

The STEMM Cell
Book Discussion - *Thinking Fast and Slow*
by Daniel Kahneman

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Outline

- 1 Introduction
- 2 Two Systems
- 3 Heuristics
- 4 Conclusions

The Author - Daniel Kahneman [1934-2024]

- Born Tel Aviv, 1934 during mother's visit from France [Saxon2024].
- Escaped Nazi occupation in France; emigrated to (then) Palestine (1948).
- Served in the IDF and trained as a psychologist.
- Education
 - Bachelor's in psychology and mathematics (Hebrew University, Jerusalem, 1954)
 - PhD in psychology (University of California-Berkeley, 1961)
- Career at Hebrew University, University of British Columbia, University of California–Berkeley and Princeton University.
- Citation for his 2002 Nobel Prize in Economics Science¹ [Nobel Prize Outreach2006] reads

In order to increase understanding of how people make economic decisions, he drew on cognitive psychology in relation to the mental process used in forming judgements and making choices. His research on decision-making under uncertainty resulted in the formulation of a new branch of economics, prospect theory.

¹With Vernon L. Smith who *established laboratory experiments as a tool in empirical economic analysis*

The Book - *Thinking Fast and Slow* [2011; 2024]

*In his best-selling 2011 book . . . , Kahneman examined the duality of how people think. He described a **fast-thinking** approach that is **intuitive and emotional** and a **slower-thinking** approach that is more **deliberate and logical**. He looked deeply into **how people make choices** in their lives, illuminating the **role of intuition** and the **benefits of slow thinking**.*

[Saxon2024]

Reception:

- The Financial Times - *“There have been many good books on human rationality and irrationality but only one masterpiece . . . Thinking Fast and Slow.”* Easterly [2011]
- The Guardian - *“An outstandingly clear and precise study of the ‘dual-process’ model of the brain and our embedded self-delusions.”* Strawson [2011]

Two Systems

System 1

Automatic, fast, little effort and no sense of control.



- What is Shaun's mood?
- What is 2×3 ?
- Complete the phrase "*A stitch in time saves*"?

System 2

Effortful mental activity requiring concentration.

- What is the value of $14 \times 23 = 322$
- (Manually) parallel park a car!
- Complete a Tax Self-Assessment form!
- Prepare a STEMM Cell Talk!
- Regulates behaviour!

Two Systems

Shane Frederick's Cognitive Reflection Test

The bat and ball problem

- A bat and ball together cost £1.10.
- A bat costs one pound more than a ball.
- How much does a bat cost?

Answer = £1.05

The widget problem

- It takes 5 machines 5 minutes to make 5 widgets.
- How long does it take 100 machines to make 100 widgets?

Answer = 5 minutes

Jumping to Conclusions

- Read this

A B C

- And this

1 2 3 4

- But why not A,13,C
- Or 12,B,14
- Context allows us to disambiguate, but is it always correct?

Peter the Great

*Will Peter **VladimirDonald** be a good leader, he is intelligent and strong?
But he is also very corrupt?*

- First statement gives insufficient information - but tempted to make a recommendation!
- What if we change the name?

What You See Is All There Is (WYSIATI)

- We tend to answer a question based on the available information
- We don't ask what information we need to answer the question!

Which country exports the most real Christmas trees?

Christmas Quiz question 2025

- A typical UK response is - **Norway**
 - Why Norway?
 - *Because they send a Christmas Tree for Trafalgar Square every year!*
 - But the tree is sent because of the UK's WW2 support of Norway!
 - The respondent answers an easier question with known answer.
- Shaun's (smug) thoughts:
 - Large, western, northern latitude country with large, adjacent export market.
 - **Canada** - correct according to the quiz master!
- But after fact-checking (annual exports):
 - **Denmark**: exports 10 million trees [Food Nation Denmark2025]
 - Canada: exports 2 million trees [Government of Canada2024]
 - Norway: imports 300,000 trees [Berglund2016]

Two Systems- Recap

System 1

- Default system
- Fast
- Low energy
- Generally allows us to stay safe and make reasonable decisions

- System 1 can be *fooled*
- System 2 can be *lazy*

System 2

- Monitors system 1 and *kicks in* when needed
- Slow
- Consumes energy
- Limited *bandwidth*

Discussion

- Do you have experiences/examples of thinking fast (System 1) and slow (System)?
- How do we *speed read*?
- Are you persuaded that we do think fast and slow?

Heuristics

Definition (Heuristic [Wikipedia2026a])

A **heuristic** or heuristic technique (problem solving, mental shortcut, rule of thumb) is any approach to problem solving that employs a pragmatic method that is not fully optimized, perfected, or rationalized, but is nevertheless *good enough* as an approximation or attribute substitution.

Once is happenstance. Twice is coincidence. Three times is enemy action. -
Auric Goldfinger *[Ian Fleming 1959]*

- System 1 uses fast running heuristics to suggest solutions to problems!
- Is Goldfinger's heuristic appropriate for relationships with families, friends and neighbours?

Answering an easier question

e.g. the earlier Christmas tree export question is replaced with **which country gifts a Christmas tree to the UK.**

Others:

- How popular will Keir Starmer be in 6 months?
How popular is Keir Starmer now?
- Should Andrew Mountbatten-Windsor testify to Congress?
How angry am I with the behaviour of Andrew Mountbatten-Windsor?
- Should cyclists pay road tax?
How angry do my thoughts of “*What would Jeremy Clarkson say?*” when I am held up by a cyclist once a month?

