Risk

ESD.864

Noelle Selin

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MIT ESD
Massachusetts Institute of Technology
Engineering Systems Division

What is risk?

- Risk = hazard x probability
  - Degree of harm x likelihood of harm
  - Must use models/technical analyses to constrain both "degree" and "likelihood"
  - Risk assessment frameworks: assessment/decision-making processes on risks

Risk as an assessment framework

- Risk vs. Risk

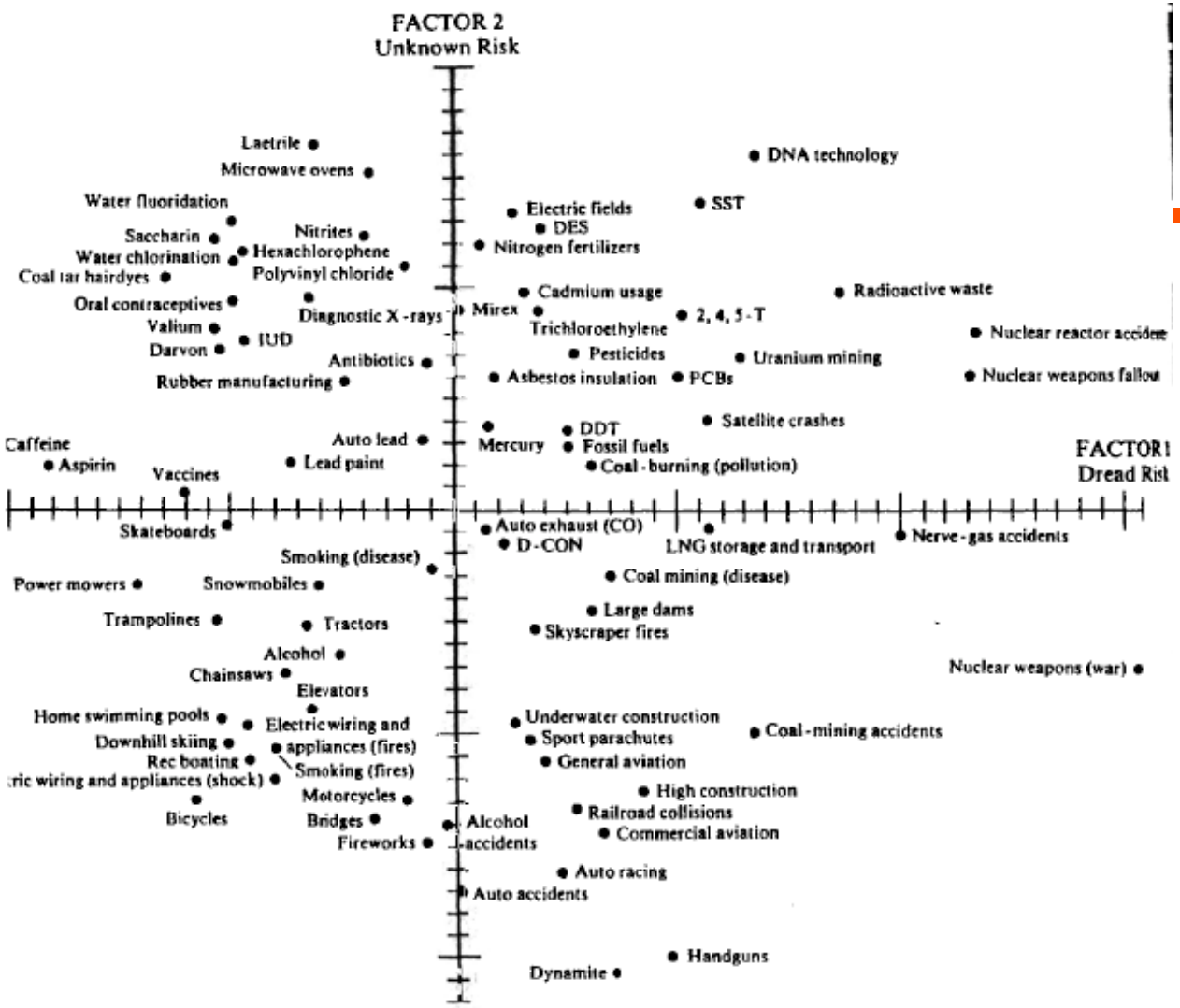
Table 3.1. Annual Fatality Rates per 100,000 Persons at Risk

Risk	Rate
Motorcycling	2000
Aerial acrobatics (planes)	500
Smoking (all causes)	300
Sport parachuting	200
Smoking (cancer)	120
Firefighting	80
Hang gliding	80
Coal mining	63
Farming	36
Motor vehicles	24
Police work (nonclerical)	22
Boating	5
Rodeo performer	3
Hunting	3
Fires	2.8
1 diet drink/day (saccharin)	1.0
4 T. peanut butter/day (aflatoxin)	0.8
Floods	0.06
Lightning	0.05
Meteorite	0.000006

Source: Adapted from Crouch and Wilson (1982).

