Emerging technologies and risk: the social, cultural and political dimensions

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Uncertainty and precaution — towards a clarification of terms

Situation	State of knowledge	Appropriate action
Risk	‘Known’ impacts; ‘known’ probabilities	Prevention: action taken to reduce known hazards
Uncertainty	‘Known’ impacts; ‘unknown’ probabilities	Precautionary prevention: action taken to reduce potential risks
Ignorance	‘Unknown’ impacts and therefore ‘unknown’ probabilities	Precaution: action taken to anticipate, identify and reduce the impact of ‘surprises’;’

Source: EEA, Late Lessons

Other issues about risk

- How are risks to be evaluated?
  - probability x impact?
  - voluntariness? familiarity? distribution?
- Danger of neglecting non-risk issues
  - global equity, justice
  - what kind of world is implied?
  - what alternative trajectories are ruled out?

Table 1: Risks Estimated to Increase The Probability of Death In Any Year By One Chance In a Million

Activity	*Cause of Death*
Smoking 1.4 cigarettes	Cancer, heart disease
Drinking 0.5 litre of wine	Cirrhosis of the liver
Spending 1 hour in a coal mine	Black lung disease
Spending 3 hours in a coal mine	Accident
Living 2 days in New York or Boston	Air pollution
Travelling 6 minutes by canoe	Accident
Travelling 10 miles by bicycle	Accident
Travelling 300 miles by car	Accident
Flying 1,000 by jet	Accident
Flying 6,000 by jet	Cancer caused by cosmic radiation
Living 2 months in Denver	Cancer caused by cosmic radiation
Living 2 months in average stone or brick building	Cancer caused by natural radioactivity
One chest X-ray taken in a good hospital	Cancer caused by radiation
Living 2 months with a cigarette smoker	Cancer, heart disease
Eating 40 tablespoons of peanut butter	Liver cancer caused by aflatoxin B
Drinking Miami drinking water for 1 year	Cancer caused by chloroform
Drinking 30 12oz cans of diet soda	Cancer caused by saccharin
Living 5 years at site boundary of a typical nuclear power plant	Cancer caused by radiation
Drinking 1,000 24oz soft drinks from plastic bottles	Cancer from acrylonitrile monomer
Living 20 years near a polyvinyl chloride plant	Cancer caused by vinyl chloride (1976 standard)
Living 150 years within 5 miles of a nuclear power plant	Cancer caused by radiation
Eating 100 charcoal-broiled steaks	Cancer from benzopyrene

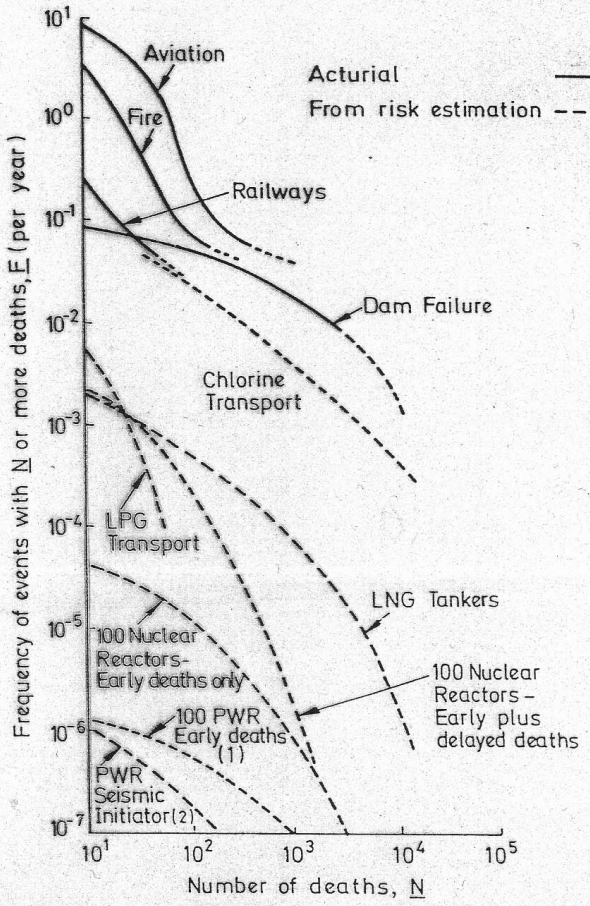


Figure 2. Examples of *F* vs. *N* lines for various man-made hazards. The risk estimates the frequencies are potential events, whereas the actuarial lines are based on actual events. The actuarial lines have extended on the basis of risk assessment. (Sources: Coppola and Hall 1981, (1) Gittas 1986, (2) United States Nuclear Regulatory Commission 1986*a*.)

