

Experimental Economics: Methods & Topics

Frieder Neunhoeffer



Lisbon School
of Economics
& Management
Universidade de Lisboa

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Outline for today

- Guessing game analysis from the last lecture
- Introduction to cognitive biases

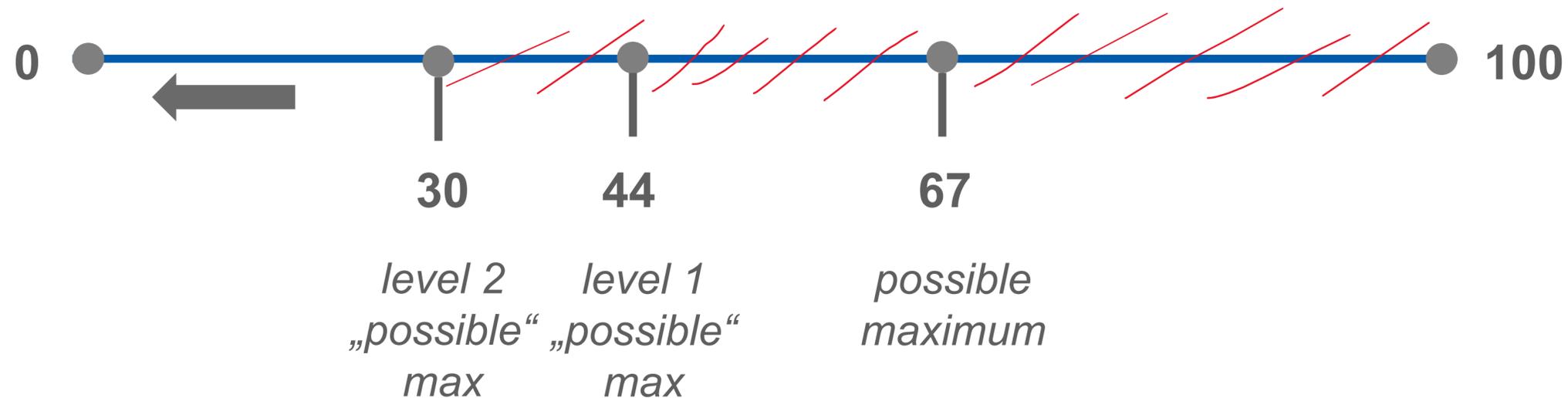
Last lecture: guessing game

and the winner is...

