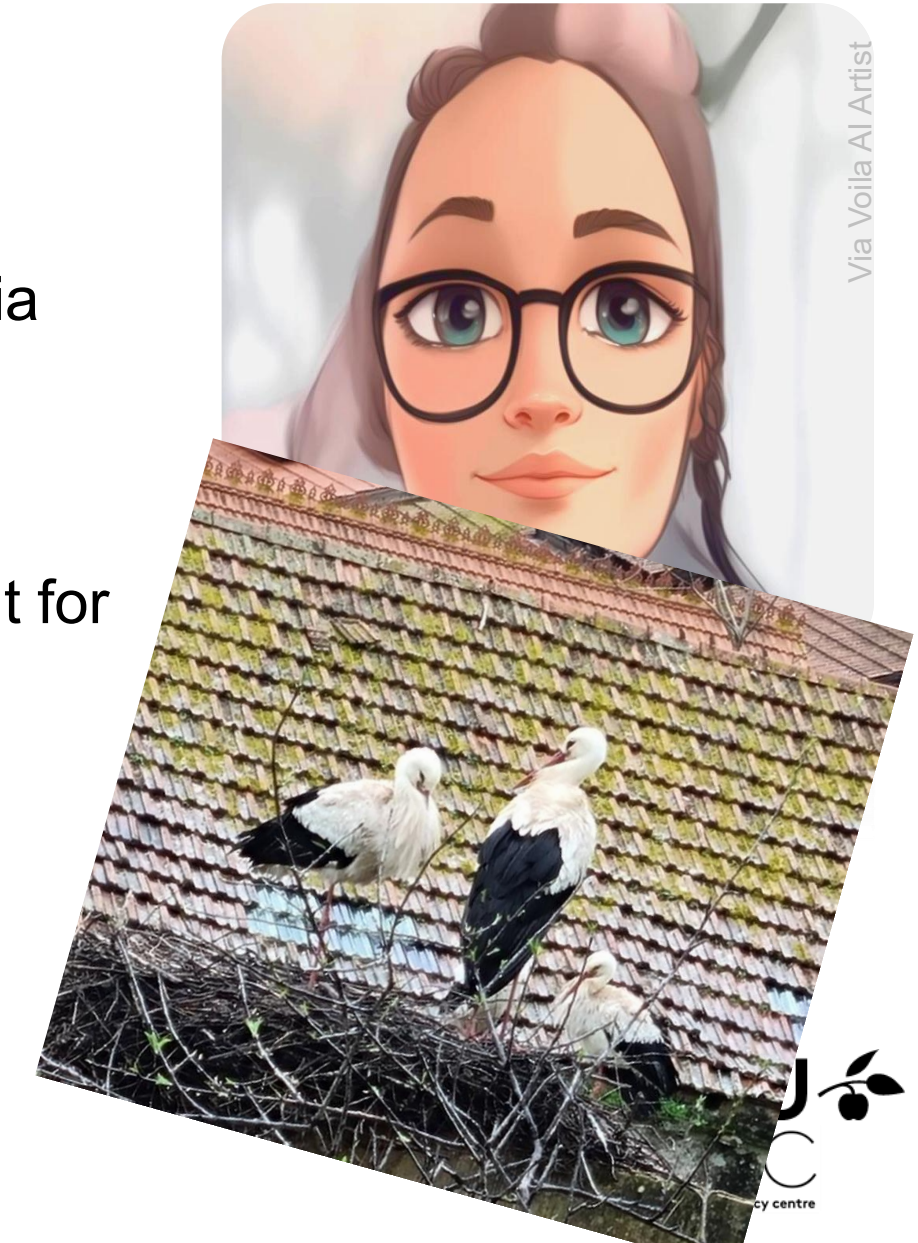
AI 507: Artificial Intelligence and Society

#1 Introduction & Intelligence

Associate Prof. Dr. Lena Frischlich

Welcome (again)

- Lena Frischlich, Associate Professor at the Digital Democracy Centre at SDU
- Background in psychology (specifically social and media psychology) and Communication science
- And as I am still learning the names – lets do a short repetition for me – stand up and tell me where you went for your last holidays
- I went to Portugal, specifically the Algarve, saw a lot of rain, but also a crazy amount of storchs



Some more formal details

- This is the lecture element of AI507 – it usually takes place on Thursdays (there is one Friday in the mix, so check your calendar) and in this room
- The course has a portfolio exam
- For the lecture, that means a 60- min via DigiExam
  with multiple-choice questions
- The exam will take in the first two weeks of June (coordinated by IMADA)
- What **is** relevant for the exam?
  - The slides for this lecture → uploaded every week to itslearning
  - One podcast, TED-talk or text per week → links in itslearning
  - In principle everything we discuss and talk about during class → it *does* make sense to attend
- What is **not** relevant for the exam?
  - At the beginning of each session, we will often have a short historical “how it started”
    before we come to the “how its going” – no need to memorize the birthdates or spell out names of persons ☺

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Why the question “is that relevant for the exam” is bad for you

- Our brain is lazy and bad at memorizing different categories of information
- If you tell yourself “This is maybe not so relevant”, you risk that your brain shifts attention to – for example – your last holiday
- Learning also works best, when you relate the content to the things you already know, that matter to you, that are interesting and fun – so take every opportunity to use what you have learned
- For example, by evaluating critically what you find on YouTube, TikTok, Reddit, in the news etc.

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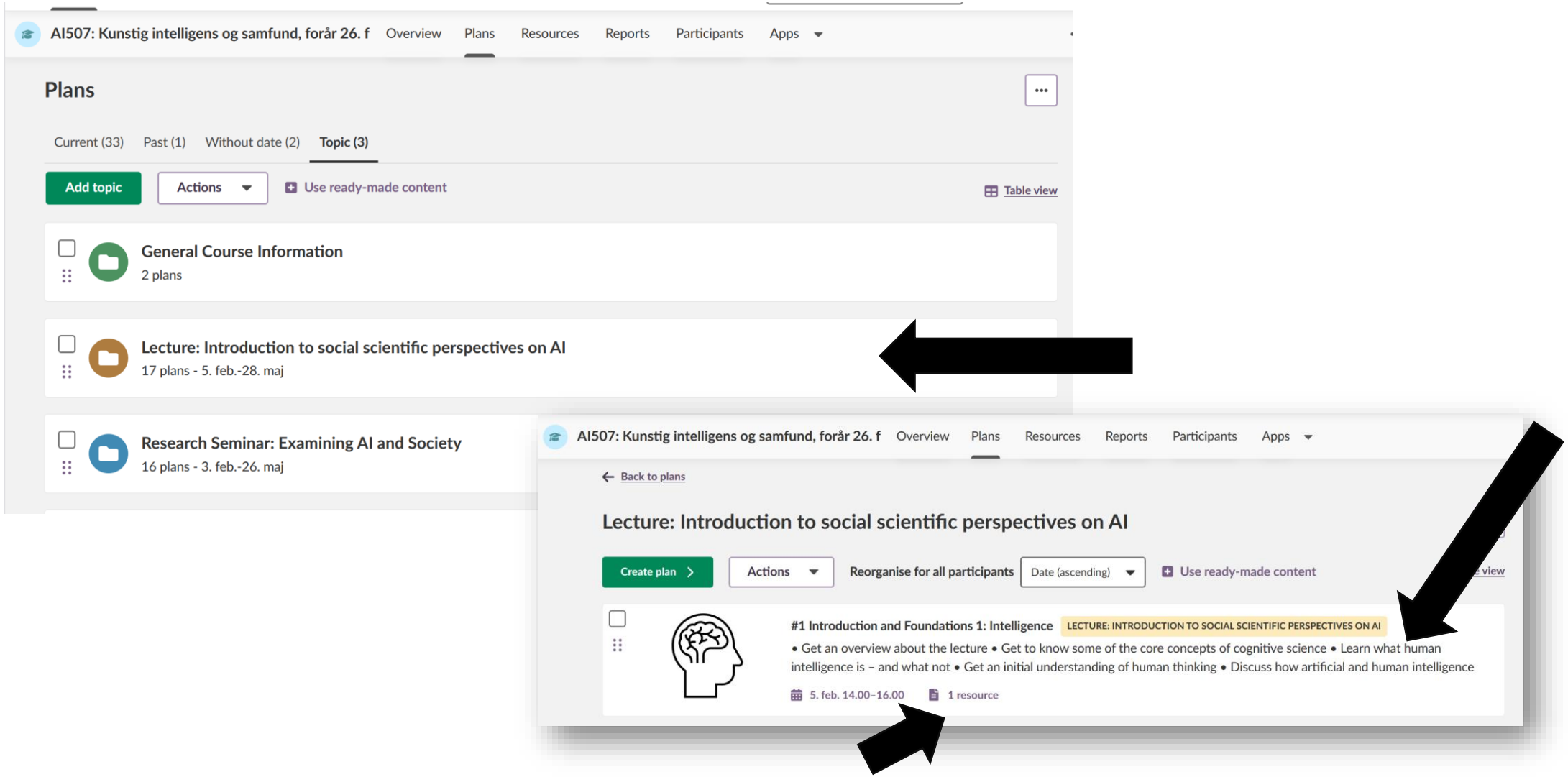
Digital Lecture Room