Paul Slovic

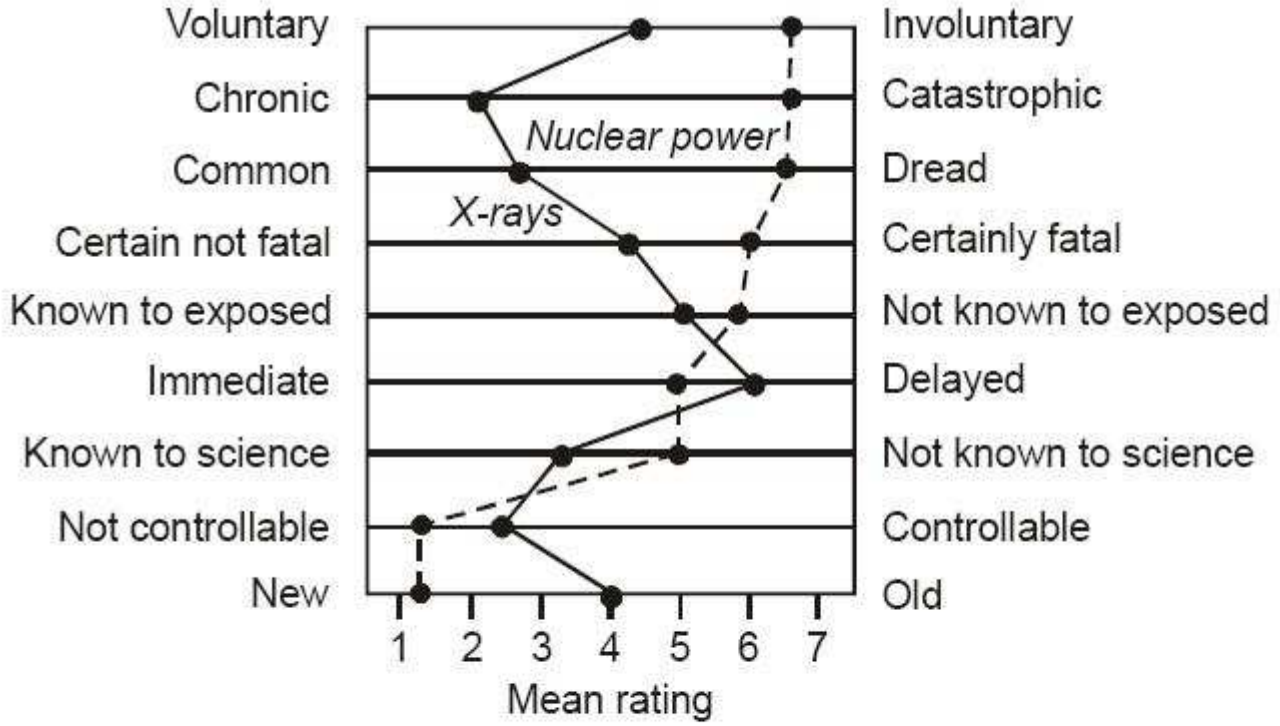
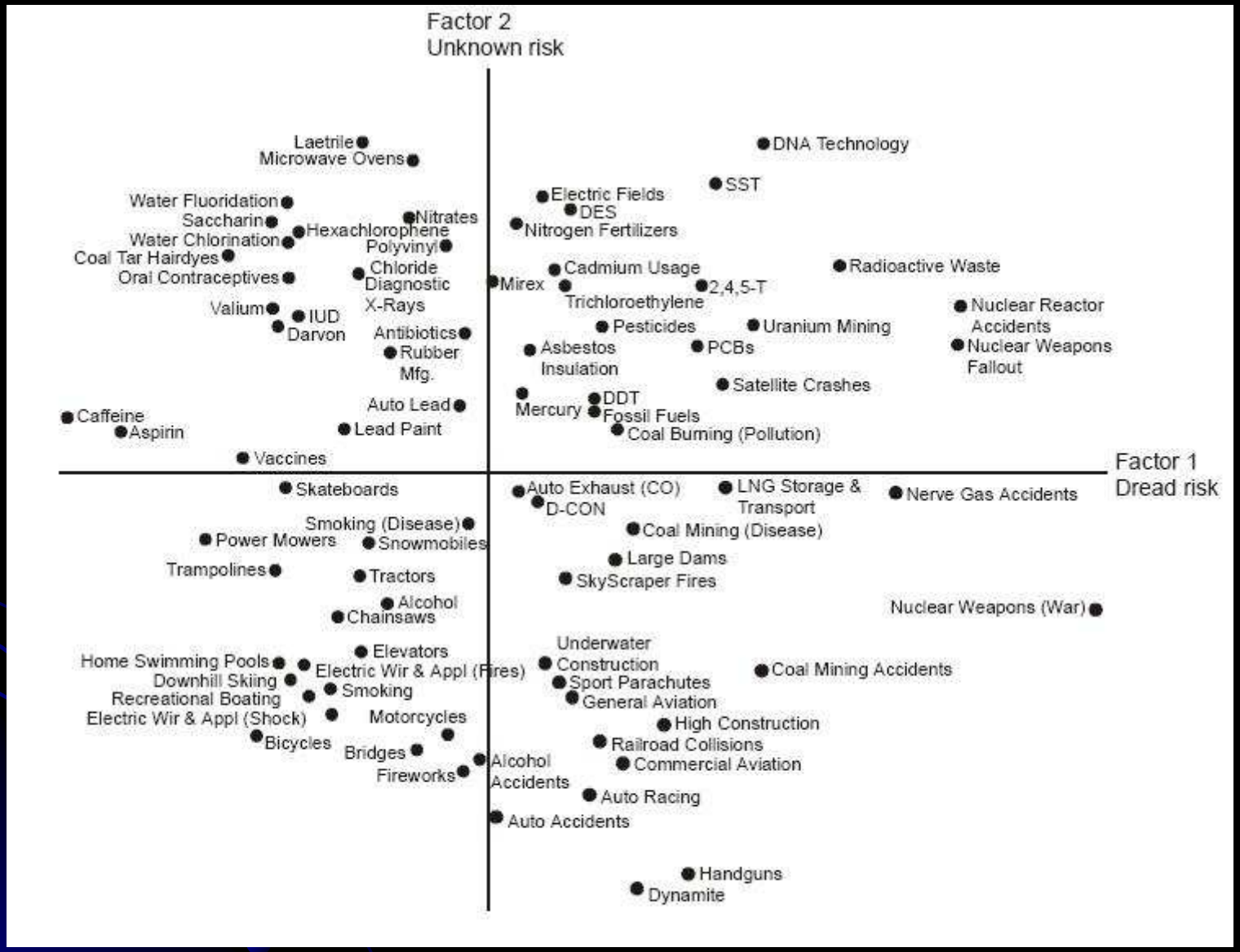


