Lecture 20/Chapter 17
Psychological Influences on Personal Probabilities

- Definitions of Various Phenomena
- Examples
- Calibrating Experts' Personal Probabilities

Psychological Influences on Risk Perception

Certainty effect: people feel better about a reduction of risk to 0 than they do about a reduction of risk by the same amount to a risk greater than 0.

Pseudocertainty effect: people prefer a complete reduction of risk on one problem to reduced risk on several problems.

Availability heuristic: people often assign personal probabilities based on how available relevant info is.

Anchoring: people's risk perception can be distorted when they are provided with a reference point, which they adjust but don't stray too far from.

Representativeness heuristic: people tend to overestimate probabilities of events that are representative of how they imagine things to happen, often due to an added touch of detail.

A heuristic is a problem-solving technique that is not necessarily justified.

More Psychological Influences

Conjunction fallacy: assigning a higher probability to one event *and* another occurring than to the probability of just one of the two events occurring.

Forgotten base rates: people tend to overestimate the probability of having a disease, given a medical test was positive, not taking into account the fact that only a small percentage have the disease.

Optimism: people tend to underestimate their own probability of being subject to misfortune.

Conservatism: people assign a low probability to ideas that are counter to their existing world-view.

Overconfidence: people assign an inflated probability of being correct when they're fairly certain, compared to when they're less certain.

Example: Russian Roulette

- **Background**: Imagine you're rich and forced to play Russian Roulette. How much would you pay to
  - Reduce the number of loaded chambers from 2 to 0? (risk goes down by 1/3)
  - Reduce the number of loaded chambers from 4 to 3? (risk goes down by 1/3)
- **Question:** Why would people be willing to pay more in the first situation, even though the risk reductions are equal?
- **Response:**

Example: Buy-one-get-one-free

- **Background**: Consider two "bargains":
  1. Buy two equally-priced items, each of which has been reduced to half-price
  2. Buy-one-get-one-free: Also starts with two equally-priced items: pay usual amount for first, nothing for second
- **Question:** Why is #2 more appealing?
- **Response:**

Example: Which cause of death is likelier?

- **Background**: Students were surveyed: which was the more likely cause of death in 2006: pneumonia/flu or stroke. In fact, stroke was more than twice as likely.
- **Question:** Why did about half the class think pneumonia/flu was more likely?
- **Response:**

Example: What's the diameter of the moon?

- **Background**: Half of surveyed students were asked, "Is the diameter of the moon more or less than **1,000** miles?"; half had 1,000 replaced with **3,000**. A later question asked them to estimate the moon's diameter.
- Survey with 1000: 40% underestimated, 60% over
- Survey with 3000: 20% underestimated, 80% over
- **Question:** Why did twice as many in the first group underestimate the diameter, which is in fact **2,160**?
- **Response:**

Example: What's Bill like?

- **Background**: Bill is 34 years old. He is intelligent, but unimaginative, compulsive, and generally lifeless. In school, he was strong in mathematics but weak in social studies and humanities. Below are statements about Bill. Rank order the statements according to how likely they are to be true of Bill…

___Bill is an accountant

___Bill plays jazz for a hobby

___Bill is an accountant who plays jazz for a hobby etc.

- **Question:** Why do people rank #3 higher than #1 or 2?
- **Response:**

Rules 6, 0, and 4 *(Review)*

Rule 6: The probability of one event *and* another occurring is the *product* of the first and the (conditional) probability of the second, given that the first has occurred.

Rule 0: Probabilities cannot exceed 1.

Rule 4: If the ways in which one event can occur are a subset of the ways in which another can occur, then the probability of the first can't be more than the probability of the second.

Example: *Conjunction Fallacy; Why is It Wrong?*

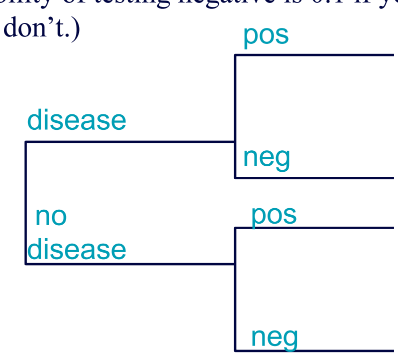
- **Background**: Rule 6 says the probability of the conjunction of events occurring (one *and* the other) is found by taking the product of two probabilities. Rule 0 says probabilities cannot be greater than 1.
- **Question:** How do these two rules together lead to Rule 4? (If one event is a subset of another, its probability cannot be greater.)
- **Response:**

Example: Chance of disease if tested positive?

- **Background**: Suppose 1 in 1000 people have a certain disease. The chance of correctly testing positive when a person actually has the disease is 90%. The chance of incorrectly testing positive when a person does not have the disease is 10%. If someone tests positive for the disease, what is the chance of actually having it?
- **Question:** Were students' estimates (average 74%) close?
- **Response:** Use a tree diagram to show…
  - Prob of diseased=0.001
    - Given diseased, prob of testing positive= _____
    - Given diseased, prob of testing negative= _____
  - Prob of not diseased=0.999
    - Given not diseased, prob of testing positive= _____
    - Given not diseased, prob of testing negative= _____

Example: *Chance of Disease if Tested Positive?*

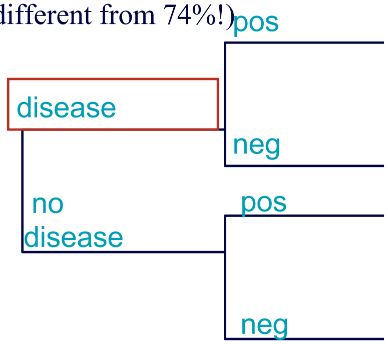
- **Background**: The probability of disease is 0.001; probability of testing positive is 0.9 if you have the disease, 0.1 if you don't. (So probability of not having the disease is 0.999. The probability of testing negative is 0.1 if you have the disease, 0.9 if you don't.)