The Bill and Melinda Gates Foundation and Funding Small Schools [Wainer and Zwerling2006]

- Mid-1990's until 2001: Bill and Melinda Gates Foundation funded \$1.7 billion to support small schools as *they produced better results*.
- Wainer and Zwerling studied average Pennsylvania Test Scores from 1,662 schools
 - Of the 50 (3%) top scoring schools, 6 (12%) were among the 50 (3%) smallest.
 - If a child's grade is independent of school size then (naively) we would expect 3%
 - Small schools 4 times better than average
- But smaller schools means we have a smaller sample size so
 - **Law of large numbers does not apply** - expect wider variation in small schools
 - Wainer and Zwerling - found that 9 (18%) of the worse performing schools were also small!
 - Small schools are 6 times worse than average.

The “law” of small numbers

The law of large numbers [Wikipedia2026b]

In probability theory, the law of **large numbers** is a mathematical law that [provably] states that the average of the results obtained from a large number of independent random samples converges to the true value, if it exists.

The “law” of small numbers Tversky and Kahneman1971]

Intuitions about random sampling appear to satisfy the law of small numbers which asserts that *“the law of large numbers applies to small numbers as well”*.

Anchoring

- The UK pension age is now 67. A friend recently retired - how old are they?
- Shaun recently retired as a university lecturer - how old is he?
- Jem recently retired as a university professor - how old are they?
- What is the boiling point of water ($^{\circ}C$) at the summit of Mount Everest? $\approx 70^{\circ}C$
- Tendency to stay close to an anchor point unless you have strong reasons.

Availability

- *“None of my friends caught the flu last year so I don’t need flu jab this winter.”*
- *“My partner thinks I do far less around the house than they do - until I go away for a week!”*

The Availability Heuristic

We overestimate[underestimate] the probability/frequency of an event the more[less] fluently we can recall several examples.

Representativeness

Max is a student at Oxford University, what faculty are they most likely to be in?

Max is of high intelligence, though lacking in true creativity. Max has a need for order and clarity, and for neat and tidy systems in which every detail finds its place. His writing is rather dull and mechanical though enlivened by corny puns.

Faculty	% of students 2022-24	% male	% female
Economics & Management	3	3	2
Engineering Sciences	6	10	3
Humanities	48	39	57
Law	7	6	9
Mathematics & Computer Sci.	8	13	4
Medicine	7	6	7
Sciences	21	23	18

[University of Oxford2025]

Causes Trump Statistics

We have identified a chronic enterocolitis in children that may be related to neuropsychiatric dysfunction [Autism]. In most cases, onset of symptoms was after measles, mumps, and rubella immunisation. Further investigations are needed to examine this syndrome and its possible relation to this vaccine.

[Wakefield et al.1998]

- Parent's seeking explanation for child's illness blamed MMR jab
- Media coverage was sensational
- Others did not wish to have their children vaccinated
- 2023-4 - UK vaccination dropped to 80% low (WHO recommend 95% level) [Godlee et al.2011] .
- 2008 measles endemic in England and Wales.
- 2012-13 MMR uptake recovered to 94.7% [NHS England]
- 2023-24, figure was is 91.2%

Backlash to Wakefield

Paper's scientific limitations were clear in 1998 [Godlee et al.2011].

- A small case series with no controls
- Linked three common conditions
- Relied on parental recall and beliefs.
- No evidence of MMR-autism link found in multiple epidemiological studies.

Clear evidence of falsification of data should now close the door on this damaging vaccine scare

[Godlee et al.2011]

Paper retracted by 10/12 co-authors.

We wish to make it clear that in this paper no causal link was established between MMR vaccine and autism as the data were insufficient.

[Murch et al.2004]

Discussion

- Do you have experiences/examples of heuristics
 - Rules of thumb
 - Answering an easier question
 - The law of small numbers
- How should you conduct a negotiation e.g. over the cost of an *Money Heist* T-shirt?
- How important is it to find baseline information before adjusting for an individual's characteristics?
- How prone are you to media reports of *pilot studies*?
- How easy do you find it to overturn beliefs in causal arguments given contradictory statistics?

Criticism of Thinking Fast and Slow

- Schimmack[2017] has been particularly critical of Chapter 4 on Priming
 - *“Kahneman’s prediction that priming research is a train wreck and readers of his book . . . should not consider the presented studies as scientific evidence that subtle cues in their environment can have strong effects on their behavior outside their awareness.”*
 - He later [2020] wrote *“Like everybody else in 2011, Kahneman trusted individual studies to be robust and replicable because they presented a statistically significant result.”* He concludes *“if Kahneman wrote a second edition, it would be very different from the first one. Chapters 3 and 4 would probably just be scrubbed from the book.”*
 - Kahneman himself acknowledged the criticism of Chapter 4 *“What the blog gets absolutely right is that I placed too much faith in underpowered studies.”*
Schimmack2017, comment-1455]
- Wenglinisky [2017] suggests *“Kahneman is dead wrong on substance, that people are reasonable rather than overcome by bias, and his deeply mistaken supposition is the result of a method that boxes his subjects into corners so that they cannot but seem hopelessly irrational. “*

Upcoming

- 26th March TBC - Visit to *Oxford History of Science Museum* - numbers?
- 28th May - Jim Mynors *The History of Engineering at Cambridge* - venue TBC
- 25th June - TBC Derek Jerome *Future Cancer Treatments*
- 23rd July - TBC Geo-4D Faringdon *Drone talk and discussion*

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