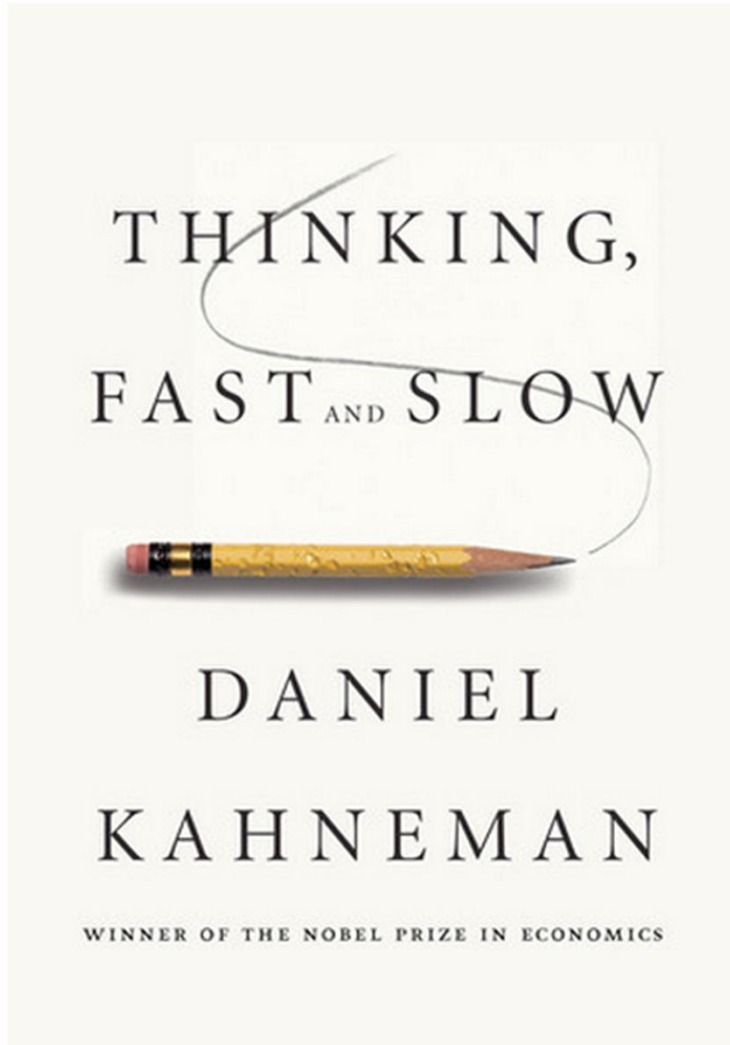


Humans as evaluators of probabilities - introduction to cognitive biases

Laura Uusitalo

Most important sources for this talk:



- Daniel Kahneman:
Thinking, fast and slow
- Morgan & Henrion:
Uncertainty. A guide to
dealing with uncertainty in
quantitative risk and policy
analysis
- *This talk just scrapes the
surface; I personally highly
recommend Kahneman's
book!*

Two systems

System 1

- Intuitive
- Automatic
- Effortless
- Fast
- Storyteller
- "Jumping into conclusions"



Ryan Piere/Getty Images

System 2

- Logical
- Conscious
- Effortful
- Slow
- Critical thinker

$$27 \times 14 =$$

Cognitive heuristics and biases

- People naturally rely on heuristics, when they need to answer questions that they don't readily have the answer for
- Cognitive bias: The tendency to make systematic decisions in certain circumstances based on cognitive factors rather than evidence.
- Everyone has them, easier to notice in others.
- We will review some heuristics and biases that may affect model building and probability estimation

What is happiness?

Heuristic: Replacing the question with an easier one

- A difficult question is replaced with another one that is easier to answer
- People often do not notice they are answering a different question
- Kahneman & Tversky: *How can people estimate probabilities, if they don't even properly understand the concept of probability?*

What is happiness?



When am I happy?