Figure 2. Qualitative characteristics of perceived risk for nuclear power and X-rays across nine risk characteristics.


Factor 2
Unknown risk
Factor 1
Dread risk
Laetrile
Microwave Ovens
Water Fluoridation
Saccharin
Water Chlorination
Coal Tar Hairdyes
Oral Contraceptives
Hexachlorophene
Nitrates
Polyvinyl Chloride
Diagnostic X-Rays
Valium
IUD
Darvon
Antibiotics
Rubber Mfg.
Auto Lead
Lead Paint
Caffeine
Aspirin
Vaccines
DNA Technology
SST
Electric Fields
DES
Nitrogen Fertilizers
Cadmium Usage
Mirex
Trichloroethylene
2,4,5-T
Radioactive Waste
Nuclear Reactor Accidents
Pesticides
Uranium Mining
Asbestos Insulation
PCBs
Nuclear Weapons Fallout
Satellite Crashes
Mercury
DDT
Fossil Fuels
Coal Burning (Pollution)
Skateboards
Smoking (Disease)
Power Mowers
Snowmobiles
Trampolines
Tractors
Alcohol
Chainsaws
Elevators
Home Swimming Pools
Electric Wir & Appl (Fires)
Downhill Skiing
Smoking
Recreational Boating
Electric Wir & Appl (Shock)
Motorcycles
Bicycles
Bridges
Fireworks
Alcohol Accidents
Auto Exhaust (CO)
D-CON
LNG Storage & Transport
Nerve Gas Accidents
Coal Mining (Disease)
Large Dams
SkyScraper Fires
Nuclear Weapons (War)
Underwater Construction
Sport Parachutes
General Aviation
Coal Mining Accidents
High Construction
Railroad Collisions
Commercial Aviation
Auto Racing
Auto Accidents
Handguns
Dynamite

I – culture

- how societies make sense of world through language, symbols, narratives, practices
- public reaction to technologies seen as cultural
- but culture also shapes science and innovation
  - values
  - assumptions
  - imaginaries

the technological fix

- Alvin Weinberg (1967) *Reflections on Big Science*
- but problems are often complex and about interconnectedness – e.g.:
  - food security
  - health
  - geoengineering

why the technological fix?

