

Probabilistic Judgments

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Probability and Intuition

- Probability theory is an incredibly powerful tool to come up with precise assessments about uncertain events. However, such formal reasoning based on probability theory does not seem to sit well with people's heuristic judgments and intuition. This is especially true when it comes to updating

Example: Three-Card Swindle

EXAMPLE

Consider a deck of cards with three cards. The first card is white on both sides. The second card is red on both sides. The third card is white on one side and red on the other. Your friend shuffles the deck well and, then, places the stacked deck on the table in such a way that you can see the visible face of the top card only. Suppose the visible side of the top card is white. What is the probability that the other side of the top card is also white?

Independence

- People do not seem to understand the concept of independent events very well
- In many occasions, they make the mistake of thinking events that are not independent as so and vice versa
- Example: Financial investments

Example: Coin Toss

EXAMPLE

A fair coin is tossed eight times. Rank the following sequence of possible outcomes of this experiment on the basis of how likely they are:

- ① *HHHHHHHH*
- ② *HHHHHHTT*
- ③ *HTTHTHHT*

Gambler's Fallacy

In a game of roulette at the Monte Carlo Casino on August 18, 1913, the ball fell in black 26 times in a row. Gamblers lost millions of francs betting against black.

Gambler's Fallacy

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More generally, gambler's fallacy refers to the cognitive process whereby an individual thinks that a departure from the average behavior of some system will be corrected in the short run. Why?

- Representativeness heuristic: People estimate the probability that some outcome was the result of a given process by referring to the degree to which the outcome is representative of the process
- Law of small numbers: People exaggerate the degree to which small samples resemble the population from which they are drawn

Base Rate Neglect

- The fraction of all “individuals” in the population who have some characteristic of interest is called the base rate. Very often people fail to take the base rate properly into account

Example: Base Rate Neglect

Participants learn the following base rate information. There are two cab companies in a fictional city named after the color of their taxis: the “Green” company and the “Blue” company. Of all the cabs in the city, 85% are blue and 15% are green (Bar-Hillel, 1980).

Then, the researchers told participants about a hypothetical scenario where a witness identifies a cab involved in a hit-and-run as green. Further results reveal that the witness can accurately distinguish the colors 80% of the time but confuse them 20% of the time. After hearing this scenario, participants predicted the likelihood that the cab involved in the hit-and-run was actually green.

Example: Base Rate Neglect

Most participants guessed that the probability that the witness correctly identified a green cab is 80%. However, everyone who gives that answer is subject to the base rate fallacy. Remember that the base rate information revealed that only 15% of the cabs in the city are green, making the actual probability that the witness was correct 41%.

Confirmation Bias

- Bayesian learning is a very effective way of updating one's opinions based on evidence
- Bayesian learning also provides a hopeful view of human nature: when rational people are exposed to the same evidence, over time they come to agree regardless of their starting point (prior)
- However, when we look at the world outside, we see that sexist and racist attitudes in relation to things like ability, for instance, continue to persist!
- That suggests that we do not quite learn like Bayesians
- Part of the reason for this is a phenomenon called the *confirmation bias*: a tendency to interpret evidence as supporting prior beliefs to a greater extent than warranted

Availability Heuristic

Availability heuristic refers to the tendency to assess the probability of some event occurring by the ease with which the event comes to mind

Example: Public Perception of Health Risks

Fischhoff, Lichtenstein and Slovic asked participants in a survey to consider pairs of causes of death: e.g., diabetes and asthma, or stroke and accidents, etc. For each pair, the subjects indicated the more frequent cause and estimated the ratio of the two frequencies. They found:

- Strokes cause almost twice as many deaths as all accidents combined, but 80% of respondents judged accidental death to be more likely
- Tornadoes were seen as more frequent killers than asthma, although the latter cause 20 times more death
- Death by accidents was judged to be 300 times more likely than death by diabetes, but the true ratio is 1:4

Heuristic and Biases Program

Heuristics are functional but imperfect rules of thumb or mental shortcuts that help us form opinions and make decisions quickly. Some examples are:

- Anchoring and adjustment heuristic
- Representativeness heuristic
- Availability heuristic
- Affect heuristic

Heuristic and Biases Program

What is behind the operation of heuristics?

- Kahneman suggests that the operation of heuristics can be understood in terms of substitution: When faced with a complex question that is hard to answer we substitute it with a simpler question that is easier to answer.

E.g., rather than answering the question, “How likely is this chopper to crash?” we substitute the question, “How easily can I imagine this chopper crashing?”