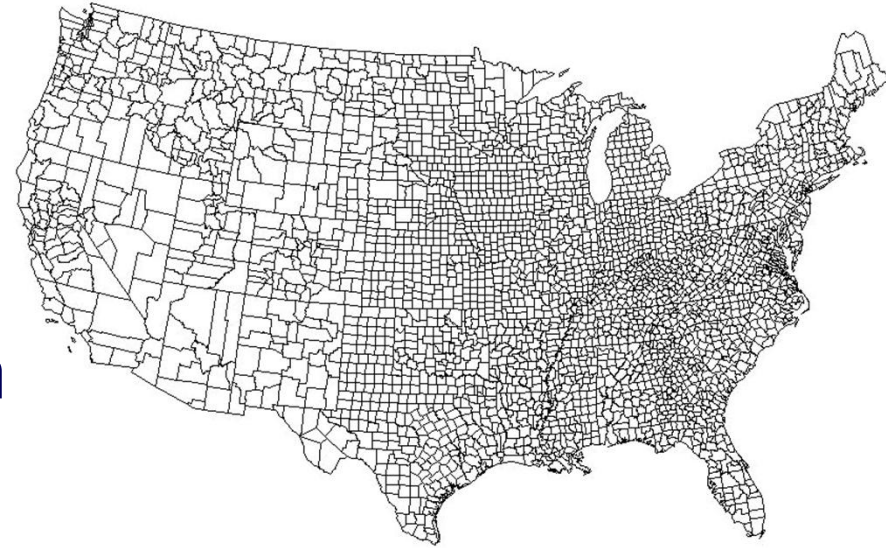
How much would I pay to save an endangered species?



How strongly do I feel when thinking of the blue whale?

3141 counties in the USA

- Lowest kidney cancer rate in
 - Rural areas
 - Sparsely populated
 - Traditionally Republican states
 - In the Midwest, the South, and the West



Why do you think this is?

“Law of Small Numbers”

- In the USA, also the *highest* rates of kidney cancer occur in sparsely populated, republican counties in the Midwest, the South, and the West.
- The mind seeks a causal explanation to things that actually occur just because of random variation!
- Focusing on the content of the information, not on its quality or quantity

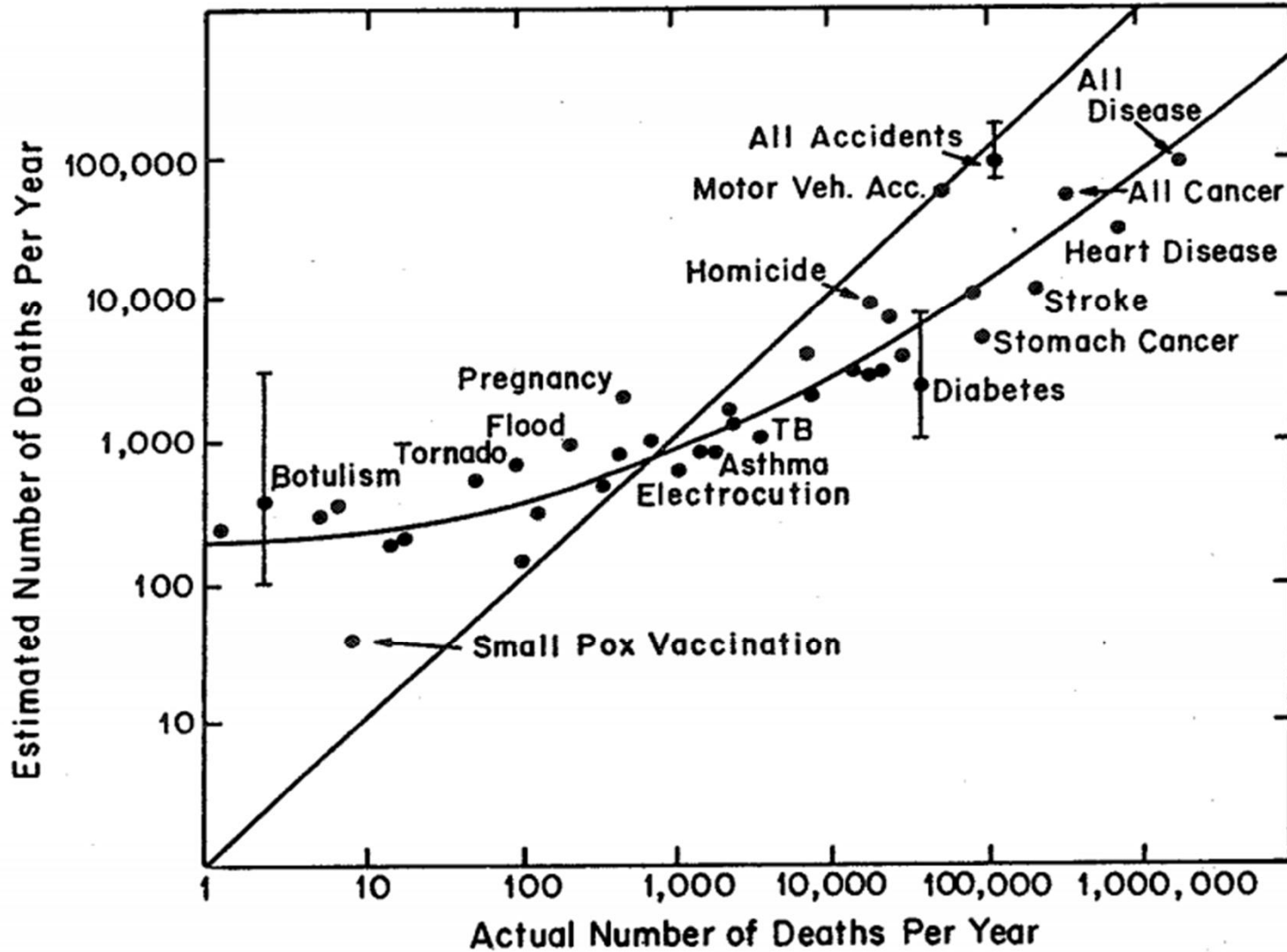
What is the risk of dying in a plane crash?