- Itslearning



Any questions so far?

Objectives of the lecture

At the end of the lecture, you will…

- …have a solid basic knowledge about social scientific perspectives on and relevance for Artificial intelligence
- …know central social scientific theories and models that allow you to evaluate the opportunities and risks of AI in different areas
- …be able to evaluate specific AI applications in (human) societies, taking social scientific knowledge into account
- …be able to form an empirically grounded opinion about the consequences of AI for individuals, social groups, and society at large – and take that into account in your own work

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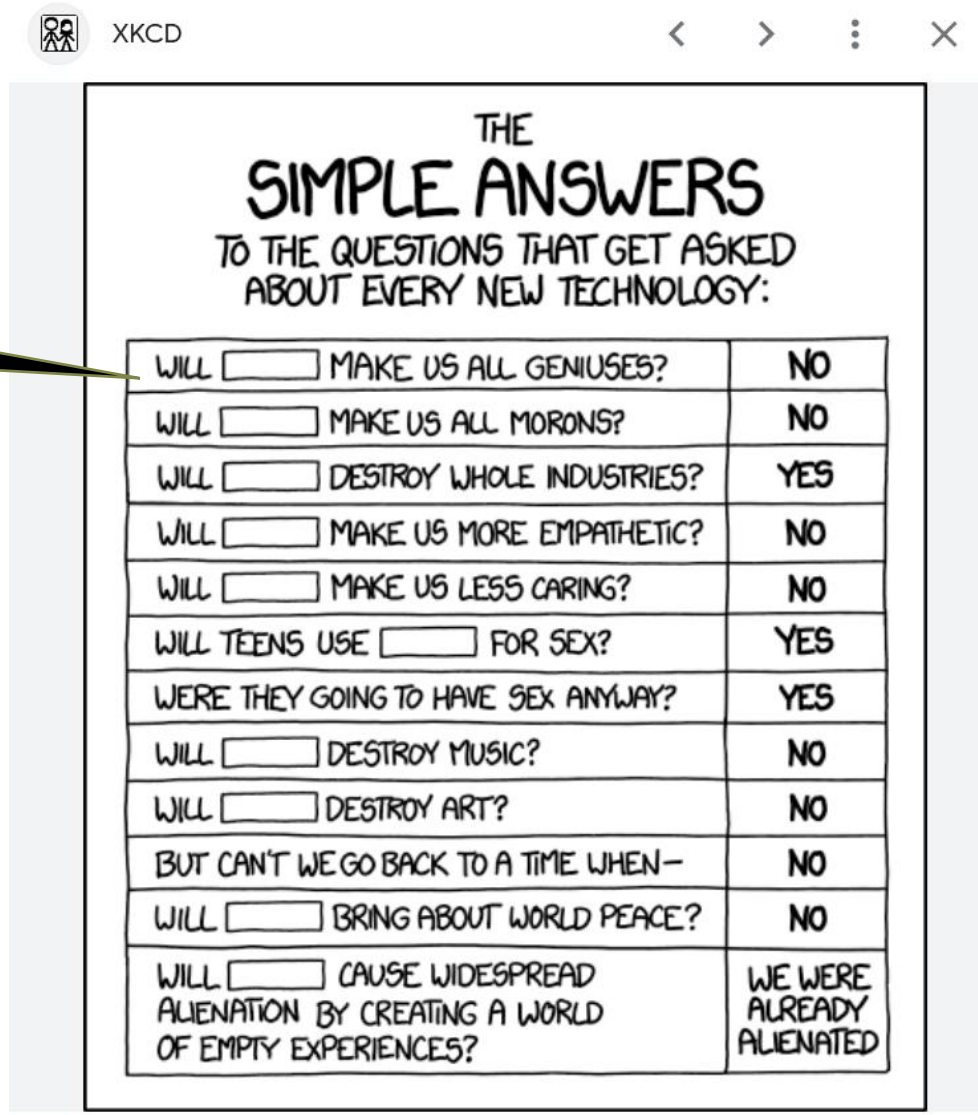
A little spoiler

AI



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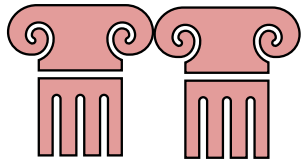
But now in detail: Course structure

Foundations



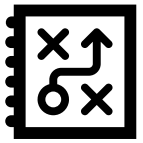
Intelligence

Learning

Communication

Social Cognition

Innovations and their dissemination



Quiz

Robots

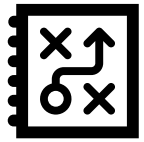
Recommender System

Chatbots

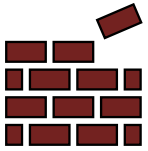
Smart things

Human-Technology Interactions

Digital platforms



Quiz



Application

Organisations & Institutions

Political Communication

Health & Wellbeing

Entertainment

Exam

Session structure

The lectures follow a typical scheme that has been found to support learning

1. Arriving and remembering
   - 10-15 min. “flashlight”, I’ll toss a (virtual) ball, you say one keyword
   - Time for your questions

   - Activates your brain
   - Supports the storage of the content in your long-term memory
   - After today, you’ll know why that matters

2. Input
   - Typically, different “chapters” (5-15 min), myself or guests
   - Talk about theoretical foundations and general models
   - Discuss current research
   - After each chapter: Time for questions

