Engineering Ethics 2025

Cognitive Biases and Deception

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LEARNING OBJECTIVES

- Define cognitive bias and recognize the forms of cognitive bias that are presented in case studies
- Describe the impact that cognitive bias can have on ethical decision making in engineering
- Recognize situations in which cognitive bias is more likely to occur
- Develop strategies to minimize the effects of cognitive bias in engineering decision making

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NATIONAL SOCIETY OF PROFESSIONAL ENGINEERING (NSPE) CODE OF ETHICS

Code of Ethics Canon 5:

“Engineers shall avoid deceptive acts.”

…And sometimes we are deceiving ourselves.

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COGNITIVE BIASES

Systematic errors in the way individuals' reason about the world due to their subjective perception of reality (Britannica)

Or, a systematic thought process caused by the tendency of the human brain to simplify information by applying a filter (mental shortcut)

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HALO EFFECT

You need to buy a used car. Which salesman do you trust?

A **B**

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FRAMING BIAS

A	B
10% Death Rate	90% Survival Rate

Which disease do you want?

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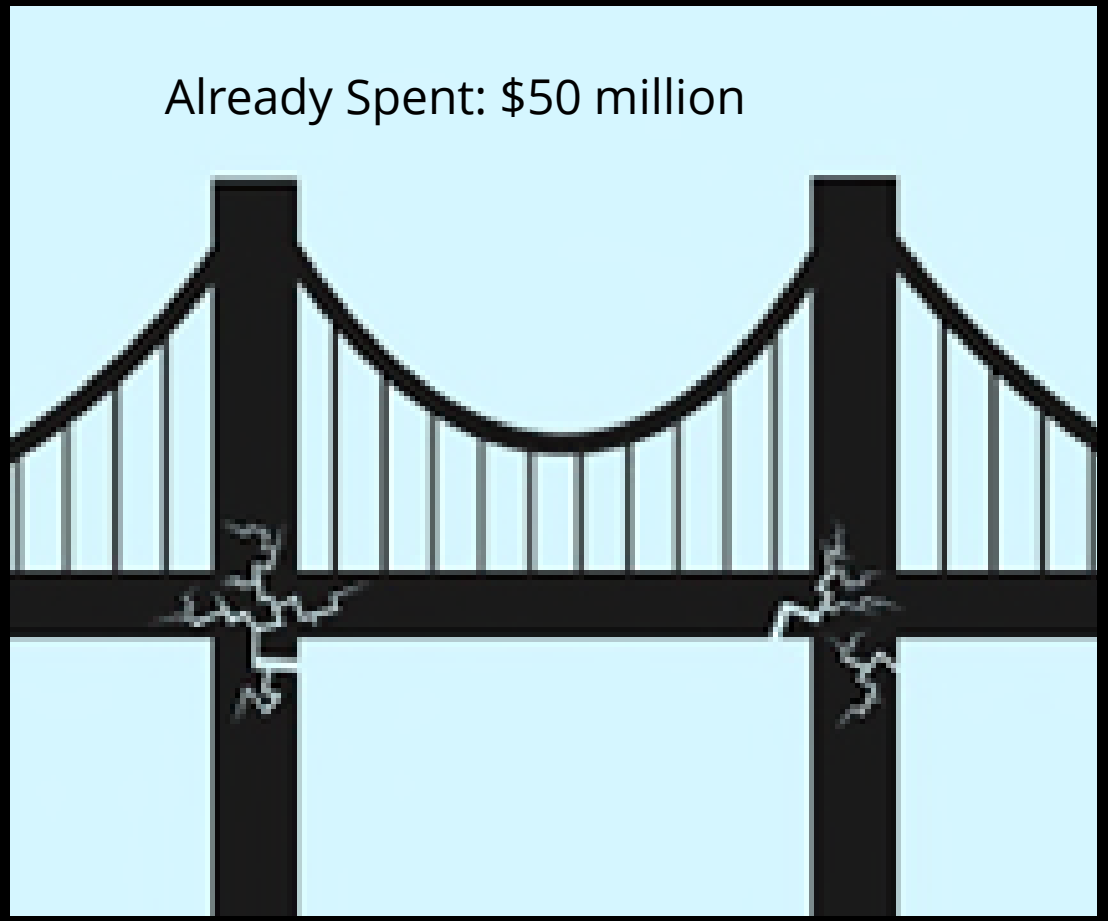
SUNK COST FALLACY



At what point do you stop construction?

