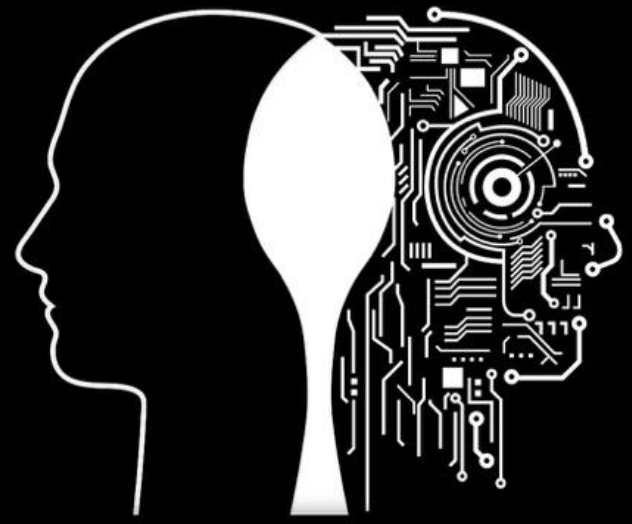
AI and cognitive science need a divorce

Cognition, computation & common sense



Tom Ziemke

tom.ziemke@liu.se

LINKÖPING UNIVERSITY


SJ gör i samarbete
med Linköpings
universitet en studie
social robotik.
Välkommen att
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My talk in a nutshell

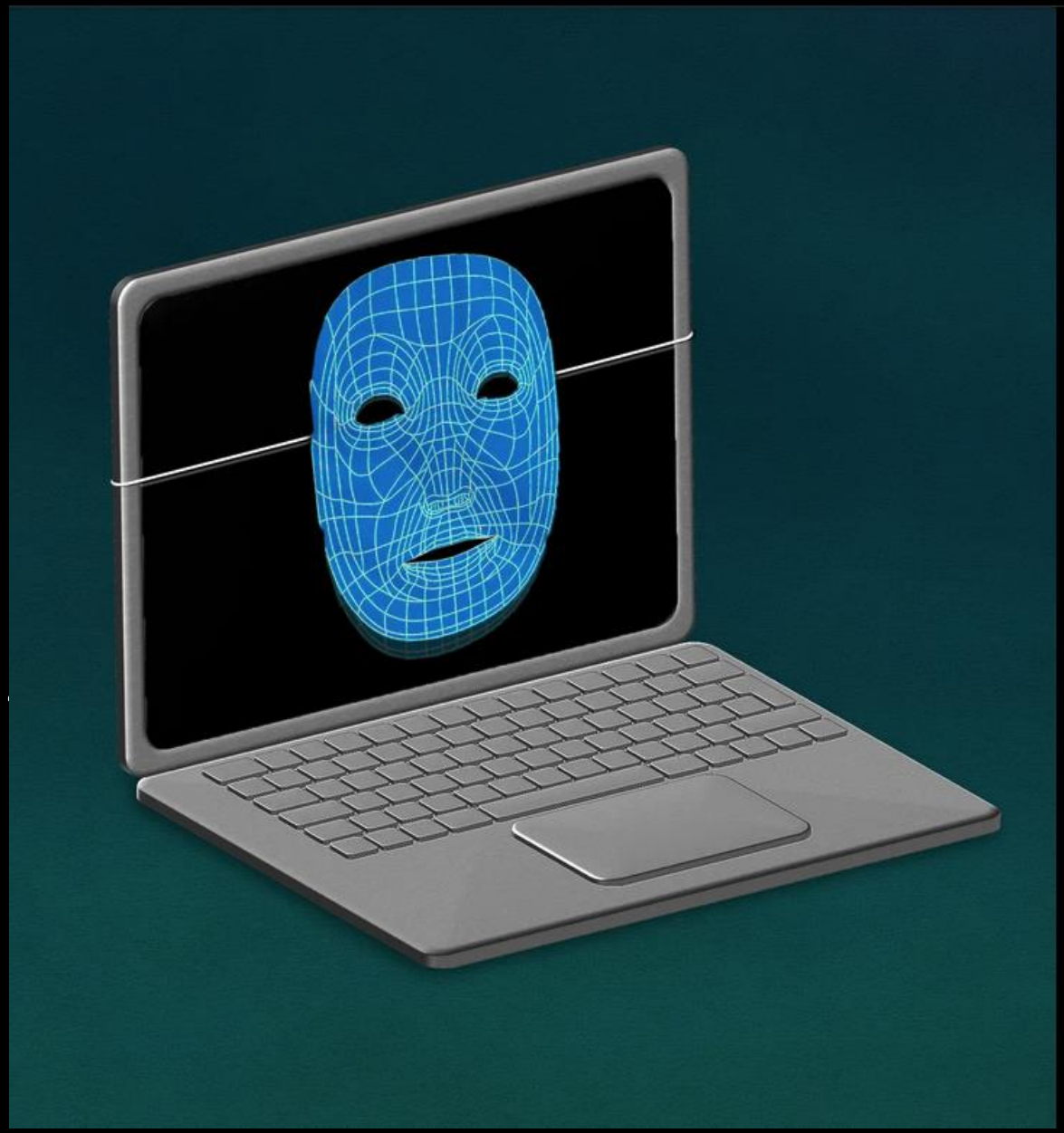
1. People are confused about the relation between AI and human cognition. But what exactly are they confused about – and why?