   - Actual knowledge gains
   - Sorted by topics to support your brain in storing the information correctly
   - Guest will bring in hands-on-experience or specific expertise

3. Applying
   - Discuss differences between humans and AI and how that relates to your other courses
   - Discuss current phenomena and events

   - Use it or loose it
   - Supports your brain
   - Allows you to speak to current debates

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Around the sessions

- Prepare yourself for the lecture
  - Listen to the TED talk/ YouTube video / Podcast of the week (all of them offer transcripts) – typically 10-30 minutes or read the text of the week (in itslearning)
  - Expect that
- During the lecture
  - Use the uploaded slides if that helps you – ask if something is not totally clear
  - In most cases, you are not the only one with a question – but probably the only one brave enough to ask it ☺
  - Consider taking notes (magically good to activate your brain – even if oldschool)

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The Neuroscience Behind Writing: Handwriting vs. Typing—Who Wins the Battle?

by Giuseppe Marano [1,2,3,*], Georgios D. Kotzalidis [1,2], Francesco Maria Lisci [1,2], Maria Benedetta Anesini [1,2], Sara Rossi [1,2], Sara Barbonetti [1,2], Andrea Cangini [4,5], Alice Ronsisvalle [3], Laura Artuso [3], Cecilia Falsini [1,2], Romina Caso [1,2], Giuseppe Mandracchia [1,2], Caterina Brisi [1,2], Gianandrea Traversi [6], Osvaldo Mazza [7], Roberto Pola [8], Gabriele Sani [1,2], Eugenio Maria Mercuri [9], Eleonora Gaetani [10,11,†] and Marianna Mazza [1,2,3,†]

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4 Fondazione Luigi Einaudi, 00193 Rome, Italy
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9 Department Women Children and Public Health, Università Cattolica del Sacro Cuore, 00168 Rome, Italy
10 Department of Translational Medicine and Surgery, Fondazione Policlinico Universitario AgostinoGemelli IRCCS Università Cattolica del Sacro Cuore, 00168 Rome, Italy

+ Show full affiliation list

* Author to whom correspondence should be addressed.
† These authors contributed equally to this work.

What are your questions so far?

Then let’s get started

At the end of today’s lecture, you will…

- …know some of the core concepts of cognitive science
- …have an idea of what human intelligence is – and what not
- …have explored how cognitive science can inform the development of AI
- … have discussed the difference between human and artificial intelligence

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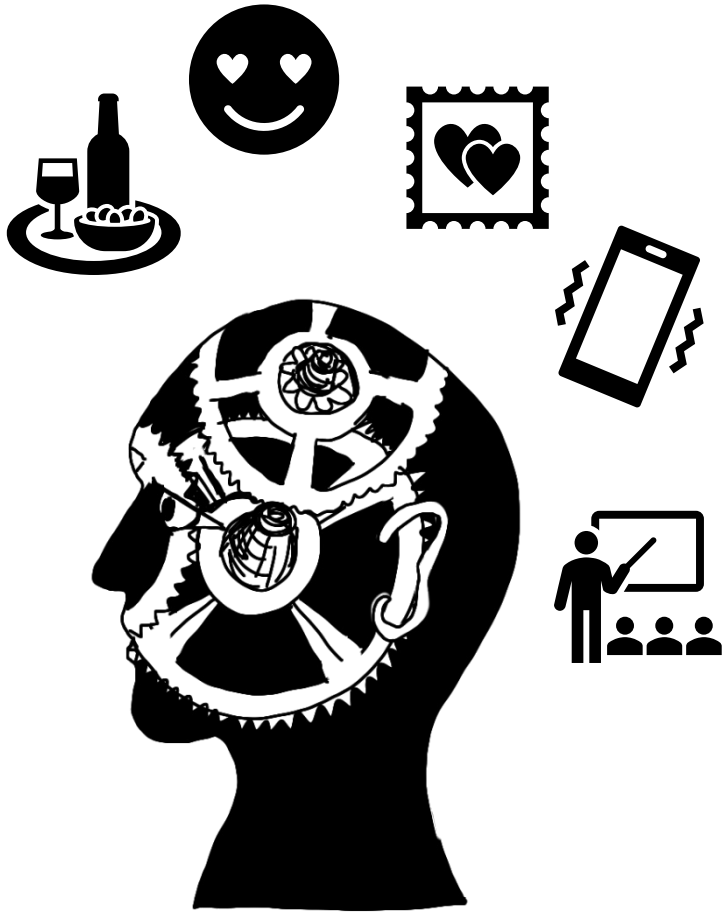
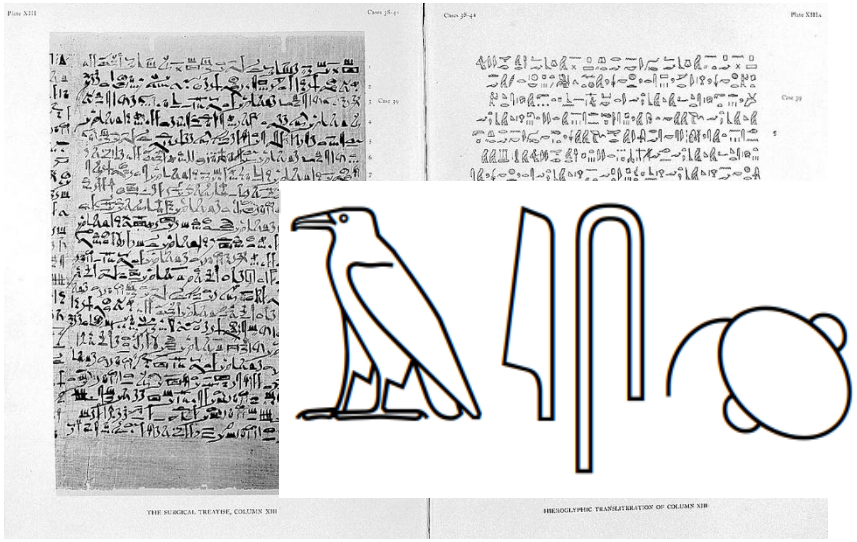
Cognition

What is cognition? (Dumper et al., 2019)



- Right now, you process several pieces of information
- You are able to remember,
  - …what you ate last
  - …whether you liked it
- Ask yourself
  - …why you ended up in this course
  - …if you like the person next to you
  - …what this one message was about
- And that all while maintaining a seated position, simulating you're interested, and sometimes even while walking and talking
- **How is that even possible?**

Humans have tried to answer this question since a *very* long time (Dumper et al., 2019; Pang, 2023)



By https://wellcomeimages.org/indexplus/obf_images/2d/f3/28afabff15c08c7db2c40409d200.jpgGallery: https://wellcomeimages.org/indexplus/image/L0003140.htmlWellcome Collection gallery (2018-03-30): https://wellcomecollection.org/works/ktg955jw CC-BY-4.0, CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=35864880

~16.000 years B.C., the Edwin Smith Papyrus (named after his buyer) mentioned the human brain and its treatment for the first time

Frans Hals – Renée Descartes
De eeuw van Rembrandt, Bruxelles: Crédit communal de Belgique, ISBN 2-908388-32-4., https://commons.wikimedia.org/w/index.php?curid=2774313