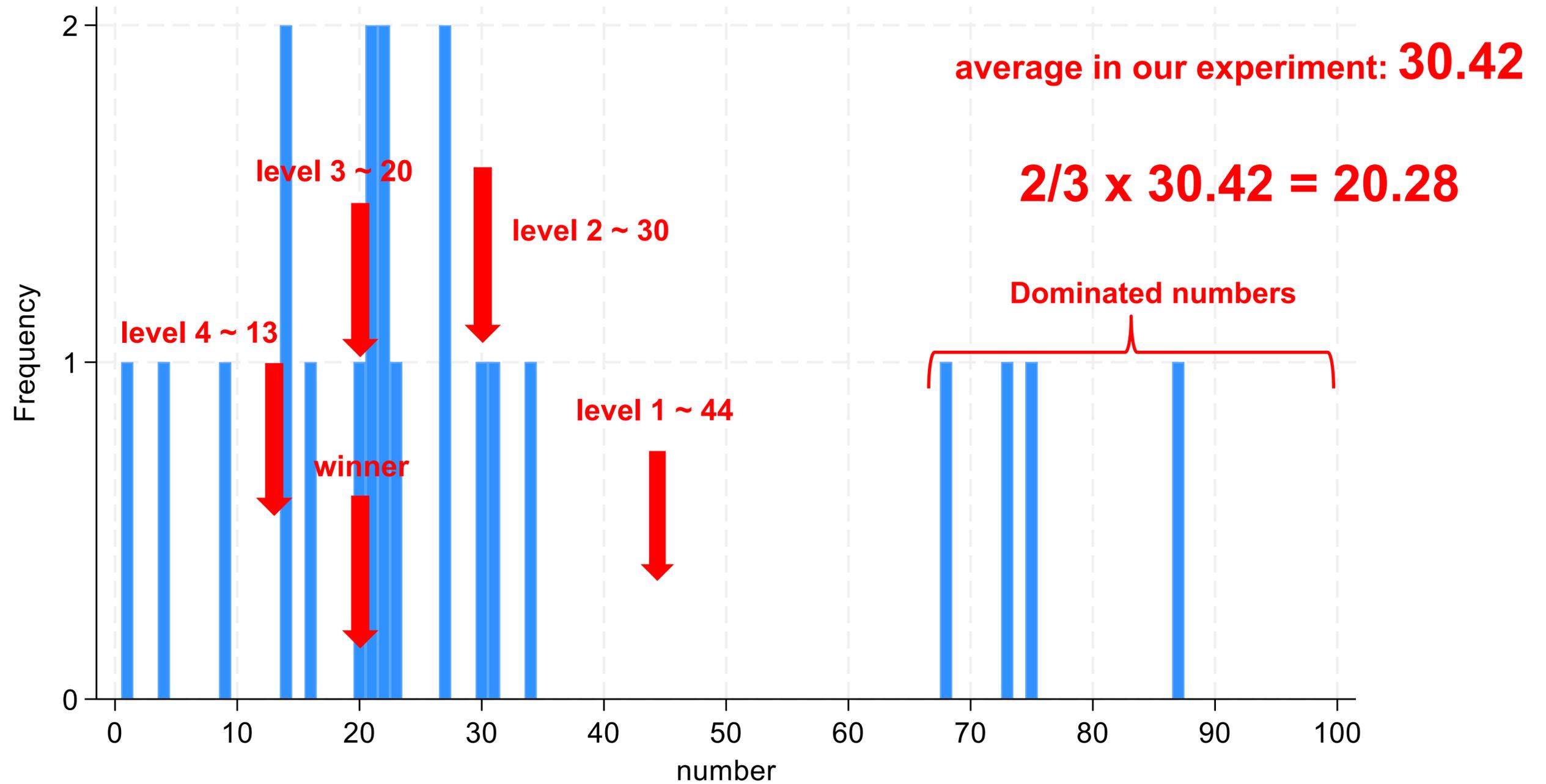
- Guess an integer from the interval 0 to 100.
- The winner is whose guess is closest to $2/3$ times the average of all guesses.
- If there are multiple winners, the price will be shared equally.

The game-theoretical solution

- Dominated numbers
- Iterative elimination of dominated numbers → theoretic equilibrium of 0



Guessing game: analysis



Clarifying coursework

- Guessing game analysis from the last lecture
- Clarify coursework
- Introduction to cognitive biases

