“Thinking” about risks

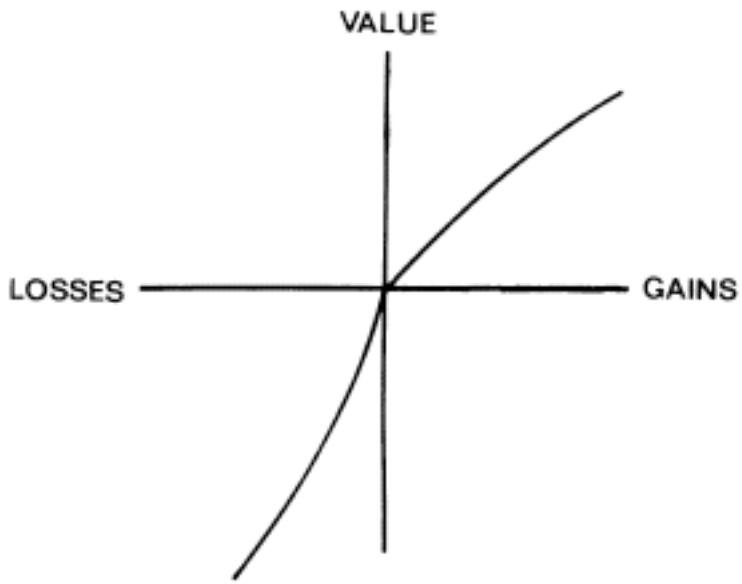