Example: *Chance of Disease if Tested Positive?*

- **Response**: The probability of having the disease and testing positive is ______________. The overall probability of testing positive is ______________________ The probability of having the disease, given you test positive, is ______________________ (Very different from 74%!)

Forgotten base rates: the low probability of having the disease (0.001) makes the numerator (0.0009) small.

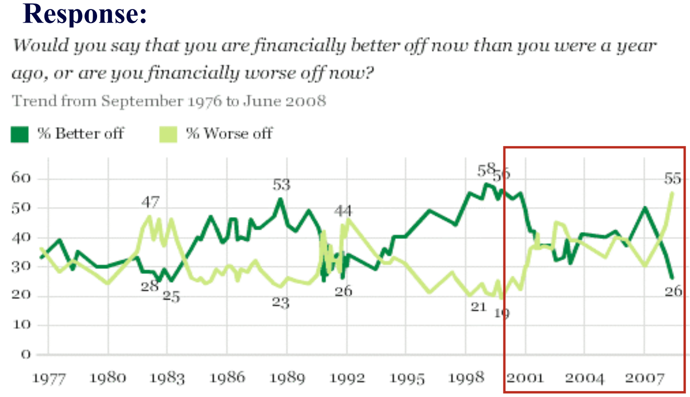


Example: *Self-rated Driving Ability*

- **Background**: "Compared to other students in this class, would you say that as a driver you are better than average, worse than average, or average?"
- **Question:** Why did many more students (30/80=38%) claim to be better than average, compared to those claiming to be worse than average (6/80=8%)?
- **Response:**

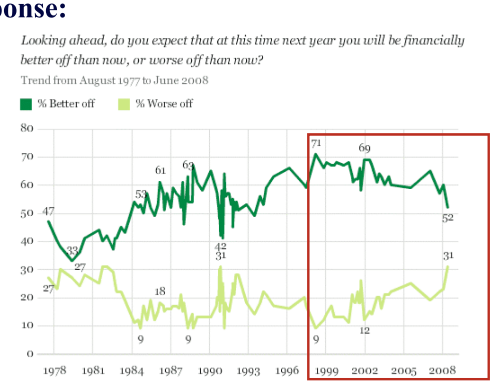
Example:*Current & Future Financial State*

- **Background**: Each year in the past decade, about 30% to 40% of surveyed Americans feel better off than the year before.
- **Question:** What % should expect to be better off next year?
- **Response:**



Example:*Current & Future Financial State*

- **Background**: Based on experience, 30% to 40% of surveyed Americans *should* expect to be better off next year.
- **Question:**Why do 50% to 70% typically expect to be better off?
- **Response:**



Example: *Purchasing Insurance*

- **Background**: People purchase insurance based on a personal probability that is their own estimated risk of a given calamity.
- **Question:**Why do people typically underestimate their own risk of having a certain calamity befall them?
- **Response:**

Example: *Cure for Trigeminal Neuralgia?*

- **Background**: Over the decades in the 20th century, neurologists had given up on a cure for a puzzling condition that causes acute facial pain; instead, they concentrated on how to treat the symptoms.
- **Question:** When Dr. Peter Janetta developed a safe and effective type of brain surgery to cure trigeminal neuralgia, when did fellow neurologists assign a low probability to the chance of the technique's success?
- **Response:**

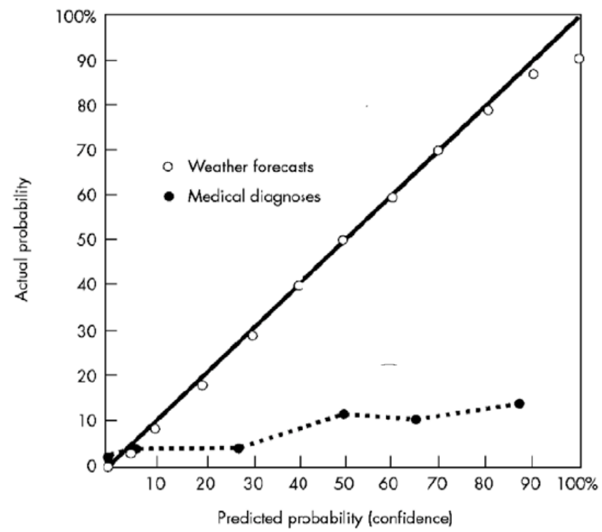
Example: *How Sure Are You?*

- **Background**: Takers of a general knowledge test were asked to accompany each answer with their personally assessed probability of being correct. For all the questions to which they assigned probability 50% of being correct, they were in fact correct about 50% of the time.
- **Question:** What percent of the time were they correct, for all the questions to which they assigned probability 99% of being correct?
- **Response:** only 80%! (due to ________________)

Example: *Calibrating Weather and Illness*

- **Background**: Weather forecasters make daily predictions of the probability of rain. Many physicians were asked to assess the probability that their patient had pneumonia, for many patients over a period of time. (In each case, possibilities are 0%, 10%,…,100%)
- **Question:** How could we judge their accuracy?
- **Response:** For all the days when they predicted 0% chance of rain, find ___________________________
  Likewise for all the days when they predicted 10% chance, etc. Similarly for physicians' predictions of pneumonia.

Example: *Calibrating Weather and Illness*



Example: *Calibrating Weather and Illness*

- **Background**: Weather forecasters make daily predictions of the probability of rain. Many physicians were asked to assess the probability that their patient had pneumonia, for many patients over a period of time.
- **Question:** Why did physician's estimates calibrate so poorly?
- **Response:**