What is the risk of dying in a car crash?

Availability

- How easy it is to recall this thing?
- People overestimate the probability of events that are easy to remember
 - A list of names of famous women and unknown men: later, people will say there were more women on the list
 - Causes of death: People will overestimate the share of dramatic causes of death, while the ordinary ones are underestimated
 - Own experiences, pictures, lively descriptions improve the memorability

*(The odds of a plane crash are one for every 1.2 million flights, with odds of dying **one in 11 million**. Your chances of dying in a car or traffic accident are **one in 5,000**.)*



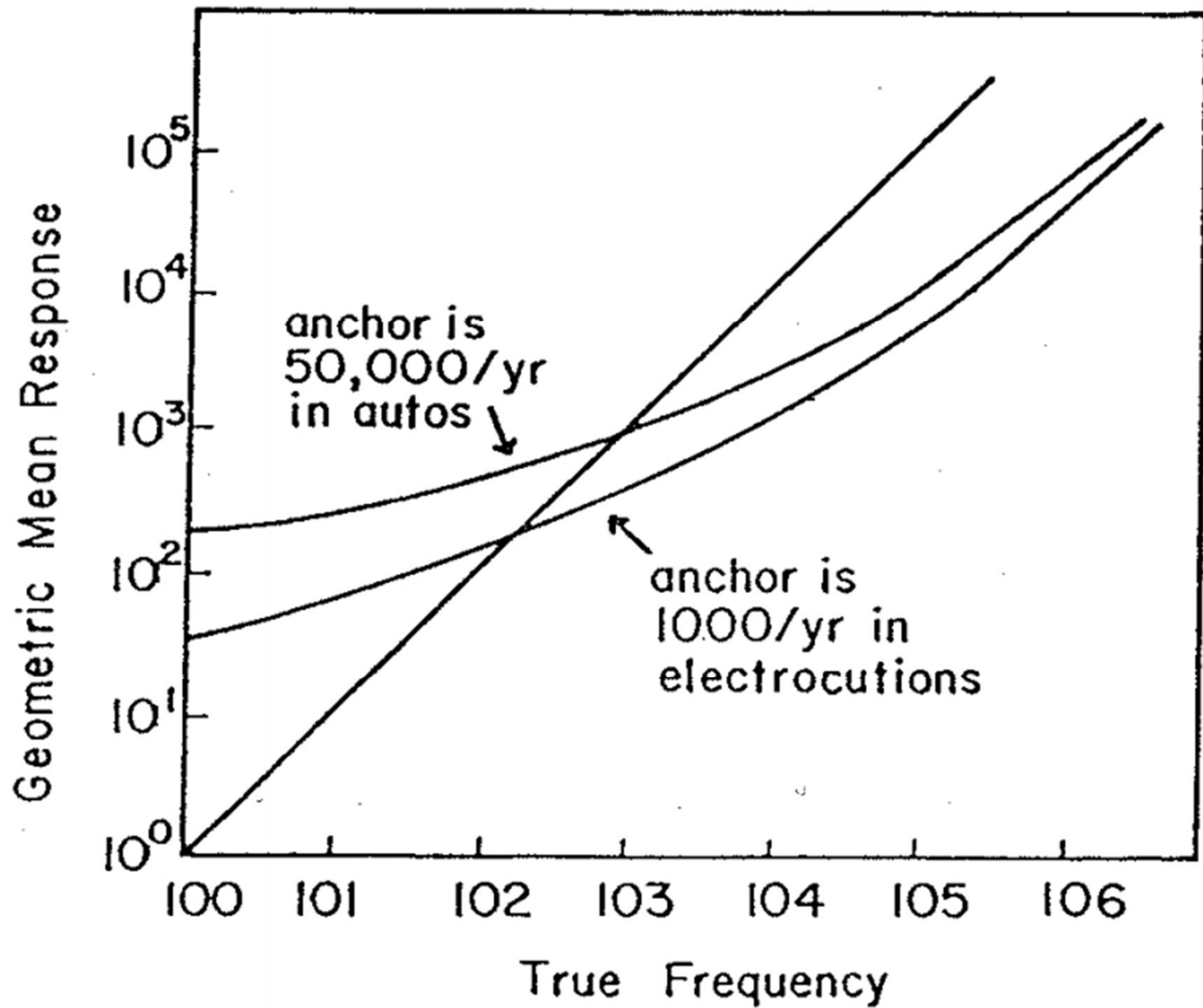
Source: Scope Report 27 - Climate impact assessment, Chapter 16, Figure 16.5, ed. by RW Kates, JH Ausubel, and M Berberian. J Wiley & Sons Ltd, UK (1985). Adapted from: Slovic et al. Rating the risks. *Environment*, 21(3) 14-39 (1979).