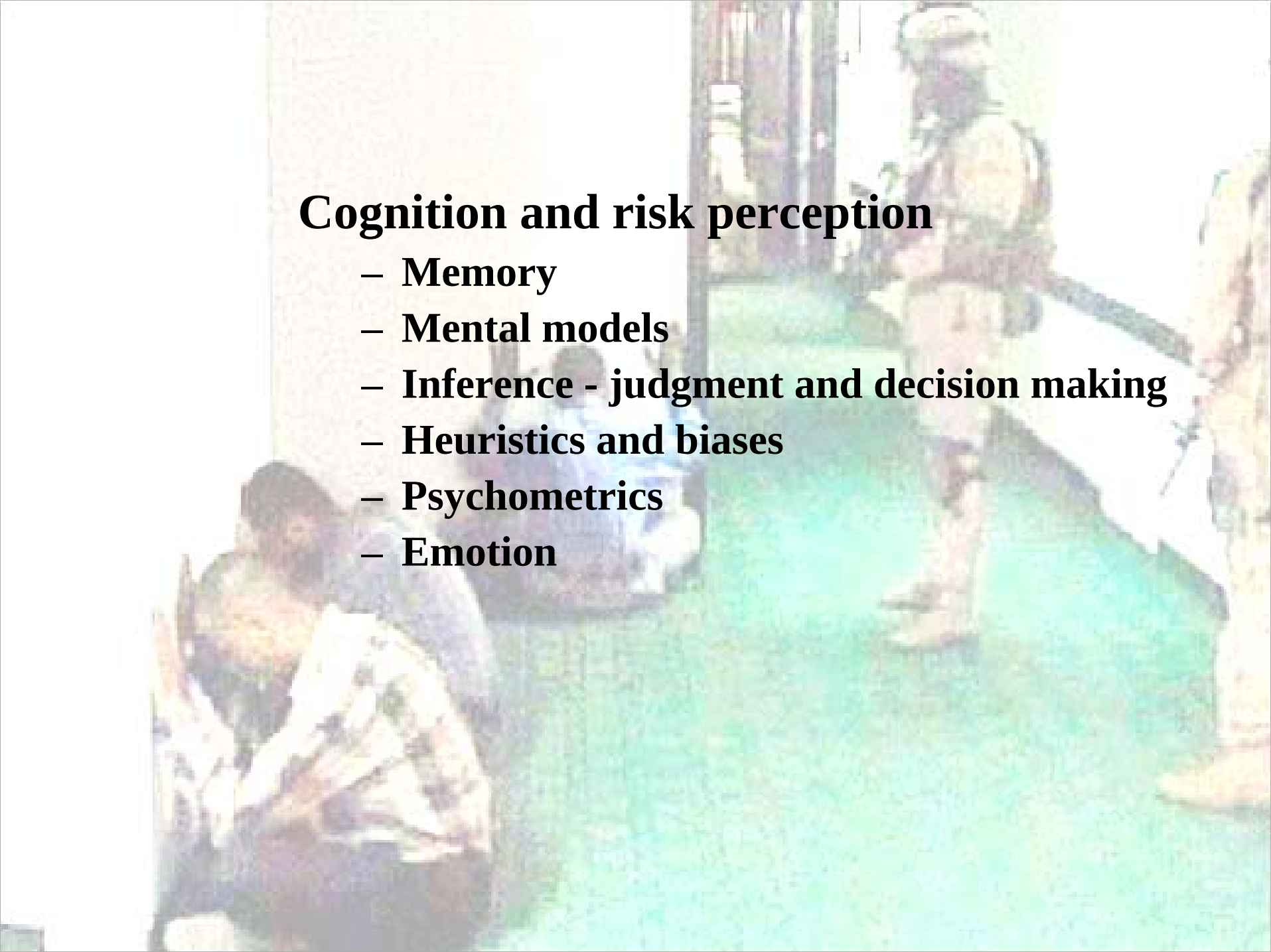
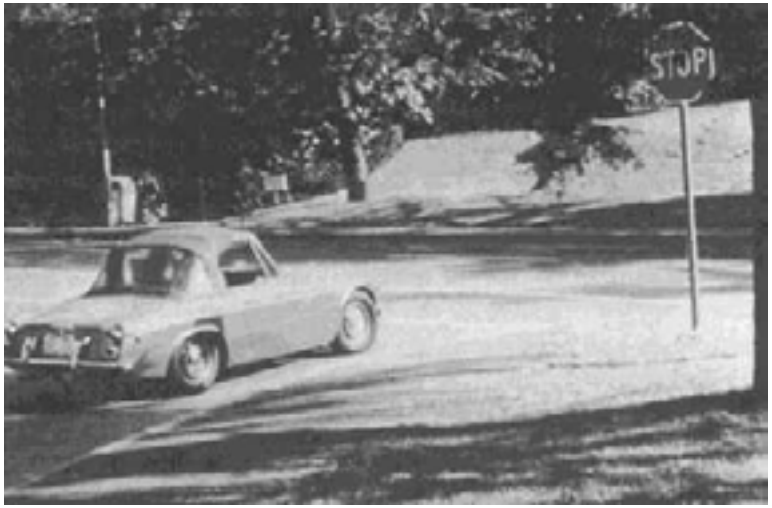