A

B

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EXCERPT FROM NASA TRAINING:

- Although cognitive bias is a natural part of the human condition, certain circumstances—such as when people are under stress or have limited time to fully examine the issues at hand—increase the likelihood that bias will occur.
- Cognitive bias also happens more frequently when a decision must be made without adequate data. “If you lack information…essentially your brain will start making things up. It’ll fill in the gaps; it just does it automatically,” said Larson.
- From: https://appel.nasa.gov/2018/04/11/mitigating-cognitive-bias-in-engineering-decision-making/

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A *FEW* FORMS OF COGNITIVE BIAS:

- Selective exposure
- Selective perception
- Selective recall
- Attitude polarization
- Biased interpretation
- Biased search for evidence
- Cherry-picking data
- Anchoring bias
- Belief perseverance
- Overconfidence bias
- Groupthink (consensus bias)
- Hindsight bias
- Authority bias
- In-group bias
- **Self-serving bias**
- Illusory correlation
- Motivated reasoning

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A *FEW* FORMS OF COGNITIVE BIAS:

- Bandwagon effect
- Availability heuristic bias
- Negativity bias
- Ostrich effect
- Self-fulfilling prophecy bias
- Projection bias
- Fundamental attribution error
- Actor-observer bias
- Confirmation by proxy
- Present bias
- Base-rate neglect
- False consensus effect
- Recency bias
- Primacy bias
- Belief bias
- Cognitive dissonance reduction

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A *FEW* FORMS OF COGNITIVE BIAS:

- Experimenter's bias
- Survivorship bias
- Sunk-cost bias
- Confirmation through repetition
- Semmelweis reflex
- Status quo bias
- Normalcy bias
- Optimism bias
- Pessimism bias
- Framing effect bias
- Expectation bias
- Diagnostic overshadowing
- Congruence bias
- Disconfirmation bias
- Outcome bias
- Planning fallacy
- Pro-innovation bias

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THREE FORMS OF COGNITIVE BIAS THAT WE WILL FOCUS ON:

1. **Selective Evidence (Cherry-Picking)**
   - Focusing only on information that supports what you already believe while ignoring contradictory data.
2. **Overconfidence / Anchoring Bias**
   - Sticking with your first judgment or design idea, even when new facts should make you rethink it.
3. **Motivated Reasoning/Normalization of deviance**
   - Convincing yourself something is okay because it helps meet your goal, instead of looking at it honestly.

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AUDIENCE VOLUNTEERS WILL BE REWARDED

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CASE STUDY 1: VOLKSWAGEN EMISSIONS SCANDAL (2015)

Volkswagen used “defeat device” software to cheat emissions tests, producing compliant results in the lab but much higher emissions on the road. After discovery of the deception, one explanation was that the standard was too low and unfair.

What kind of bias was this and why?

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CASE STUDY 2: FLORIDA UNIVERSITY PEDESTRIAN BRIDGE COLLAPSE (2018)

A pedestrian bridge under construction collapsed in Miami, killing six people. Cracks had been observed in the structure days before the failure. Cracks could not be “replicated by the engineering analysis.”

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CASE STUDY 3: CHALLENGER SPACE SHUTTLE DISASTER (1986)

NASA and contractor managers focused on past launches that had succeeded despite O-ring erosion, rather than heeding warnings about the cold launch-day temperatures.

"Take off your engineering hat and put on your management hat."

– Jerry Mason, Morton-Thiokol SVP

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COGNITIVE BIASES IN ENGINEERING: IS ANYTHING OBJECTIVE?

- Data analysis
- Risk analysis
- Decision making
- Brainstorming
- Hiring and promotion
- Project planning & scheduling
- Safety reporting
- Client communication
- Root cause analysis
- Design reviews
- Testing & validation
- Procurement/vendor selection
- Budgeting/cost estimation
- Technology adoption

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HOW CAN WE MINIMIZE THE EFFECTS OF COGNITIVE BIASES TO FOLLOW THE ENGINEERING CODE OF ETHICS?

- **Acknowledge biases exist –** Be aware that everyone is vulnerable, even experienced engineers.
- **Seek disconfirming evidence –** Actively look for data that challenges your assumptions.
- **Encourage peer review –** Invite colleagues to critique designs and decisions.
- **Diversify teams –** Different perspectives reduce blind spots.

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HOW CAN WE MINIMIZE THE EFFECTS OF COGNITIVE BIASES TO FOLLOW THE ENGINEERING CODE OF ETHICS?

- **Use structured decision processes**
  - Checklists, risk assessments, and design reviews help counter shortcuts.
- **Pause under pressure**
  - Step back when deadlines or authority figures push for fast decisions.
- **Tie choices to ethics – Reframe:**
  - “Does this protect public safety and welfare?”

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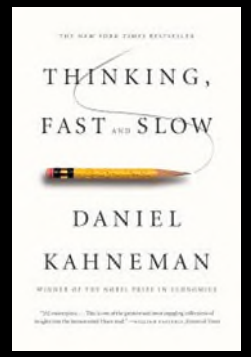
Thinking Fast and Slow: Two Modes of Thought *by Daniel Kahneman*



System 1 – "Fast Thinking"

- Automatic, quick, intuitive, emotional
- Useful for routine tasks and rapid judgments
- Vulnerable to cognitive biases

System 2 – "Slow Thinking"

- Effortful, deliberate, logical, reflective
- Engages when solving complex problems
- Better at catching errors and questioning assumptions

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Ethical engineering requires knowing when to slow down. Use System 2 thinking for safety, risk, and public welfare decisions. Recognize when your System 1 shortcuts may be clouding judgment

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully to enhance the honor, reputation, and usefulness of the profession.

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Thank you!
Questions?

NSPE NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

https://www.nspe.org/sites/default/files/resources/pdfs/Ethics/CodeofEthics/NSPECodeofEthicsforEngineers.pdf

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