Brief history

Individual choice experiments

- Daniel Bernoulli (1738) – St. Petersburg paradox

St. Petersburg paradox

Toss a fair coin

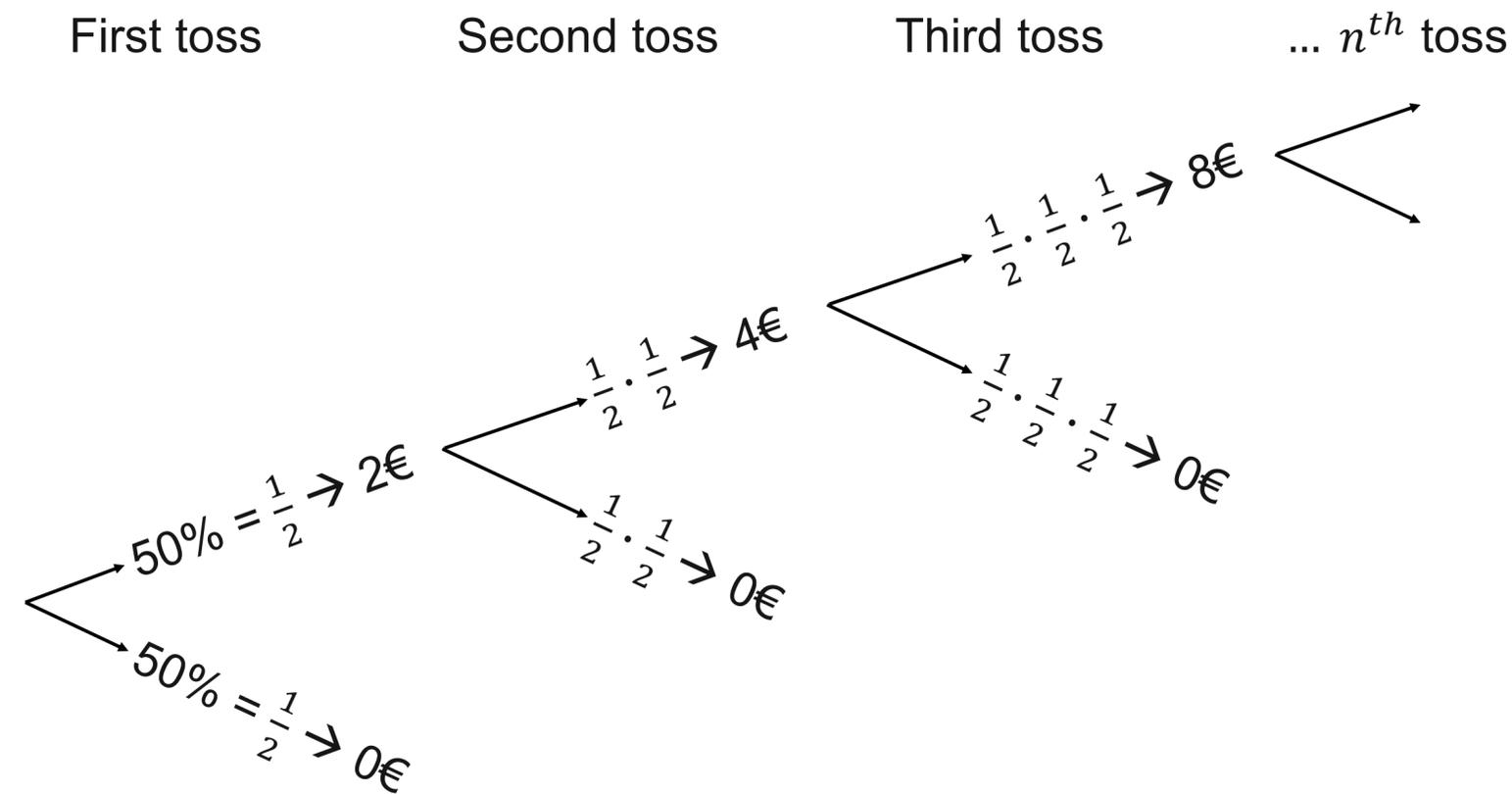
- How much would **you** pay to play?
- What is the expected value (EV)?



$1 \times \rightarrow 2 \text{ €}$
 $2 \times \rightarrow 4 \text{ €}$
 $3 \times \rightarrow 8 \text{ €}$
 $n \times \rightarrow 2^n \text{ €}$