FIGURE 3.—A hypothetical value function.



Cognition and risk perception

- Memory
- Mental models
- Inference - judgment and decision making
- Heuristics and biases
- Psychometrics
- Emotion



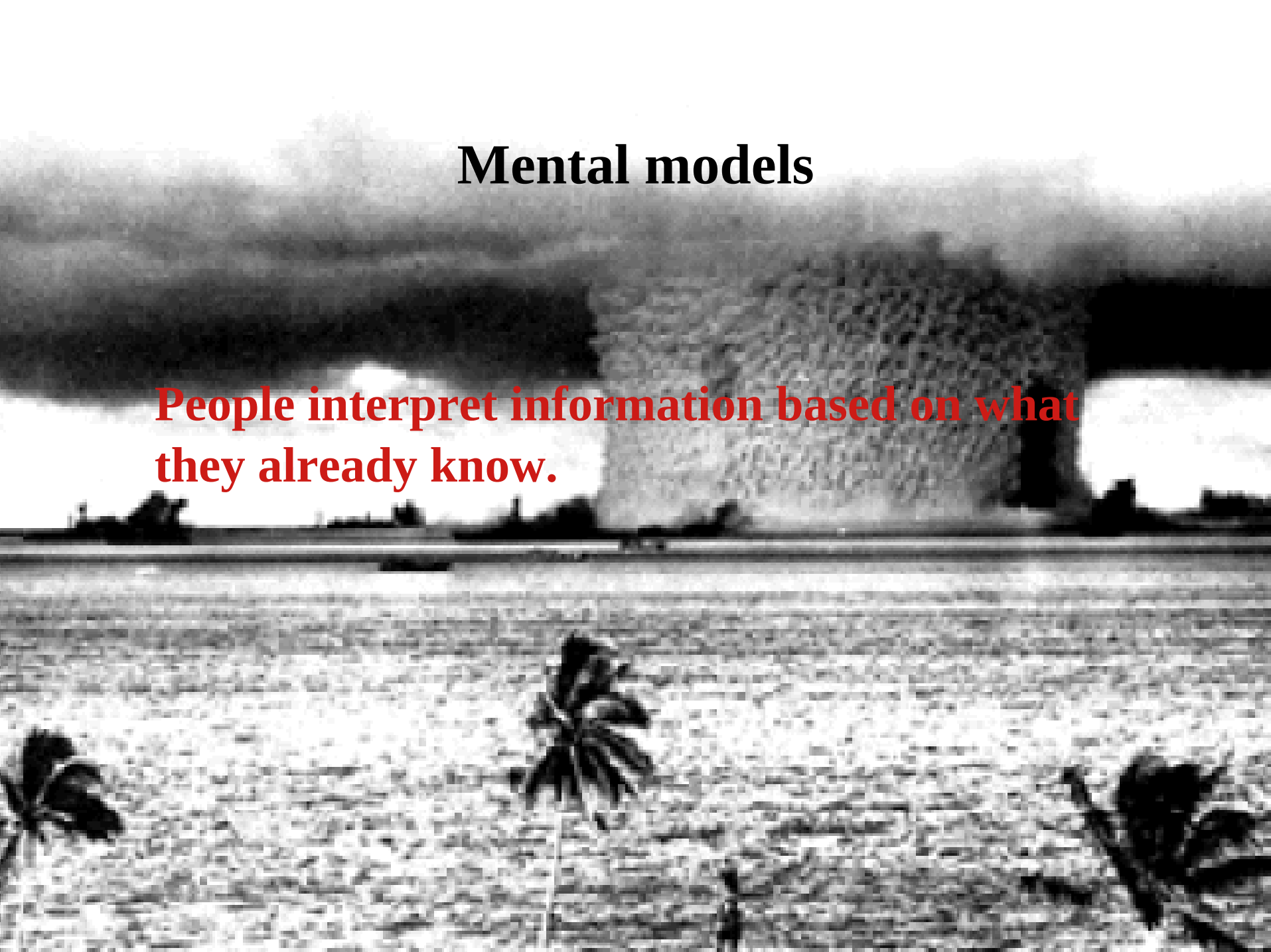
Nonexistent objects can be introduced into people's recollections (Loftus, 1975, 1978). First photos, then one of the following post-event questions (i.e., information):

"Did another car pass the red Datsun while it was stopped at the stop [yield] sign?"

Later asked to pick correct photo from the pair. When the intervening question contained consistent [inconsistent] information, 75% [41%] responded accurately

Borrowed nearly verbatim from E. Loftus (1996). Eyewitness Testimony. Harvard University Press: Cambridge, Mass.

Mental models



People interpret information based on what they already know.

Tell me about the smallpox vaccine

- Far as I know you have to be vaccinated about 4 times for it to work and I'm not exactly sure how the vaccine works other than a small amount of the disease or a small amount of the dead disease that they inject into you. [R22]

- Um, all that I can really think about it is it's something we had when we were children for elementary school, I think before we can start kindergarten. [R27]

- Um, well, there's was one developed in the 17th century and um, from what I heard on the news lately there's a new strain of the smallpox virus (uh-oh!) and um it's resistant to the original vaccine. [R25]

What-if questions regarding vaccination, asked of the 5 (N=24) Georgia Tech students who responded that they would NOT get vaccinated as a precaution against a terrorist attack using smallpox disease (19 said they would get vaccinated). The corresponding % respondents from the Blendon et al (N=1006) study is given in parentheses.

If the following situations occurred, would it change your mind and make you <u>want</u> to get vaccinated? (National sample in parentheses)

	No, would not change mind	Yes, would change mind
Cases of smallpox were reported somewhere in the world.	100% (35%)	(65%)
Your doctor and most other doctors were getting vaccinated against smallpox.	80% (27%)	20% (73%)
President Bush and his family were getting vaccinated against smallpox.	60% (34%)	40% (66%)
Cases of smallpox were reported in the United States	40% (25%)	60% (75%)
Cases of smallpox were reported in your community	(12%)	100% (88%)

Inferences about risk …

- **Assessing exposure**
  - **risk from single exposures overestimated**
  - **risk from cumulative exposures underestimated**

