Day 06

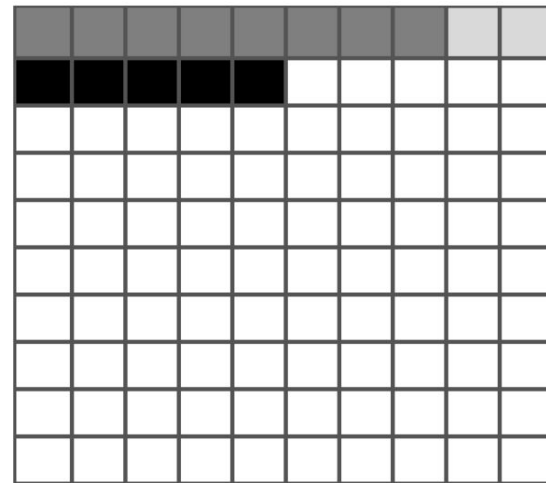# Base rates, Biases

- Base rates
- Conditional probability
- Cognitive biases

100 potential drugs; 10 of them actually work.

- Statistical test & p-value < 0.05; Assume power = 0.8.

- What is the FPR and FDR?

- What do you think about the following statement?

    ○ "There is a 1 in 20 chance that an ineffective drug is picked by the trial."

Base rate fallacy

"There is only 1 in 10,000 chance that this result arose as a statistical fluke because p = 0.0001."

Base rate fallacy

A diagnostic test for a particular disease is 99% reliable:

- 99% of people who are sick $\rightarrow$ test positive

- 99% of people who are healthy $\rightarrow$ test negative

If a patient tests positive, what is the probability that the patient is sick?

Base rate fallacy

0.8% of women who get mammograms have breast cancer.

90% of women with breast cancer → mammogram result is positive.

7% of women without breast cancer → mammogram result is positive.

If a woman gets a positive mammogram result, what are the chances that the woman has breast cancer?

Ascertainment bias

Sampling / selection bias: arises when data for a study or analysis is collected (or surveyed, screened, or recorded) such that some members of the intended population are less likely to be included than others.

- More intense surveillance or screening for the outcome among exposed individuals than among unexposed individuals, or differential recording of the outcome.

- In screening, where take-up can be influenced by factors such as cultural differences.

- In case-control studies in the initial identification of cases and controls, which can be skewed by relevant exposures, leading to biased relationships.

- In a clinical trial, if allocation concealment and blinding are lacking, then outcome ascertainment can be overtly influenced by knowledge of the allocation.

Survivorship bias

NEVER STOP BUYING LOTTERY TICKETS, NO MATTER WHAT ANYONE TELLS YOU.

I FAILED AGAIN AND AGAIN, BUT I NEVER GAVE UP. I TOOK EXTRA JOBS AND POURED THE MONEY INTO TICKETS.

AND HERE I AM, PROOF THAT IF YOU PUT IN THE TIME, IT PAYS OFF!
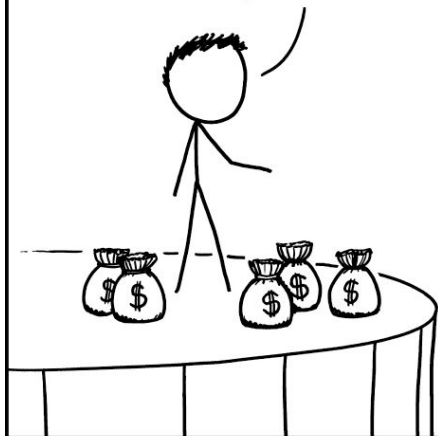
EVERY INSPIRATIONAL SPEECH BY SOMEONE SUCCESSFUL SHOULD HAVE TO START WITH A DISCLAIMER ABOUT SURVIVORSHIP BIAS.
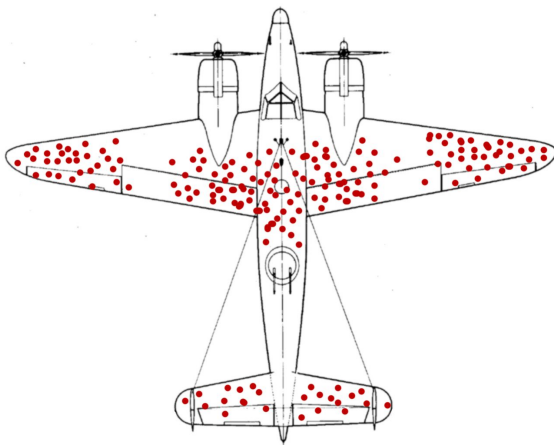
To minimize bomber losses to enemy fire, add armor to the areas with most damage.

[Abraham Wald said no!]

Dramatic rise in field hospital admissions of severe head injury victims → redesign!

[Unknown statistician said no!]

https://xkcd.com/1827/; https://en.wikipedia.org/wiki/Survivorship_bias

Puzzle

A Quick Puzzle to Test Your Problem Solving

By **DAVID LEONHARDT** and **YOU**   JULY 2, 2015

A short game sheds light on government policy, corporate America and why no one likes to be wrong.   **RELATED ARTICLE**

Here's how it works:

We've chosen a rule that some sequences of three numbers obey — and some do not. Your job is to guess what the rule is.

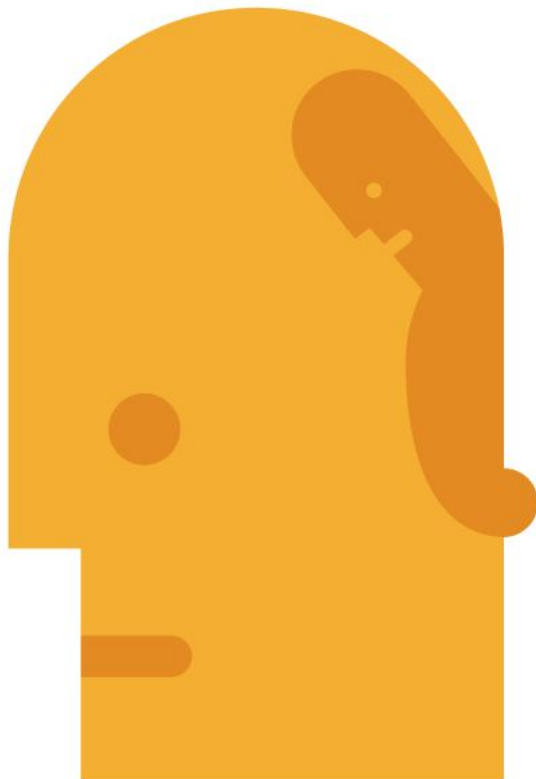We'll start by telling you that the sequence 2, 4, 8 obeys the rule:

| 2 | 4 | 8 | **Obeys the rule** |

Now it's your turn. Enter a number sequence in the boxes below, and we'll tell you whether it satisfies the rule or not. You can test as many sequences as you want.

Enter your first sequence here:

[   ] [   ] [   ] Check

I don't want to play; just tell me the answer.

Confirmation bias

The tendency to search for, interpret, favor, and recall information in a way that confirms one's beliefs or hypotheses.

- Scientists rate studies that report findings consistent with their prior beliefs more favorably than studies reporting findings inconsistent with their previous beliefs.

- Data that conflict with the experimenter's expectations may be more readily discarded as unreliable.

"It is the peculiar and perpetual error of the human intellect to be more moved and excited by affirmatives than by negatives; whereas it ought properly to hold itself indifferently disposed towards both alike."
– *Francis Bacon*

https://www.nature.com/articles/nmeth.3091