End of the game



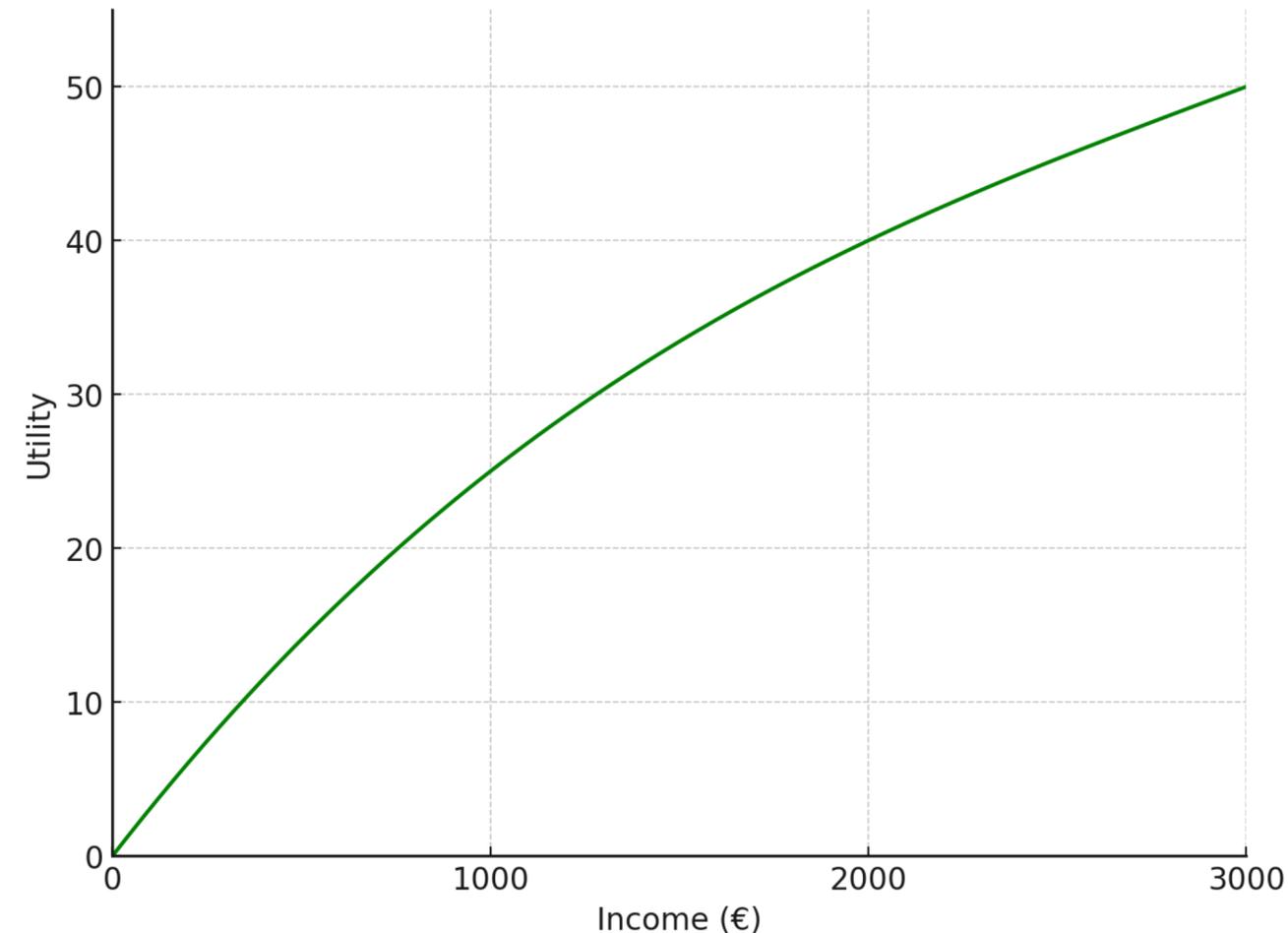
- $$EV = \frac{1}{2} \cdot 2\text{€} + \frac{1}{4} \cdot 4\text{€} + \frac{1}{8} \cdot 8\text{€} + \dots + \frac{1}{2^n} \cdot 2^n \text{€}$$

$$= 1\text{€} + 1\text{€} + 1\text{€} + \dots + 1\text{€} = \infty$$

Brief history

Individual choice experiments

- Daniel Bernoulli (1738) – St. Petersburg paradox
 - classical solution: *diminishing marginal utility of money*
- Neo-classical theory
 - von Neumann & Morgenstern (1944):
 - Expected utility theory (EUT)
 - *homo economicus* → utility maximization
 - purely self-interested
 - fully rational
- Maurice Allais (1953) – Allais paradox
 - Nobel prize winner in Economics (1988)