    P Linville, GW Fischer & B. Fischhoff (1993)
- **Interpreting verbal probabilities**

  T.S. Wallsten, D.V. Budescu, and R. Zwick (1993); Brun & Teigen (1988)
- **Comparing risks**

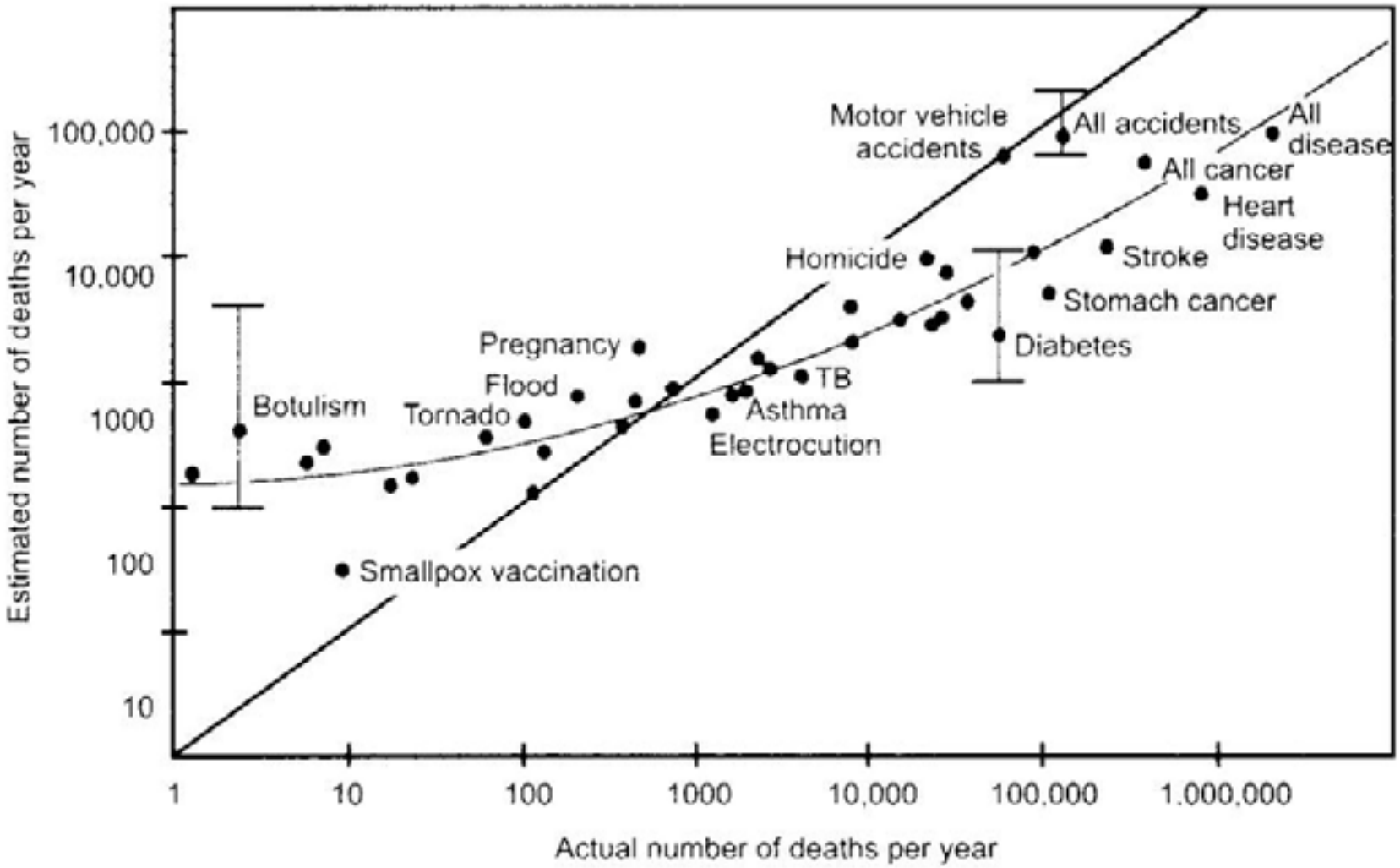
  E. Roth et al (1990); P. Slovic et al (1990); BB Johnson (2003); BB Johnson & C. Chess (2003)

  D. Gentner, K. J. Holyoak, & B. N. Kokinov (2001) *The Analogical Mind*. MIT Press.

Heuristics and biases: cognitive shortcuts

Heuristics affect quantitative estimates of risk. Subjective estimates of relative frequencies are consistent across different response modes, but estimates of absolute frequency are affected by

- **anchoring -** lack of feel for absolute frequency
- **compression -** can lead to overestimates of small frequencies, underestimates of large frequencies
- **availability -** events which are easily remembered or imagined are available, frequencies may be overestimated
- **miscalibration -** overconfidence, inadequate sensitivity to the extent of one's knowledge.