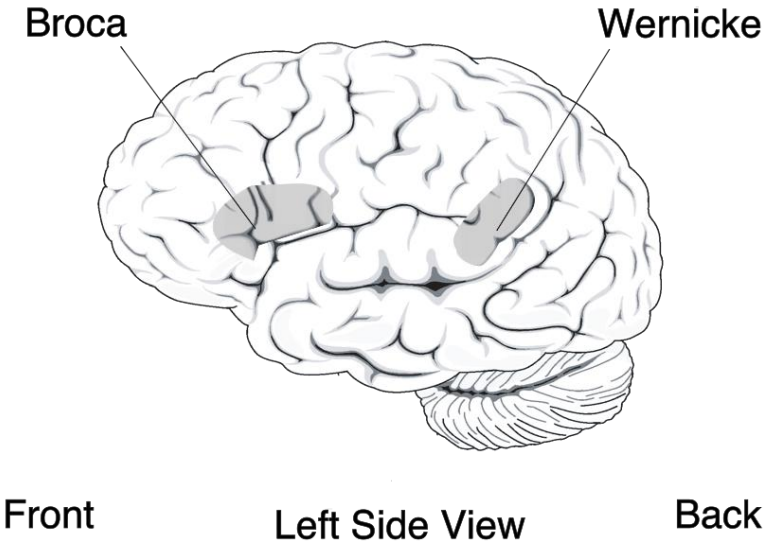
16th century: French Philosopher Renée Descartes declared mind and body to be distinct (mind-body dualism) and argued "I think, therefore I am"

Our thoughts are created solely through the stimulation of our senses (empiricism)
e.g., Bishop George Berkley, Philosopher John Locke

No! We are born with innate knowledge that allows us to form language and maintain conscious experiences (nativism)
e.g., philosopher Immanuel Kant

New insights through brain studies (often on injured patients) (Broca, 1861; Dumper et al., 2019)

- French physician Pierre Paul Broca: A patient, who could only say “tang” had a specific area of his brain-injured → central for language *production*
- German physician Carl Wernicke: Damages in another region of the brain central for *comprehension*
- Today: While the brain has different areas that are central for different tasks, it is also highly connected (“function circuits”)



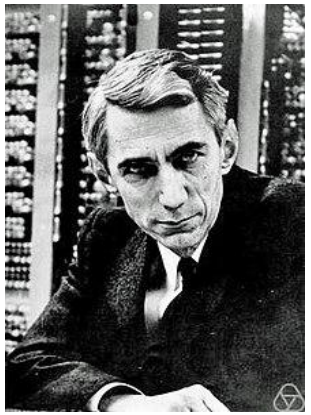
Von Taken from NIH publication 97-4257, https://www.nidcd.nih.gov/health/aphasia (https://www.nidcd.nih.gov/sites/default/files/Documents/health/voice/Aphasia6-1-16.pdf), CC-BY https://commons.wikimedia.org/w/index.php?curid=352704

New insights through psychological experiments (Russo Kraus, 2022)

Wilhelm Wundt (1832-1902), Weltrundschau zu Reclams Universum 1902, NOT-PD-US-URAA

- In 1879, Wilhelm Wundt founded the first psychological laboratory at the University of Leipzig
- With his experimental approach he is considered to be the father of modern experimental psychology
- Renown for his ability to measure psychic quantities and show exact relationships between them
- Argued that “nothing is in the intellect that was not first in the senses, except the intellect itself” (*"Nihil est in intellectu quod non fuerit in sensu, nisi intellectu ipse." (Leibniz, Nouveaux essais, 1765, Livre II, Des Idées, Chapitre 1, § 6))*
- Logic inferences, categories of thought, the principle of causality, etc. all go beyond direct sensory impressions

The cognitive revolution in the 20th century: Minds & Computers (Gigerenzer & Goldstein, 1996, Shannon, 1948)



Jacobs, Konrad – Claude Shannon (~1963) https://opc.mfo.de/detail?photo_id=3807

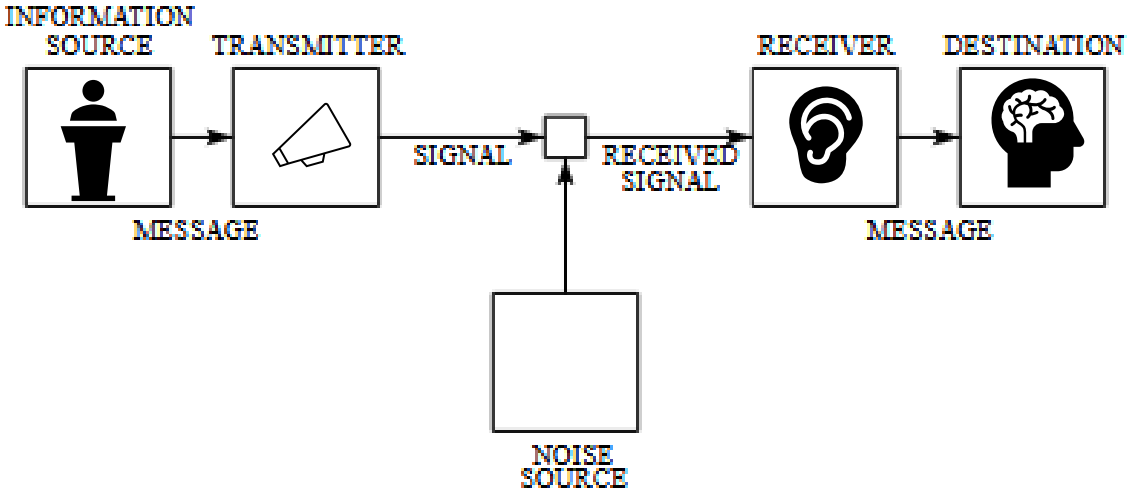


Fig. 1—Schematic diagram of a general communication system.

John von Neumann |Source= http://www.lanl.gov/history/atomicbomb/images/NeumannL.GIF |Date= 01/20/08

Highly influential work "a mathematical theory of information" (1948)

https://berichtenuithetverleden.wordpress.com/2013/01/29/alan-turing-1912-1954/

Computers can imitate human minds (Alan Turing, 1948) → Computers as minds

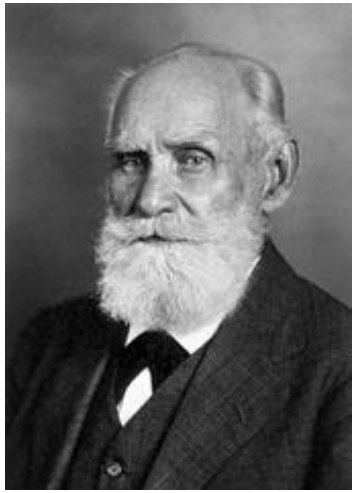
The neural system has similarities to the computer (von Neumann, 1958) → Minds as computers

Psychology was still vey behaviourist (Akpan, 2020; Domjan, 2005)

- Central observation: External stimuli motivate behavioural responses
- The association between stimulus and response can be conditioned
  - Classical conditioning:
    - Food → Salvation
    - Food + Bell → Salvation
    - Bell → Salvation
  - Operational conditioning / reinforcement learning
    - Sanctioning emerging behaviour
    - Reward: more behaviour, punishment: less
    - Can be used to train very complex behaviours