Allais paradox

A violation of Expected Utility Theory (EUT)

| Treatment 1 | Lottery A | Lottery B |
|-------------|-----------------------|----------------------|
| | 1 million € with 100% | 5 million € with 10% |
| | | 1 million € with 89% |
| | | 0 € with 1% |

| Treatment 2 | Lottery C | Lottery D |
|-------------|----------------------|----------------------|
| | 1 million € with 11% | 5 million € with 10% |
| | 0 € with 89% | 0 € with 90% |

Allais paradox

A violation of Expected Utility Theory (EUT)

| Treatment 1 → 2 | Lottery A → C | Lottery B → D |
|-----------------|---------------------------------|---------------------------------|
| | 1 million € with 11% | 5 million € with 10% |
| | 1 million € with 89% | 1 million € with 89% |
| | | 0 € with 1% |

| Treatment 2 | Lottery C | Lottery D |
|-------------|----------------------|----------------------|
| | 1 million € with 11% | 5 million € with 10% |
| | 0 € with 89% | 0 € with 90% |

- Deviations from EUT and homo economicus gave rise to **behavioral economics**

Ellsberg paradox

A violation of Expected Utility Theory (EUT)

Framing effects

The Asian disease example

Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs, A and B, to combat the disease have been proposed. Which one do you prefer?

Lives saved
frame

- **Program A:**
1/3 probability that 600 people are saved, otherwise 0 people are saved

- **Program B**
200 people are saved for sure

Lives lost
frame

- **Program A':**
1/3 probability that 0 people will die, otherwise 600 people will die

- **Program B'**
400 people will die for sure

Usually, humans behave risk averse for gains and risk seeking for losses.

The decoy effect

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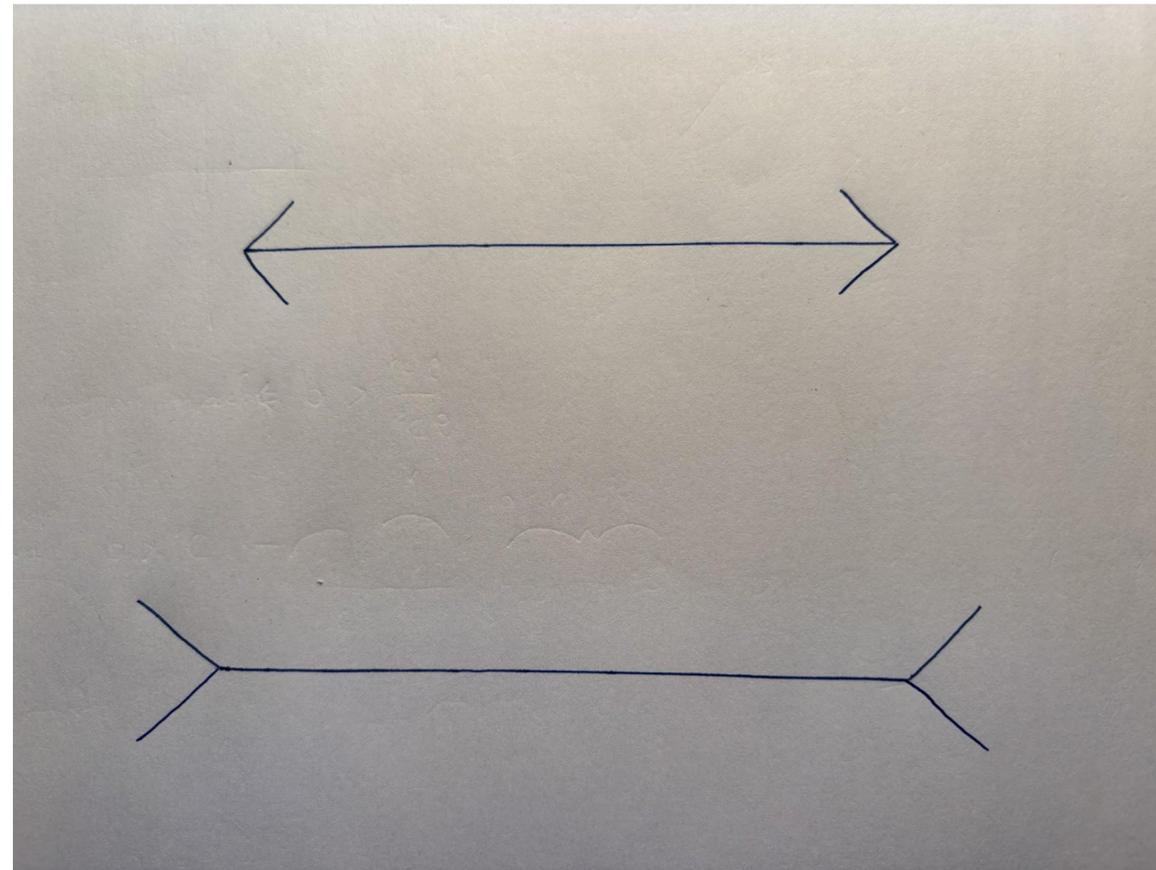
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Mueller-Lyer illusion