Estimated number of deaths per year
100,000
10,000
1000
100
10
1
10
100
1000
10,000
100,000
1,000,000
Actual number of deaths per year
Motor vehicle accidents
All accidents
All disease
All cancer
Heart disease
Homicide
Stroke
Stomach cancer
Diabetes
Pregnancy
Flood
TB
Botulism
Tornado
Asthma
Electrocution
Smallpox vaccination

Risk Factors

Lay people can assess annual fatalities, but their judgments of "risk" correlate with other characteristics of hazards as well, including catastrophic potential and controllability

Psychometric research by Baruch Fischhoff, Paul Slovic, Sarah Lichtenstein, and others indicates that two or three dimensions of risk are important predictors of how acceptable people perceive a risk to be:

- **Familiarity** **(voluntary, well-known, controllable)**
- **Dread** **(high catastrophic potential, threat to future generations)**

Psychometrics

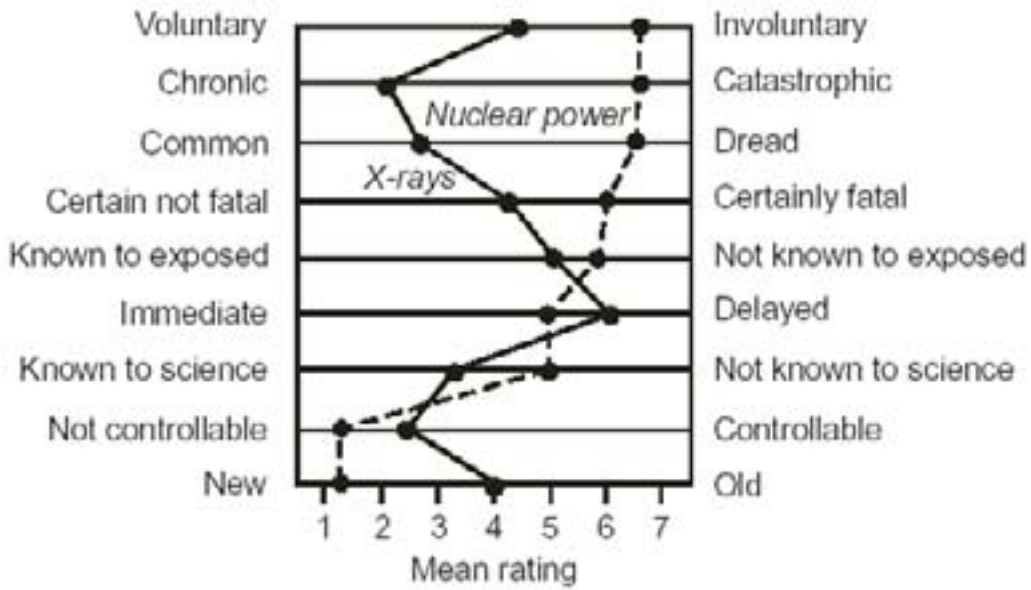
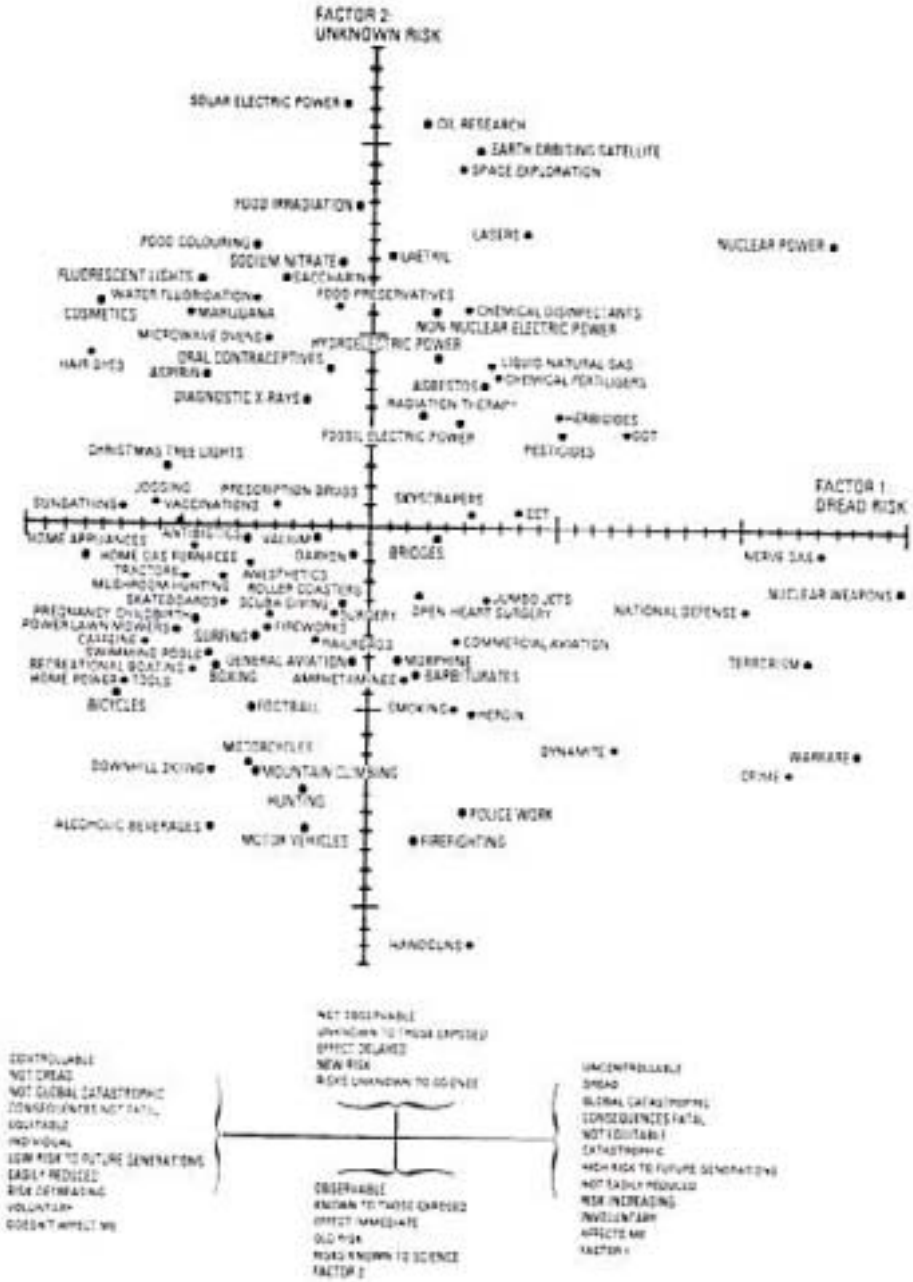