General idea Stimulus → Reaction

BUT



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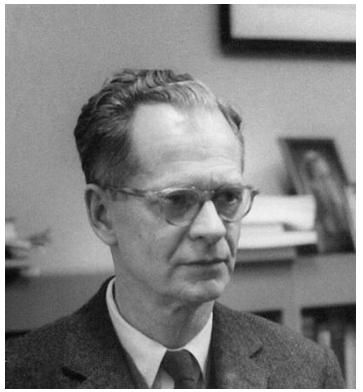

Burrhus Frederic Skinner
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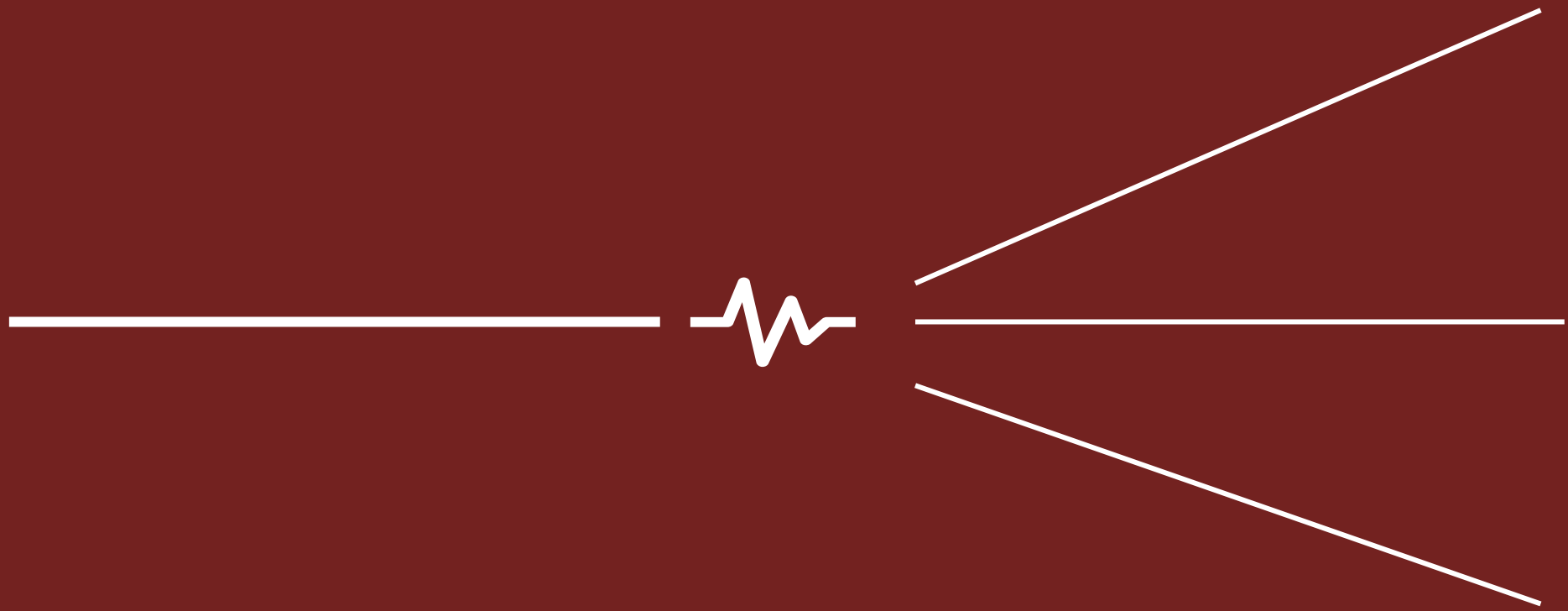
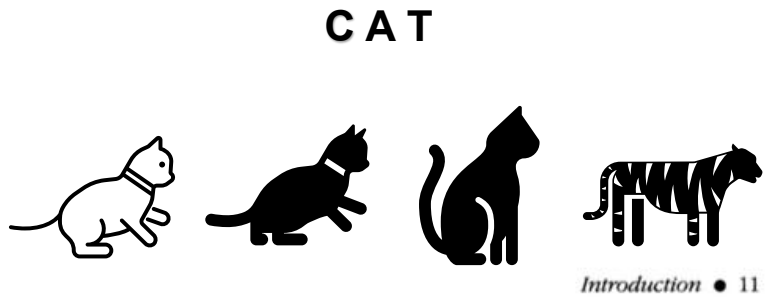


Between stimulus and response, there is a space. In that space is our power to choose our response.

(unknown, see Coleman-Baker, 2018)

Core concepts today (Kellog, 2003; von Eckhardt, 2012)

- **Mental representation:** Input is internally encoded (“represented)
- **Stages of processing:** This encoding can happen in different stages (superficial vs. deep encoding)
- **Consciousness:** can refer to self-knowledge, information access, or sentience (vs. e.g., coma) – there are forms of unconscious information processing
- **Cognitive architecture**
  - Symbolic models: the mind is a computer
  - Connectionist models: the mind works over distributed neurons and layers



Introduction • 11

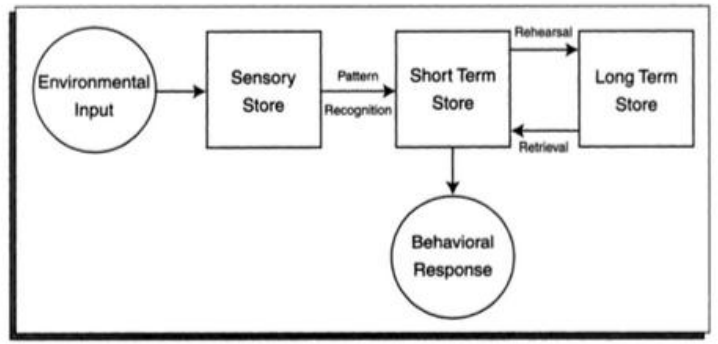


Figure 1.3. Cognitive architectures: Example of a symbolic model.
SOURCE: Adapted from Atkinson and Shiffrin (1971).

12 • SCOPE AND METHODS

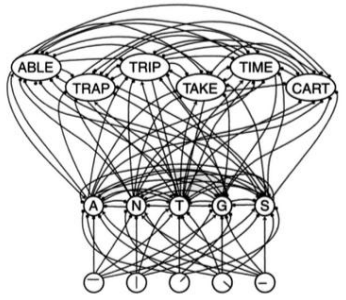


Figure 1.4 Cognitive architectures: Example of a connectionist model.
SOURCE: McClelland and Rumelhart (1981).

Kellog, 2003 p. 11-13

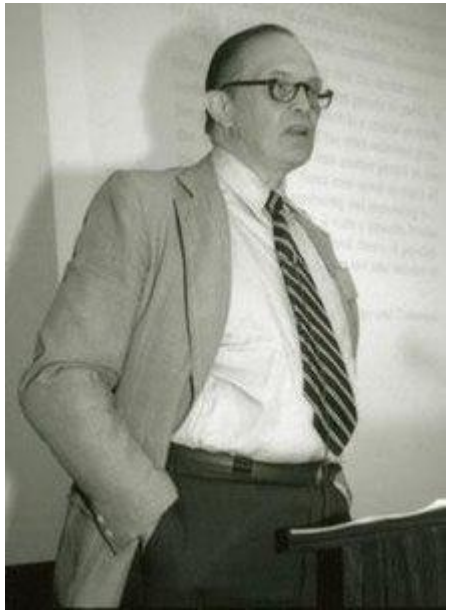
Where do you see the similarities between human and artificial cognition?