- western thought?
- gender?
- power?

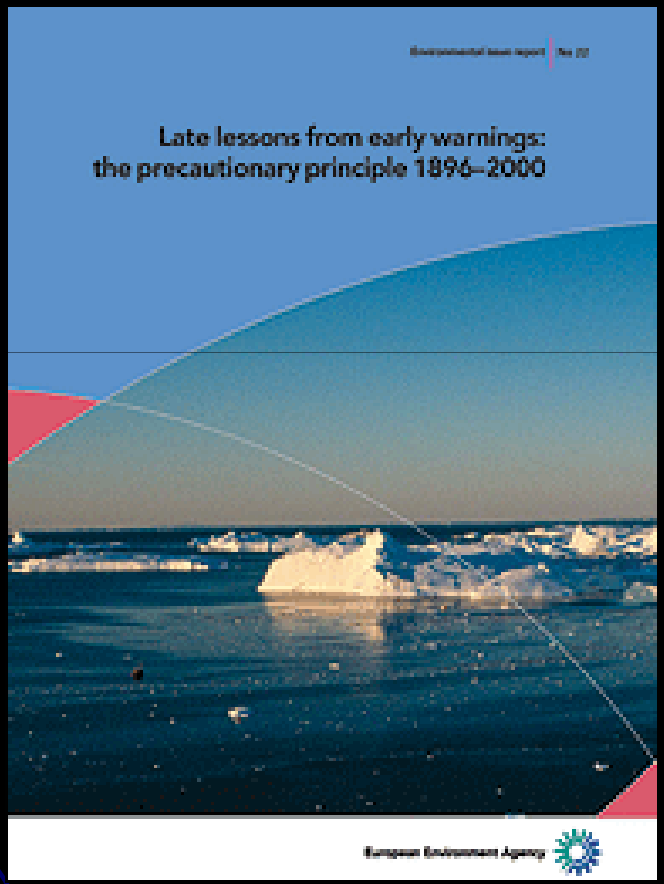
II – capital

- neoliberalism and science
  - new relationships between universities and industry
  - culture of industry entering the academy
- but innovation crisis
  - ‘Department 1’ vs ‘Department 2’
  - second industrial revolution and long boom
  - new economy and diminishing returns
  - myth of biotech revolution

innovation and profit

- low hanging fruit – e.g. HR GM crops
- shift to promise and financialisation
- concentration
- primitive accumulation – ‘accumulation by dispossession’

III – publics


Late lessons from early warnings:
the precautionary principle 1896–2000
European Environment Agency

EEA - twelve late lessons

- Acknowledge and respond to ignorance, as well as uncertainty and risk, in technology appraisal and public policy-making.
- Provide adequate long-term environmental and health monitoring and research into early warnings.
- Identify and work to reduce blind spots and gaps in scientific knowledge.
- Identify and reduce interdisciplinary obstacles to learning.
- Ensure that real world conditions are adequately accounted for in regulatory appraisal.
- Systematically scrutinise the claimed justifications and benefits alongside the potential risks.
- Evaluate a range of alternative options for meeting needs alongside the option under appraisal, and promote more robust, diverse and adaptable technologies so as to minimize the costs of surprises and maximise the benefits of innovation.
- Ensure use of 'lay' and local knowledge, as well as relevant specialist expertise in the appraisal.
- Take full account of the assumptions and values of different social groups.
- Maintain the regulatory independence from interested parties while retaining an inclusive approach to information and opinion gathering.
- Identify and reduce institutional obstacles to learning and action.
- Avoid 'paralysis' by analysis' by acting to reduce potential harm when there are reasonable grounds for concern.

public engagement

- problem of misplaced certainty in the ‘core set’ involved in science and innovation
- at least two roles for publics
  - helping reduce scientific blind spots
  - alternative framings, values, priorities
- need ‘upstream engagement’ to shape innovation
- but dilemma when engaging over unfamiliar technologies and issues