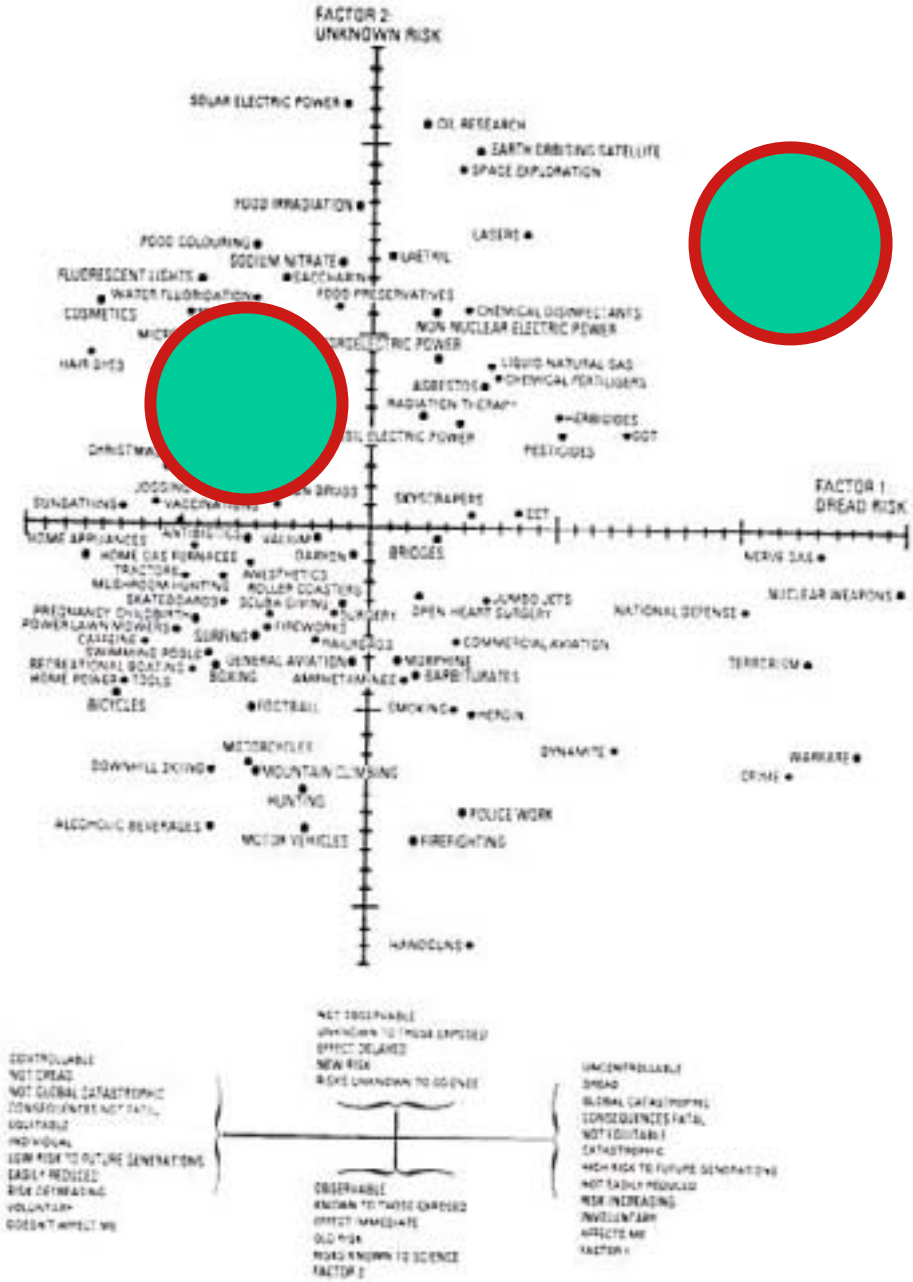
Figure 2. Qualitative characteristics of perceived risk for nuclear power and X-rays across nine risk characteristics.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). **How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. Policy Sciences**, 9, 127-152.

Figure borrowed from P. Slovic and E. Weber (2002) Perception of Risk Posed by Extreme Events. http://www.ldgo.columbia.edu/res/pi/CHRR/Roundtable/slovic_wp.pdf



Note. Factor 3 (not shown) reflects the number of people exposed to the hazard.



Note. Factor 3 (not shown) reflects the number of people exposed to the hazard.

Hazard dimensions + Outrage factors = Perceived risk

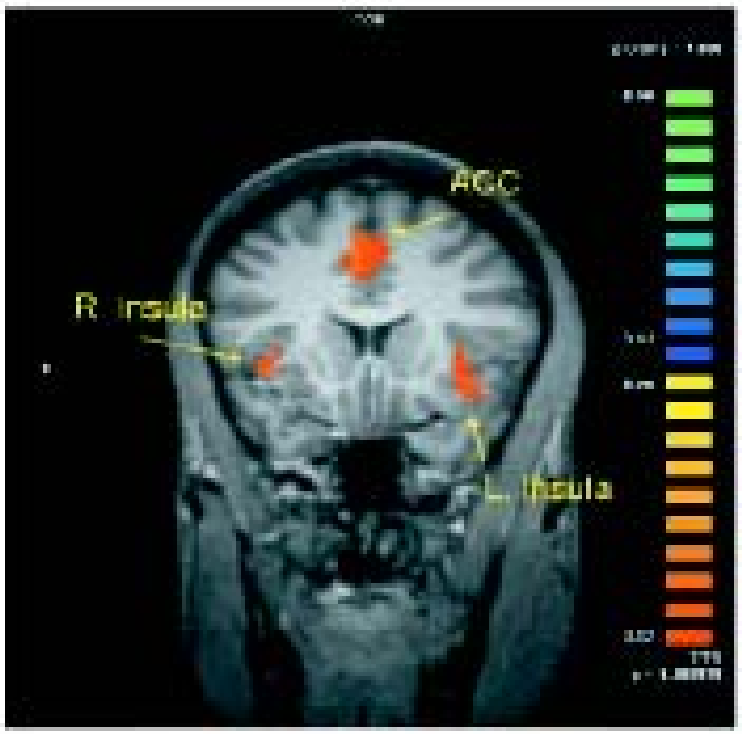
B.J. Hance, C. Chess, and P. Sandman (1988);