Cognitive Revolution in Psychology

(Dumper et al., 2019; Neisser, 1967)

- In 1967, the Harvard Center of Cognitive Studies was founded by George Miller, the father of cognitive science and psycholinguistics
- His student, Ulrich Neisser published the first cognitive psychology textbook in 1967
- For the first time, cognition was defined as

  "all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used. It is concerned with these processes even when they operate in the absence of relevant stimulation, as in images and hallucinations." (p. 4)



http://www.psychologicalscience.org/observer/getArticle.cfm?id=2004

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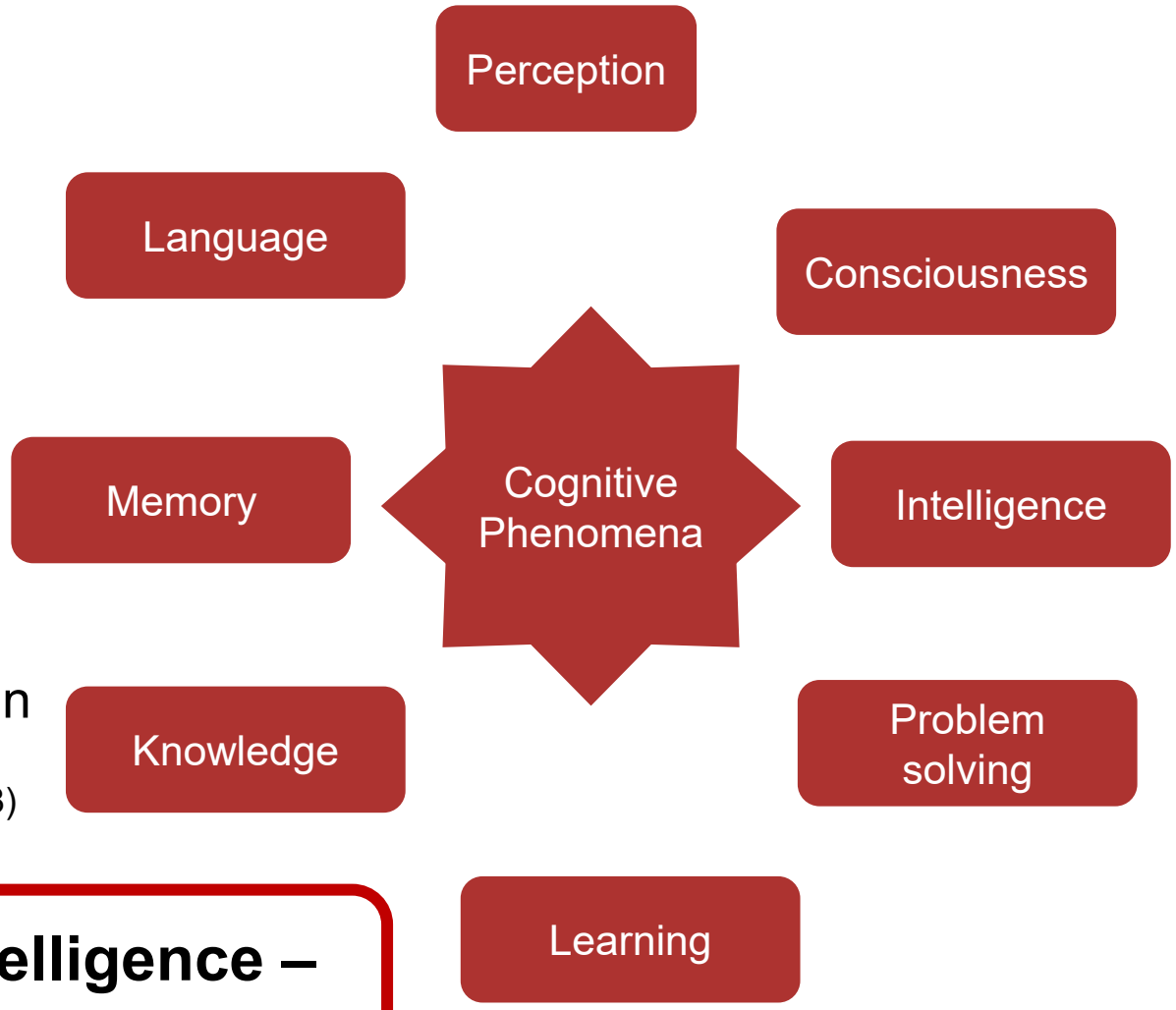
In short: cognition is thinking

(Dumper et al., 2019; Kellog,2003)

- Involves several phenomena
- Humanity has long tried to understand
- Cognitive Science is rooted in neuro-bio-physiological traditions and psychological experiments and has flourished alongside the triumphal march of computer science
- Between stimulus and response, there is a space. In that space lies our freedom (unknown, cf.Coleman-Baker, 2018)



Artificial intelligence is – like human intelligence – only one facet of cognition

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What are your questions so far?

Time for a break

What do you think: What is intelligence?

What is intelligence? (Bingham, 1937, Fletcher & Hattie, 2011; Gottfredson, 1997, 52 signatories)

Intelligence is:

- A very general mental capability that involves the ability to
  - …reason, plan, solve problems, think abstractly,
  - …comprehend complex ideas,
  - …learn quickly and learn from experience
- Something that can be reliably measured via intelligence tests and expressed as intelligence quotient or IQ
- While intelligence tests differ from each other and can be more or less culture-fair, they do all measure the same general factor “intelligence”

Von Timothy Bates (President of ISIR, International Society for Intelligence Research) - DISTINGUISHED CONTRIBUTOR INTERVIEW Linda Gottfredson, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=74173545

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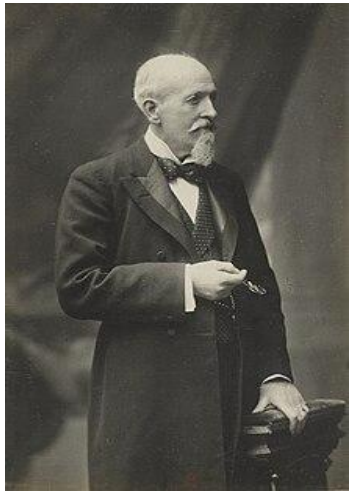
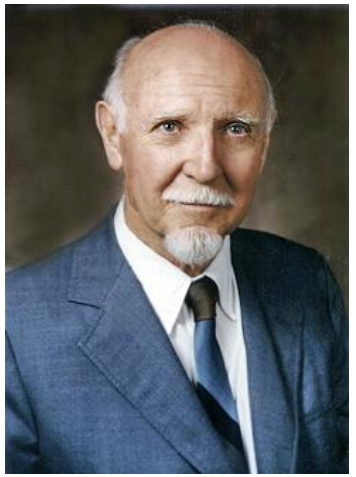
Spearmans' 'g' factor (Cattell, 1963; Nisbett et al., 2012; Spearman, 1904; Warne & Burningham, 2019)

- People who perform well in one cognitive test often also perform well in another
- Common factor or shared variance in a series of correlated cognitive tasks
- Found across the world – even in non-Western, non-industrialized nations
- The dream of AGI is rooted in this general intelligence concept
- Despite *g*: Different factors within intelligence, e.g., two-factor theory by Raymond Catell
  - Fluid intelligence (= speed of information processing)
  - Crystalline intelligence (= knowledge, language skills, experience with problem-solving, etc.)
- They are distinct from each other – amongst others over the lifespan



Exposition universelle de 1900 : portrait de M. Spearman.