Source: Slovic, Paul. "Beyond Numbers: A Broader Perspective on Risk Perception and Risk Communication." *Acceptable Evidence: Science and Values in Risk Management* (1991): 48-65.

From Slovic, "Beyond Numbers"



Source: Slovic, Paul, Baruch Fischhoff, et al. "Characterizing Perceived Risk." R. W. Kates, C. Hohenemser, & J. X. Kasperson (eds.), Perilous progress: Managing the Hazards of Technology, pp. 91-125, Westview, 1985.

Slovic et al 1985

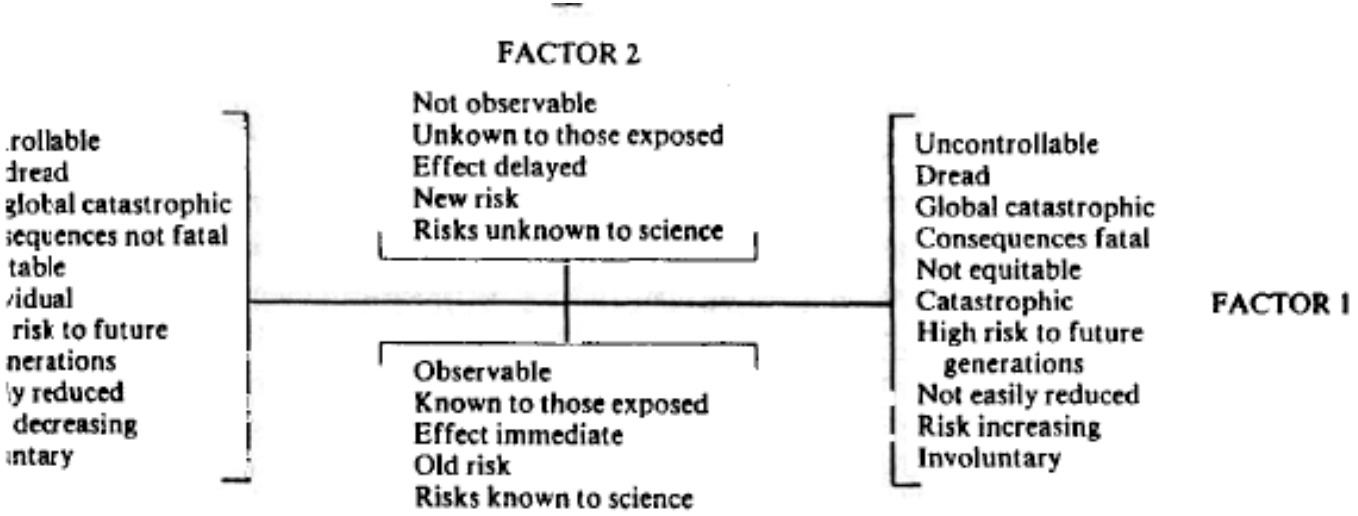


Figure 3.1 Location of eighty-one hazards on Factors 1 and 2 derived from the relationships among eighteen risk characteristics. Each factor is made up of a combination of characteristics, as indicated by the lower diagram. (Slovic, Fischhoff, and Lichtenstein 1985)

Table 3.4. Characteristics Examined in Psychometric Studies of Perceived Risk

Voluntary–Involuntary
Chronic–Catastrophic
Common–Dread
Injurious–Fatal
Known to those exposed–Not known to those exposed
Known to Science–Not known to science
Controllable–Not controllable
Old–New

Risk as a decision tool

- Zero risk (no animal carcinogens in food)
- *De minimis* risk ($<10^{-6}$ lifetime risk of cancer)
- Safety (no observable effect level)
- Acceptable risk (regulatory policy standard)
- Risk tradeoffs
  - risks vs. benefits (economic, social)
  - risks vs. risks (flying vs. driving)

Traditional Risk Analysis: Steps

- Research
- Hazard identification
- Exposure assessment
- Risk characterization
- Risk communication
- Risk management

National Research Council, "Red Book" Model of Risk Analysis (1983)