Hallman (1989); Wandersman and Hallman (1993)

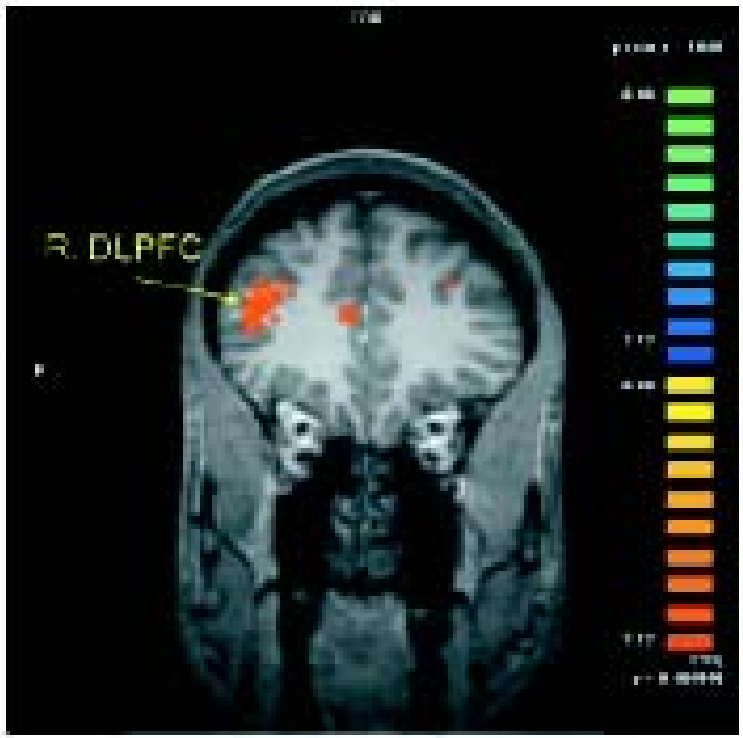
Differences in activation: unfair - fair offers

“Models of decision making cannot afford to ignore emotion as a vital and dynamic component of our decisions and choices in the real world.” Sanfey et al. (2003, p 158). *Sanfey et al., The neural basis of economic decision making in the ultimatum game. Science, vol 300, 13 June 2003, 1755-58.*

A Bilateral anterior insula and anterior cingulate cortex



B Dorsolateral prefrontal cortex



Anger, fear

Americans randomly assigned to the "fear condition" perceived greater risks from terrorism, while those in the "anger condition" perceived less risk. - Lerner et al., 2002


CAN HOBBES AND I GO PLAY IN THE RAIN, MOM?
NO.
WHY NOT?
YOU'LL GET SOAKED!
WHAT'S WRONG WITH THAT?
YOU COULD CATCH PNEUMONIA, RUN UP A TERRIBLE HOSPITAL BILL, LINGER A FEW MONTHS, AND DIE.
I ALWAYS FORGET. IF YOU ASK A MOM, YOU GET A WORST-CASE SCENARIO.
I HAD NO IDEA THESE LITTLE SHOWERS WERE SO

Bush: "Saddam to Blame for Epidemic"(War on Obesity Planned)

Posted March 26, 2003
thepeoplesvoice.org
by Keetjie Ramo

“President Bush announced today that Saddam Hussein is responsible for the burgeoning problem of obesity in America. According to the President, recent satellite photos reveal overweight Americans wolfing down supersize meals at MacDonald's and Wendy's outlets. In the photos, newspapers with articles about Saddam Hussein are lying about in plain sight, he said.”