Von Cattell family - Wikipedia:Contact us/Photo submission, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=3927018

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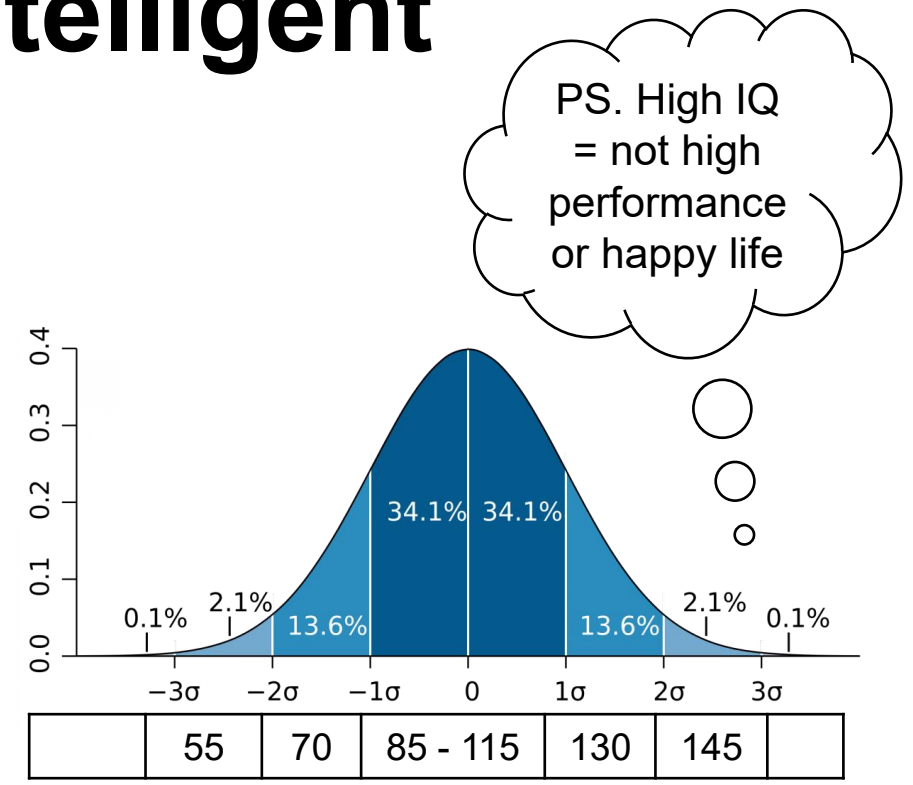
You are – likely – averagely intelligent

(Gottfredson, 1997; Nisbett, 2012)

- Results of intelligence tests are normally distributed
- Most people have an average IQ that is around 100 in a standard Intelligence test
- If you do one, reliable psychologists will only tell you if you have an average IQ (most of us) a slightly above/below one (still a third), an IQ below/ above average less than 5%, or are even more extreme
- Intelligence has a strong genetic component (~ 40-80%), but family members can differ
- Socio-economic background and ethnicity predict average IQ scores – but individuals within one group differ considerably
- Your environment during childhood matters too



The bell-curve controversy (Fletcher et al., 2011; Nisbett, 2012)

- 1994 book “The Bell Curve” by Herrnstein and Murray
- Focussed on the average differences in the IQ between Whites, PoC, Jews, and Asians (all in the realm of average IQ though)
- The authors claimed that IQ is what predicts school success and that it is not malleable, wherefore interventions are not necessary (also saying that low IQ → criminality…)
- This has been debunked since
- While there are systematic differences (Jews tend to score higher than Whites, Blacks lower), socio-economic status and education shape the performance
- Differences are shrinking and across countries, the average IQ is rising (“Flynn effect”)
- Centrally: The interest of cognitive scientists has moved towards cognitive performance, largely accepting a general factor “g”, making some of these cognitive tasks easier for some of us

Why does that matter today?

TECH NEWS

Elon Musk Seems to Endorse Tweet Saying Students at Black Colleges Have Low IQs

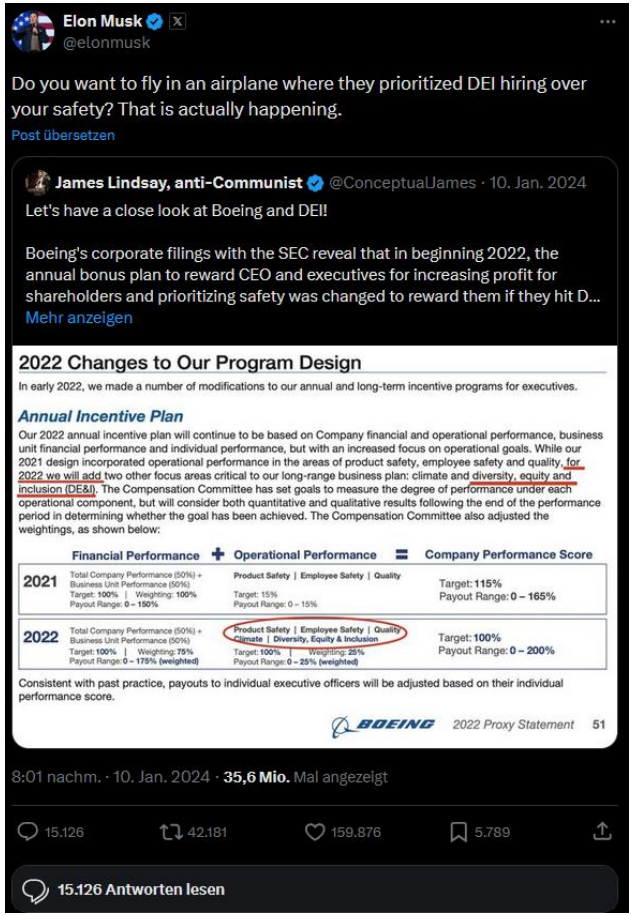
The world's richest man shares more of his thoughts about race on X.com.

By **Thomas Germain** Published January 10, 2024 |
Comments (145)

BEST OF CES 2025 AWARDS

https://gizmodo.com/elon-musk-endorses-tweet-saying-students-at-black-colle-1851156533