- 100 points for correct answer, otherwise nothing

Cognitive reflection test (CRT)

- Imagine the red marker and the green marker cost together 2.20€
- The red marker costs 2.00€ more than the green marker
- How much costs the green marker?
- 100 points for correct answer, otherwise 0.

Equilibrium reasoning

| A | | Player 2 | |
|-----------------|-------------|-----------------|-------------|
| | | UP | DOWN |
| Player 1 | UP | 6,6 | 2,8 |
| | DOWN | 8,2 | 4,4 |

| B | | Player 2 | |
|-----------------|-------------|-----------------|-------------|
| | | UP | DOWN |
| Player 1 | UP | 5,5 | 1,4 |
| | DOWN | 4,1 | 2,2 |

- You get 100 points if your decision corresponds to the game-theoretical correct answer

Linda problem (conjunction fallacy)

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Which is more probable?

- Linda is a bank teller.
 - Linda is a bank teller and is active in the feminist movement.
-
- 100 points for correct answer, otherwise 0.

Sample size neglect

- Two factories make office chairs. The larger factory produces **45 chairs** each day, and the smaller factory produces **15 chairs** each day.
- For both factories, there is a **10% random chance** that any given chair is defective. However, since this is random, the exact percentage varies from day to day. Sometimes it may be higher than 10%, sometimes lower.
- Over **1 year**, each factory recorded the days on which **MORE THAN 20%** of the chairs were defective.
- **Which factory do you think recorded more such days?**
 - The larger factory
 - The smaller factory
 - About the same (that is, within 2% of each other)
- 100 points if your decision corresponds to the statistically-correct option given the information you are provided, and nothing otherwise.

