Bias and Cognitive Bias

Critical Skills and Practice

Tuesday 24th November 2026

This Week

Monday: Argue with Evidence + Methodology

Tuesday: Bias and Cognitive Bias

Thursday: Command Line and Git (Please bring a laptop if you can)

Interpersonal Biases

- What is a bias?
  - A personal opinion that leads to instinctive assumptions and actions
- Unconscious bias:
  - “Unconscious bias refers to the deep-seated prejudices we all absorb due to living in deeply unequal societies."
  - May be with or without malicious intent, but generally with negative consequences

Conscious and Unconscious Bias with Roni Savage - Institution of Civil Engineers (2022)

How do biases appear in every day life?

Understanding Different Types of Bias - NHS England

University Students

- You are all from different backgrounds
- You may have some shared experiences and some very different experiences
- Use your time here to learn about everything you can, including other people
- Unconscious bias might hinder this

Identity Based Biases

- Ageism
  - Excluding someone from social events because of their age
  - Not being included in offers of training or promotion because of age
- Name bias
  - Someone with a name that less western sounding being less likely to be given a job.
- Beauty Bias…
  - People perceived as "beautiful" are more likely to be given leadership roles
  - Or perceived as more self-confident

Courtright, S. H., Thurgood, G. R., Liao, H., Morgan, T. J., & Wang, J. (2026). The Beauty Bias and Leader Emergence: A Theoretical Integration, Extension, and Meta-Analysis.

Gender Bias

- Gender Bias
  - Preferring one gender over another in a job interview, despite having the same qualifications and experience
  - Not giving jobs to women of certain ages on the assumption they will require maternity leave in the near future
  - Pay disparity between genders

University of Edinburgh Equal Pay Audit 2025

Gender Bias in University

Computer Science courses in the UK are often male-dominated

e.g., "Girls don't take computer science" - My school teacher

How many times do you think that bias has helped or hindered you on your journey?

Perception Biases

- Halo/Horn effect
  - One positive or negative trait affecting the perception of the person as a whole
- Attribution Bias
  - Assuming the actions of an individual are a trait of their gender or race

Nisbett, Richard E; Wilson, Timothy D (1977). "The halo effect: Evidence for unconscious alteration of judgments"

Social and Decision-Making Biases

- Conformity Bias or "Groupthink"
  - Picking a solution that minimises conflict and aligns with the group consensus
- Affinity Bias
  - Favor those who are similar to themselves and to exclude those who are different
- Authority Bias
  - Attributing greater accuracy to the opinion of an authority figure
- Status Quo Bias
  - The preference to keep things the same

Reducing Bias requires effort

- I have not covered every example of bias that you might experience
- Acknowledging that bias exists is not enough to counteract it
- A 10 minute section in a lecture is not a cure for a lifetime of absorbed prejudice and structural inequalities
- Talking to, and working with, more varied groups of people helps reduce bias

The Complicated Battle Over Unconscious Bias Training - BBC News (2021)

Information Processing Biases

Information Processing Biases

- Confirmation bias
  - Give greater weight to evidence that confirms our views and experiences. Not seeing or valuing evidence that contradicts our beliefs.
- Recency Bias
  - The most recent thing in a list is easier to remember
- Illusory Correlation
  - Inaccurately relating two events that are related only by coincidence

Anchoring Bias: Example

- I'm going to show two equations,
- Join in pairs, and pick a letter A or B each
- You have 5 seconds to estimate (in your heads) the sum of the equation

Take 10 seconds now to decide whether you are working out equation A or B

Anchor Bias: Equations

A

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8$

B

$8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

Anchor Bias: Results

- Ok, not an exact replica of the experiment
- Your estimate is influenced by the sequence of information that is presented to you, the sequence is the "anchor"
- A = 1 × 2 × 3 × 4 × 5 × 6 × 7 × 8 had a median estimate of 512
- B = 8 × 7 × 6 × 5 × 4 × 3 × 2 × 1 had a median estimate of 2250

- The correct answer is 40,320
- The order in which the information is presented impacts the output

Amos Tversky, Daniel Kahneman, Judgment under Uncertainty: Heuristics and Biases (1974)

Heuristics (In behavioural economics)

Heuristics are mental shortcuts

"A heuristic is a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and/or accurately than more complex methods..."