Tweeting While Racist
1.12.24, 2:32 PM EST by Victor Tangermann



https://x.com/elonmusk/status/1745158868676546609

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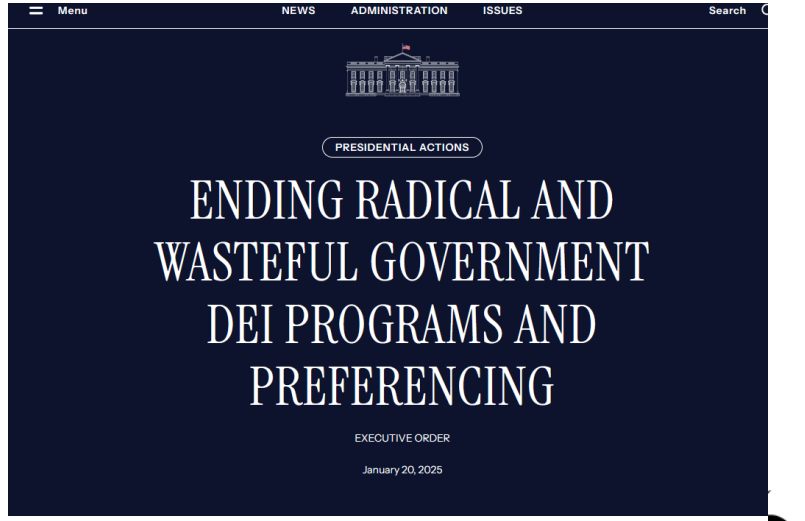
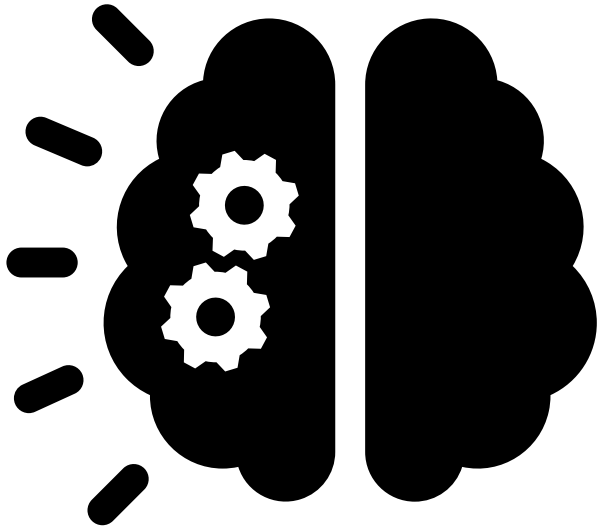


https://www.whitehouse.gov/presidential-actions/2025/01/ending-radical-and-wasteful-government-dei-programs-and-preferencing/

To sum up

- Intelligence is a very general mental capability
- Makes several cognitive tasks easier
- This general factor can be reliably measured
- Most of us have an average amount of that
- While there is considerable genetic heritability, education and environment matter
- Not least for crystalline intelligence
- Group differences are there – but they are overinterpreted for racist purposes – 1997 as well as 2025
- The dream of AGI is rooted in this tradition – whether we want it or not



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What are your questions so far?

How do humans think?

Thinking (Kahnemann, 2012; Tversky & Kahnemann, 1974)

Two types of thinking

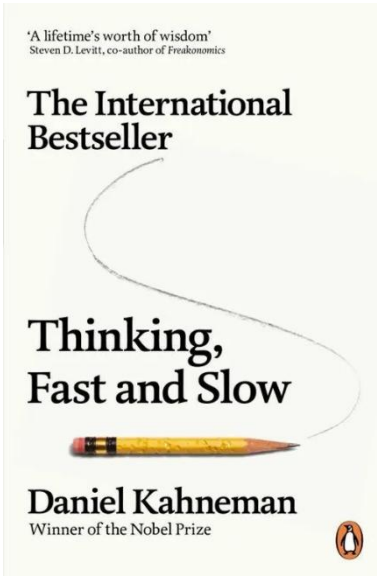
- automatic, passive, usually “fast” thinking (System I)
- effortful, deliberatively, attentional, able to do complex computations, execute self-control (System II)

How does that work?

- Look at your neighbour's face
- Think about beer and vomit
- Did you notice something?

We will meet much more of these two process models later in this lecture – but for now, let’s hear why that matters for AI

Daniel Kahnemann & Anton Twersky, Kahnemann, 2012, p. 55



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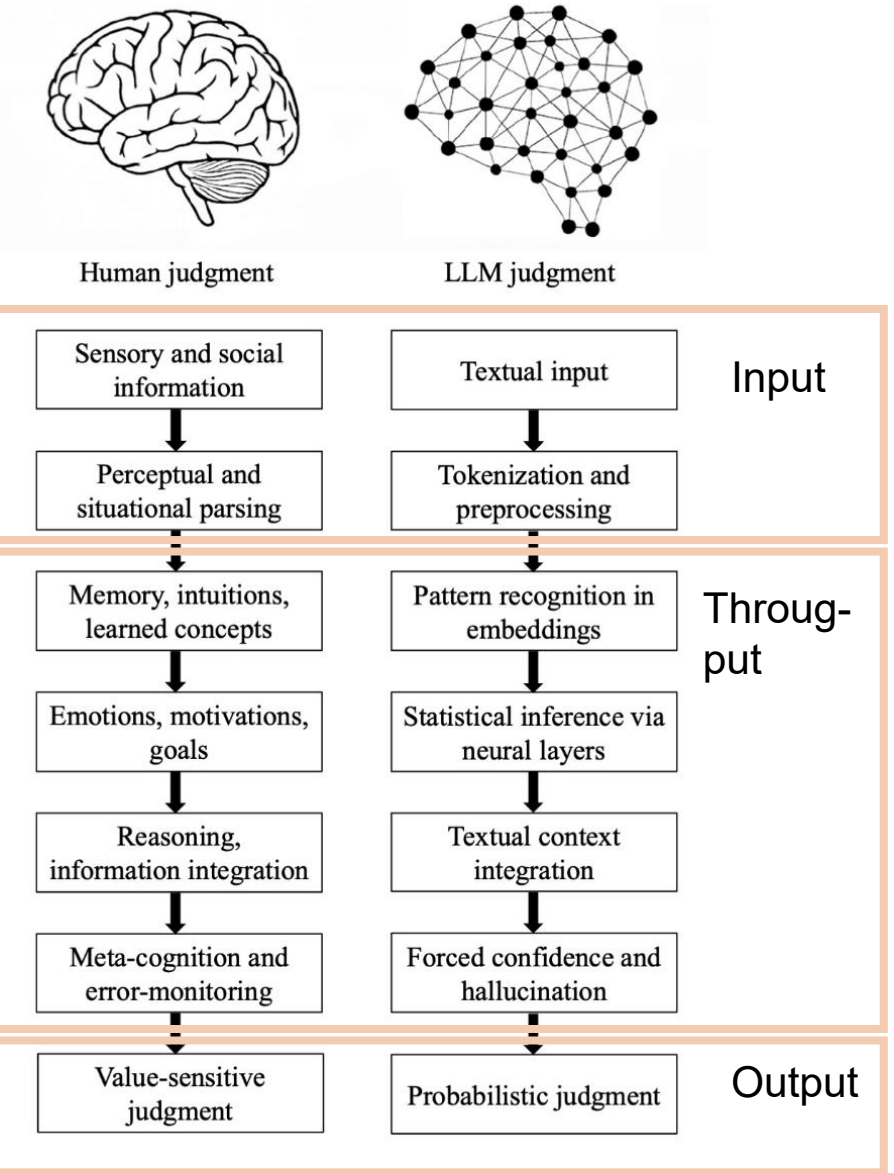
https://www.ted.com/talks/noam_brown_ai_won_t_plateau_if_we_give_it_time_to_think?subtitle=en

So, what are the differences between AI and human cognition? (Quattrociocchi et al., 2025)

- The apparent alignment between human and machine outputs conceals a deeper structural mismatch in how judgments are produced
- Humans as “epistemic agents” who actively construct knowledge through thinking
- AI as “stochastic parrot”
- seven epistemic fault lines



What do you think about artificial “intelligence” and “thinking`”?

Any more questions for today?

AI 507: Artificial Intelligence and Society

#1 Introduction & Intelligence

Associate Prof. Dr. Lena Frischlich

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