Exponential growth bias

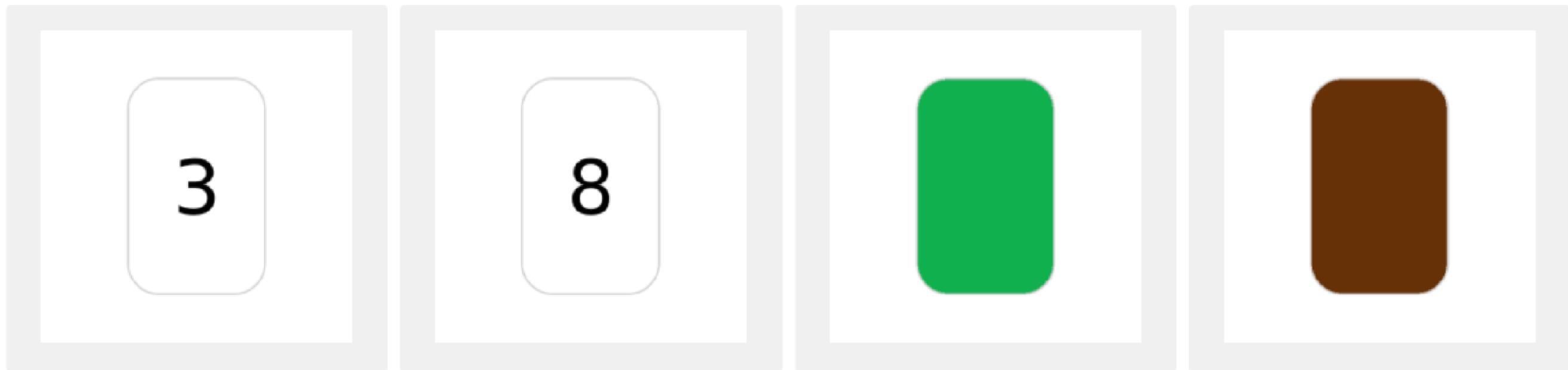
- Suppose a stock starts at a value of \$100.
- It grows by 5% each year relative to its beginning-of-year value.
- How much is it worth after 20 years? (round to the nearest integer)
- You get 100 points minus the absolute difference between your decision and the correct stock value. For example, if the absolute difference between the true stock value and your decision is \$10, subtract 10 points.

Correlation neglect

- There are three people: Ann, Bob and Charlie. Each estimates the weight of a water bucket.
- Ann and Bob both get to see the bucket. They are equally good at estimating weight. Each of them gets weight estimates right, on average, but sometimes makes random mistakes. Ann and Bob are equally likely to make mistakes in any given estimate they make.
- Ann and Bob both share their estimates with Charlie, who has never seen the bucket. Because he has never seen the bucket, Charlie computes his best estimate of the weight of the bucket as the average of the estimates of Ann and Bob.
- You have never seen the bucket either. Ann and Charlie share the following estimates
- Ann's estimate: 70
- Charlie's estimate: 40
- Your task is to estimate the weight of the bucket.
- You get 100 points if your decision corresponds to the statistically correct answer minus 3 points for every number you are away from the correct answer.

Wason test

- “In my deck of cards, all of the cards with an even number on one side are green on the other.”
- You get 100 points if:
- you turn over ALL of the card(s) that can be helpful in determining whether my statement is true AND
- you do not turn over ANY of the cards that CANNOT be helpful in assessing whether my statement is true.



Violating dominance

- 50 points for the correct answer in A vs B
- 50 points for the correct answer in X vs Y

Gambler's fallacy

- I have tossed this fair coin before class eight times in a row. This was the result. (where T stands for TAILS and H stands for HEADS)
- **T – T – T – H – T – H – H – H**
- **Which event is more likely to happen on the next coin toss?**
 - Heads is more likely
 - Tails is more likely
 - Both are equally likely
- 100 points if your decision corresponds to the statistically-correct option given the information you are provided, and nothing otherwise.

Regression to the mean

- The average score on a standard IQ test is 100. Suppose a randomly selected individual has obtained a score of 140.
- Suppose further that an IQ score is the sum of both true ability and random good or bad luck. The luck component can be positive or negative but equals zero on average (over all people).
- **Which of the following statements is correct?**
 - This person's true IQ is more likely to be above than below 140.
 - This person's true IQ is more likely to be below than above 140.
 - This person's true IQ is equally likely to be above or below 140.
- 100 points if your decision corresponds to the statistically-correct option given the information you are provided, and nothing otherwise.

Racing car

- You get 100 points minus the absolute difference in km/h between your decision and the correct answer. For example, if the absolute difference between the true speed and your decision is 10km/h, subtract 10 points.