Chow, Sheldon, "Many Meanings of 'Heuristic'". The British Journal for the Philosophy of Science (2015)

Stereotypes are a type of heuristic that:

1. Allow us to understand that a tall plant is most likely a tree
2. Make assumptions based on someone's appearance whether they are wealthy or not

Biases stem from use of stereotypes without critical analysis

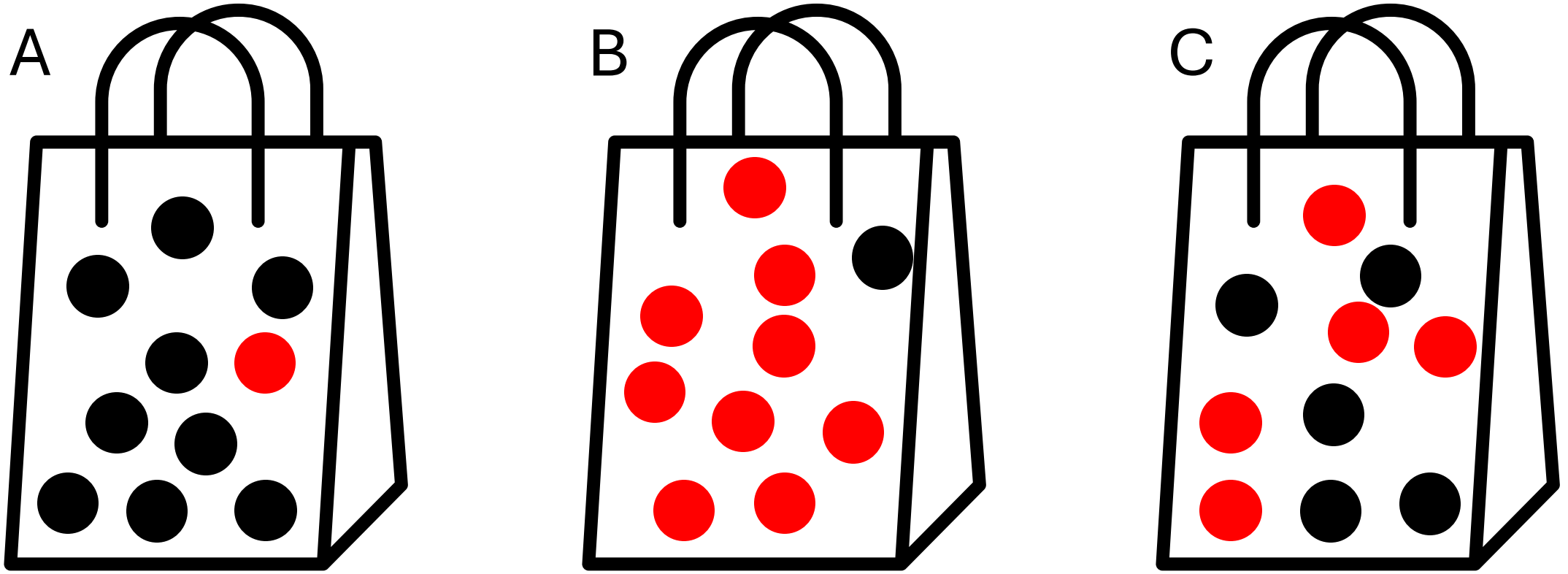
Gigerenzer, Gerd, Ralph Hertwig, and Thorsten Pachur (eds), Heuristics: The Foundations of Adaptive Behavior (2011)

Why do we use heuristics?

- They are useful when we face complex problems, or have incomplete information
- They use less cognitive load
- We use them when the cost of a mistake is low and the reward of a correct selection is high
  - E.g. selecting a grocery shop based previous cost rather than current item prices.

How do we use heuristics to estimate probability?