Was Gandhi under or over 35 years old when he died? How old was he?

Anchoring

- People start from a number they recently saw, and adjust it to the correct direction, but never enough!
- This is equally true when people know for a fact that the number they just saw has nothing to do with the problem at hand
 - Roulette wheel, die roll

(Gandhi died in the age of 78.)



Which result is more likely?



There is a party at your friends' house. They tell you that a third of their guests are lawyers and the rest are engineers.

In this room, you meet John. He's 42 years old, tall and blond. He's good in his job, and well liked by his colleagues. He tells you he likes to go swimming on his free time, and in the summertime he also likes to ride his bicycle. He has two children, aged 5 and 8. Their names are Josh and Steven.

How likely do you think it is that John is a lawyer?

Representativeness

- People tend to estimate that a “normal-looking” case is more likely than a “non-representative” one
- Forgetting the frequencies or probabilities in the population where the cases come from; only looking at what the case “feels like”
 - Irrelevant information makes people forget the probabilities! Their performance worsens when they are provided irrelevant information.

Why does Susan always leave the gate open?

If I stare long enough at the red traffic light, it always turns green!

Confirmation bias

- We notice things that support our view
- We do not notice opposing evidence



WYSIATI principle

- Daniel Kahneman: "What you see is all there is"

We form our opinion based on what we know and what's on our mind

vs.

figuring out what we need to know in order to have an informed opinion

- The content of our information seems relevant, the amount and quality not so much

Priming

- Signals that we don't even notice on a conscious level, affect our thinking and how we act (in a measurable and consistent way)
- Associations: it's easier to think of examples related to something we just saw or heard
 - People who had seen words associated with old age walked slower
 - People who had been asked to walk slowly, recognised "old-age words" more readily
 - People who had seen money-related things were more individualistic and less helpful
 - Smiling and nodding makes people have more positive and less critical opinions; frowning and shaking the head makes people more negative and critical

