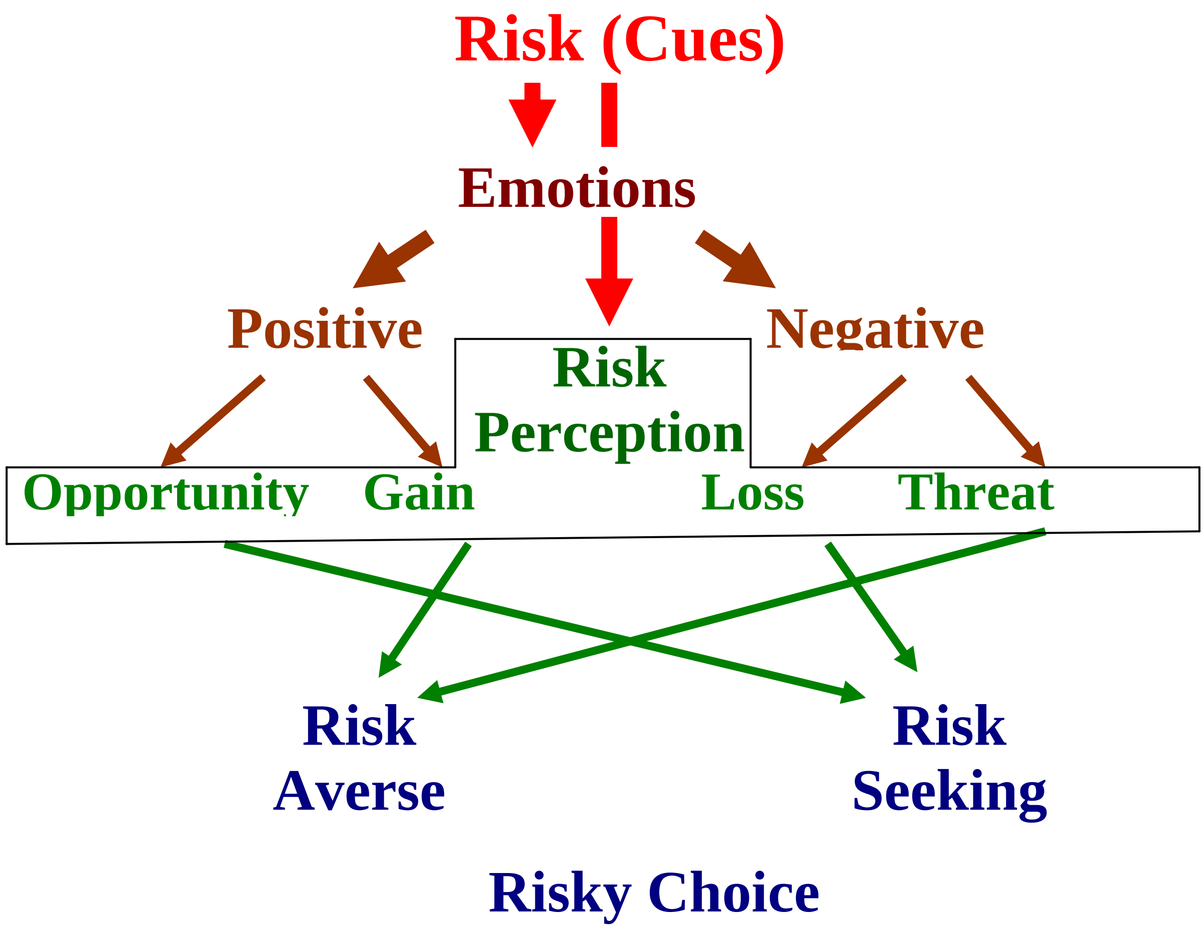
Risk is measured either by nonlinearities in the revealed utility for money or by the variance of the probability distribution of possible gains and losses associated with a particular alternative (also see Pratt, 1964; Arrow, 1965).

**We enjoy managing risks**:

Dawes (1988, p267): “Imagine a life without uncertainty. Imagine how dull life would be if variables assessed for admission to a professional school, graduate program, or executive training program really *did* predict with great accuracy who would succeed and who would fail. Life would be intolerable – no hope, no challenge.”

**Opportunities, Threats, Gains and Losses**

### Risk Perception and Risk Preference




**Developing Valid Inventories of Risk Perception**

**Sensation Seeking Scales**

**Domain –specific risk perception scales**

Within-Group Competition & Cooperation
Between-Group Competition & Cooperation
Survival and Physical Risks
Reproductive Risks
Mating and Resource Allocation

**Inconsistency in Perception and Measures of Risk**:

Legal statutes are less tolerant of carcinogens in our food than in our drinking water or our air.

In the United Kingdom, 2,500 times more money per life saved is spent on safety measures in the pharmaceutical industry than in agriculture (Sinclair, Marstand, and Newick, 1972).

According to some calculations, U.S. society spends about $140,000 in highway construction to save one life and $5 million to save a person from death due to radiation exposure (Howard, Matheson, and Owen, 1978, p. 2).

People are more willing to wear seatbelts if they are told they have a .33 chance of an accident over a 50-year lifetime of driving rather than a .00001 chance each trip.

If a company is considering earthquake protection over the 25-year life of its plant, managers are far more likely to take the risk seriously if they are told the chance of an earthquake is 1 in 5 during the entire period rather than 1 in 100 in any given year. Most people feel small numbers can be easily dismissed, while large numbers get their attention.

People also are willing to pay considerably more to reduce the risk of some adverse events if the likelihood is depicted as ratios rather than very tiny probabilities. For example, saying that the risk of an event occurring when one is protected is half of what it is when one is not protected elicits a far stronger reaction than saying the risk is reduced from .000006 without protection to .000003 with protection.

Studies have shown that even just multiplying the numerator and denominator of a probability estimate– presenting it as 10 in 1,000 or 100 in 10,000 instead of 1 in 100 – makes it more likely that people will pay attention to the event.

**Biases in Probability Judgment and Risk Perception**

1. Attenuation (treating uncertainty as certainty) and rarely ask for data on probability
2. Estimate the likelihood of an event by the ease of recall
3. Overestimate low probability events and underestimate high probability events
4. Anchoring effects
5. Experience and affect-dependent risk perception
6. Goal framing effects
7. Hindsight effects
8. Conjunction fallacy
9. Gambler's fallacies
10. Regression to the mean
11. The law of small numbers
12. Base rate neglect
13. The social amplification of risk