Example from Bar-Hillel



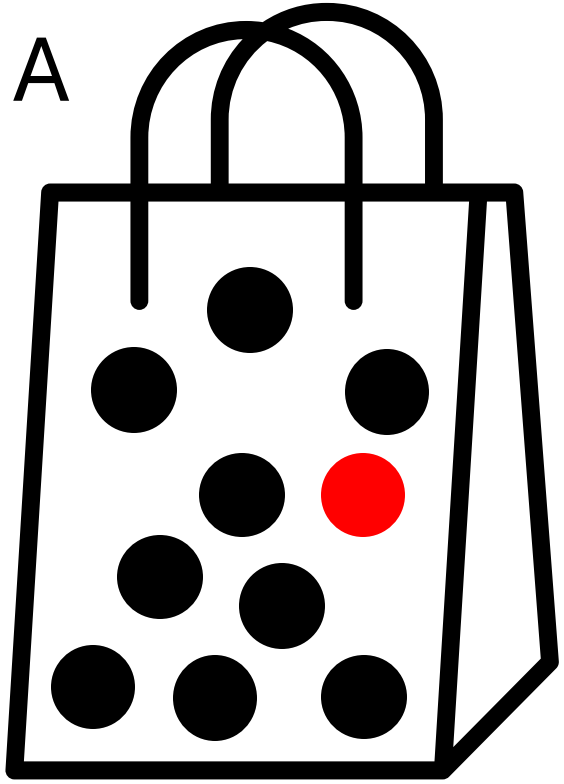
Maya Bar-Hillel, On the subjective probability of compound events (1973)

Which would you bet £100 on?

After each sample, you return the ball



A



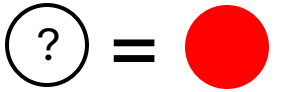
You get at least one red ball in 7 draws



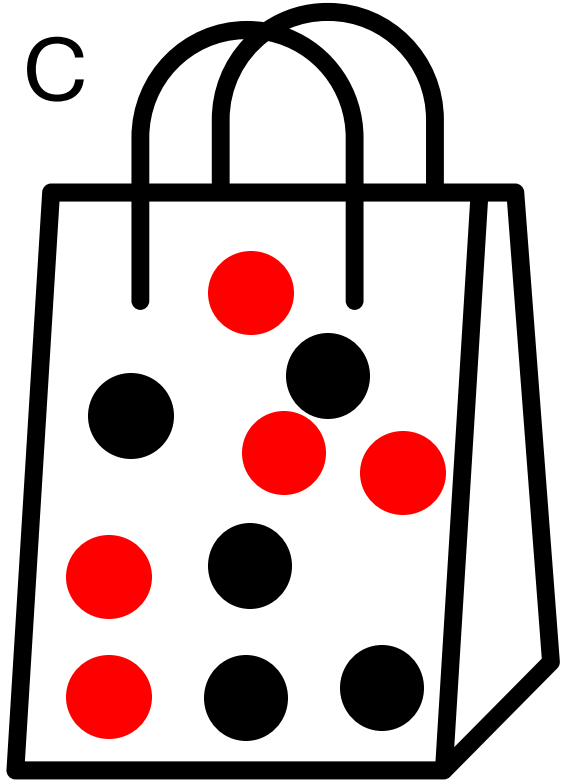
B



You pull a red ball 7 times



C



The ball you pull is red

Which would you bet on?

- A is a **disjunctive** event and your probability of winning is 0.52
- B is a **conjunctive** event and your probability of winning is 0.48
- C is a **simple** event and your probability of winning is 0.5

In the study, subjects overestimate the probability of B

Heuristics and Bias

- The likelihood is that you didn't calculate the probability of each in the time provided
- Instead, you use some internal heuristics or bias to guess
- Like the subjects in the experiment, this could result in picking the wrong option

- Heuristic
  - Mental shortcut, "If A then do B"
- Bias
  - Systematic, deviation from rationality

- The two terms are often used interchangeably

Nadurak, V. Heuristics and cognitive biases: A conceptual analysis. (2026)

Biases in Software Engineering

Biases in LLMs

- Models mirror subtle yet harmful stereotypes that are perpetuated in media
  - e.g., inspiration porn and able-bodied saviours
- Not representative of disabilities
  - Often fixated on wheelchair-users

Have disabled communities been incorporated into the development of these systems to help reduce the prevalence of biases?