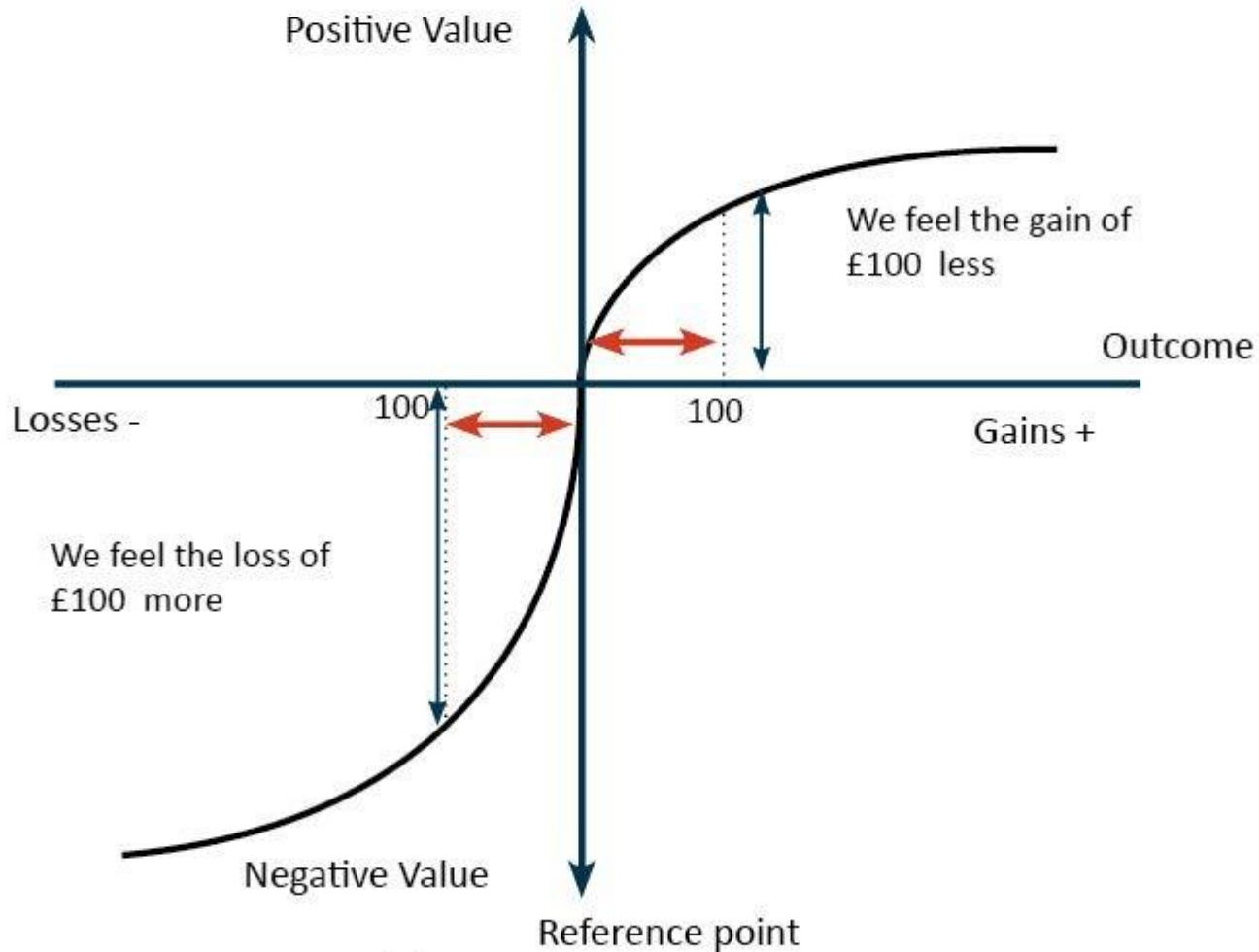
I give you 1000 €. After that, you may choose to take 500 € more for certain, or to toss a coin. Heads, and you'll get another 1000 €.

I give you 2000 €. After that you get to give me 500 € back or toss a coin. Tails, and you have to give me 1000 €.

Values: Framing and reference point

- People's preferences vary strongly depending on the context the question is set to:
- When talking about winnings, people tend to avoid risks
- When talking about losses, people tend to take risks
- The reference point determines whether you see the outcome as gain or loss

Values: Prospect theory





BNs in interdisciplinary research Laura
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Check out:

How question setting affects the answers:

https://www.ted.com/talks/dan_ariely_asks_a_re_we_in_control_of_our_own_decisions

It may be that thinking in a foreign language makes us less prone to biases:

<https://digest.bps.org.uk/2017/11/21/thinking-in-a-foreign-language-were-less-prone-to-superstition/>