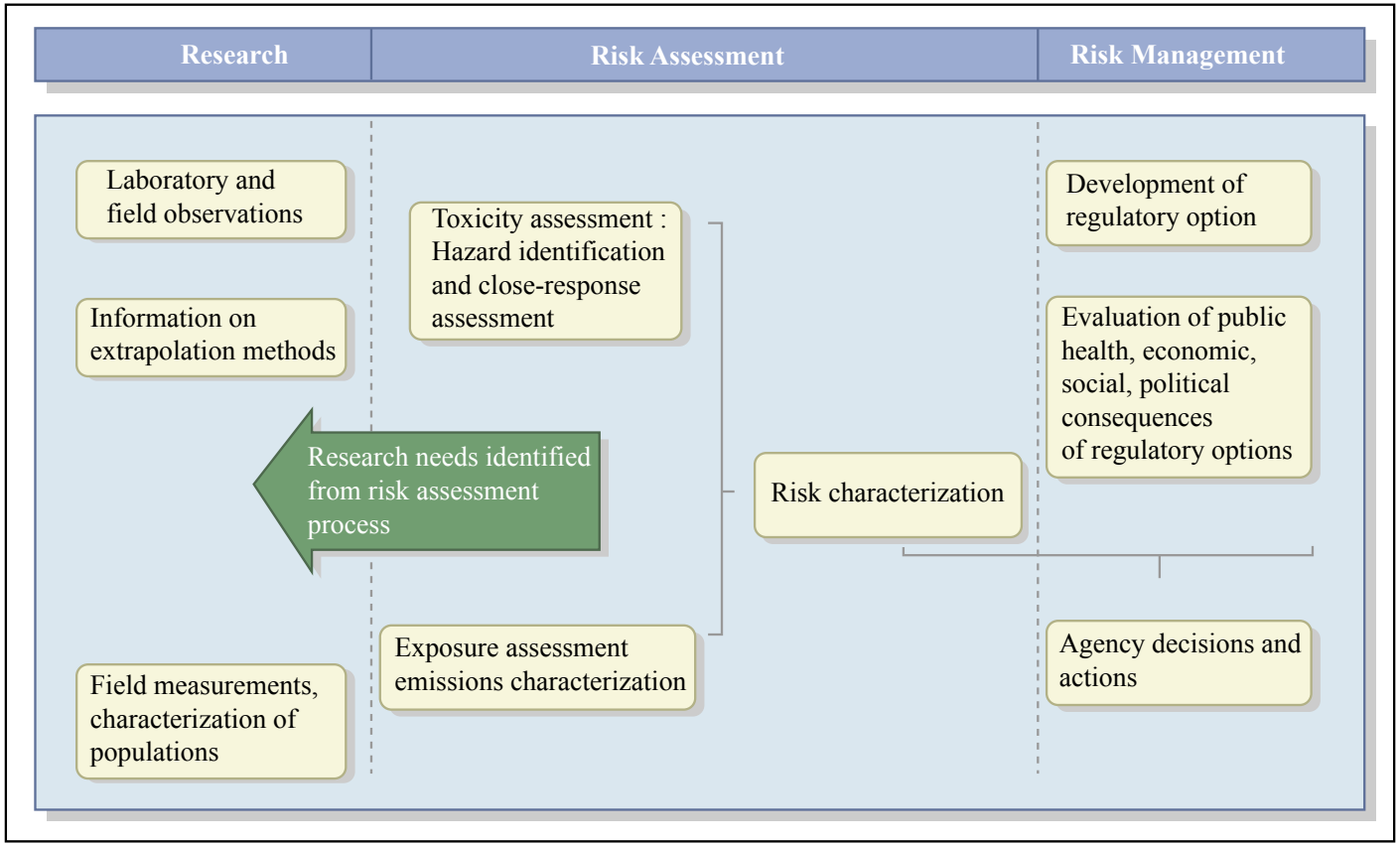


Image by MIT OpenCourseWare.

Issues raised by traditional risk-based approaches

- Framing of the problem
- Uncertainty…and ignorance?
- Different sorts of expertise; lay public input
- Separation of risk assessment, risk management functions
- Conservative bias?
- Risk vs. risk considerations?

Build-your-own risk assessment model

- Imagine an assessment process for a new and potentially hazardous chemical (let's say it's a pesticide). With reference to the NRC 1983 risk diagram, construct your own risk-assessment model which would address some of the criticisms of that model. You might think about:
- How something is selected for risk analysis
- Feedbacks from the process?
- Role of the public in defining risks, risk communication, etc.
- Conceptual separation between risk assessment/risk management
- Any changes to steps?

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