V. Gadiraju et al., "I wouldn't say offensive but...": Disability-Centered Perspectives on Large Language Models (2023)

Chattopadhyay et al., Cognitive biases in software development (2022)

- Each engineer would verbalise their thoughts and interactions with their work
- Researchers observed software engineers for 1 hour
- Each action was encoded: **Read**, **Edit**, **Navigate**, **Execute**, **Ideate**
- The researchers then annotated each action with whether it was the result of a type of bias
- They settled on 10 types of cognitive bias

As Informatics Students

- Using the Big6
  - A structured description of how people process information

I'll describe the bias categories found in Chattopadhyay et al., Cognitive biases in software development (2022) in the context of the Big6

1. Task Definition

- Define the problem.
  - I need to resolve some code not producing an output log for error tracing
- Identify the information needed.
  - I need to know what is stopping the code producing the output

Bias: "Fixation"

Base problem-solving efforts on initial assumptions, and do not modify the initial assumption based on added information.

- Assuming that the issue is external, did I even put a logging call in the code?

2. Information-seeking strategies

- Determine all possible sources.
  - Documentation, Debugging Output, Colleague, Stack Overflow
- Select the best source.
  - Colleague

Bias: "Resort to default"

Developers choose readily available options based solely on their status as the default.

- I'm a junior developer so I just ask my colleague because they usually tell me what to do

3. Location and access

- Locate source.
  - Find which colleague to speak to

Bias: "Subconscious action"

Offloading evaluation and sense-making to external resources without regard to the actual merits of such information.

- Speaking to your manager rather than someone directly working on the code because you hope the manager will fix it for you

4. Use of information

- Engage (e.g., read, hear, and view).
  - Listen to the explanation from the colleague
- Extract relevant information.
  - Understand what the colleague is suggesting as the solution

<u>Bias: "Superficial selection"</u>

Actions and information being unduly valued based on superficial criteria.

- The manager is interested in football, the same as you, so you take their suggestion rather than considering whether it fixes the problem

5. Synthesis

- Organize the information from multiple sources.
  - Your own experience, the explanation from the colleague, your knowledge of the code
- Present the information.
  - Decide that you need to write a new class to do logging for you

Bias: "Ownership"

Give undue weight to something you create or already possess.

- It's great because I made it

6. Evaluation

- Judge the result (effectiveness).
  - The code outputs a log of the errors now!

- Judge the process (efficiency).
  - The code produces more error logs than ever, it must be good!

Bias: "Optimism"

The premature conclusions regarding efficiency or correctness of a chosen solution.

- I don't want to work on this problem anymore so it is probably fine

Other Biases in Software Engineering

- Convenience
  - The assumption that simple causes exist for every problem
- Preconceptions
  - The tendency to select actions based on preconceived mental models for the task at hand, ignoring some degree of solution space exploration required
- Memory bias
  - Developers preferring to use the most recent information encountered, or react as a result of information most readily available in the memory
- Blissful ignorance
  - The assumption that everything is working, even in the face of information indicating otherwise.

Which bias do you think you have most recently acted on when writing code?

Chattopadhyay et al., Cognitive biases in software development (2022)

Reflection

I have included a list of the cognitive biases observed in software development

You can use these as a jumping off point to reflect:

1. Which bias do you find yourself doing most often?
2. What are the possible negative impacts of acting on this bias?
3. How might you reduce how much you rely on this bias?

Debiasing

- Stepping Back
  - Documentation days, Training days
- Different Perspectives
  - Programming in pairs, brain-storming
- Systematic Approach
  - Compare and contrast tools explicitly
- RTFM
  - API documentation, journal your process
- Processes
  - Rubber duck, carry out code reviews, write TODOs in the code

Is it possible to "de-bias"?

- Positionality is something that is discussed much more in other fields
  - I am white, English, non-binary
  - This impacts my view on the world

- Your biases are related heavily to your position and experience
- Your brain is constantly finding ways to be more efficient in its decision making, creating new biases all the time.

When developing systems, consider this:

What is my positionality with regards to this task?

How can I combine other ways of thinking with my own to reduce the impact of bias?

Summary

- A brief overview of the types of interpersonal biases that exist
- A summary of some information processing biases
- How we use heuristics and how anchoring impacts our decisions
- How biases appear in software development
- Debiasing in software engineering