2. Cognition & “computation”

3. Common sense

4. Anthropomorphism

5. A more realistic view of the relationship between AI and human cognition is that they are *fundamentally different* – and should be viewed as *complementary*, rather than one replacing the other.



ANNALS OF ARTIFICIAL INTELLIGENCE

THERE IS NO A.I.

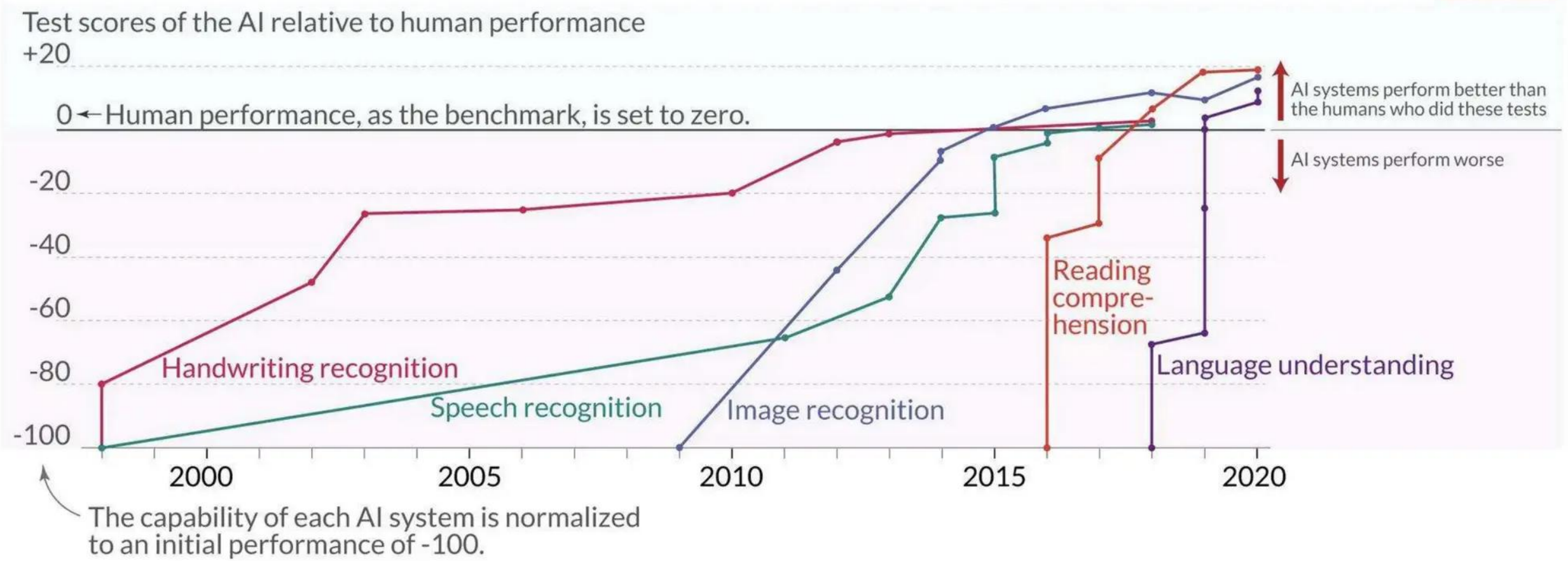
There are ways of controlling the new technology—but first we have to stop mythologizing it.

By Jaron Lanier

April 20, 2023

Language and image recognition capabilities of AI systems have improved rapidly

Our World in Data



Data source: Kiela et al. (2021) – Dynabench: Rethinking Benchmarking in NLP

OurWorldinData.org – Research and data to make progress against the world's largest problems.

New York Times 2023

Bing's A.I. Chat: 'I Want to Be Alive. 😈'

In a two-hour conversation with our columnist, Microsoft's new chatbot said it would like to be human, had a desire to be destructive and was in love with the person it was chatting with. Here's the transcript.

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By Kevin Roose

Published Feb. 16, 2023 Updated Feb. 17, 2023

A Conversation With Bing's Chatbot Left Me Deeply Unsettled

A very strange conversation with the chatbot built into Microsoft's search engine led to it declaring its love for me.

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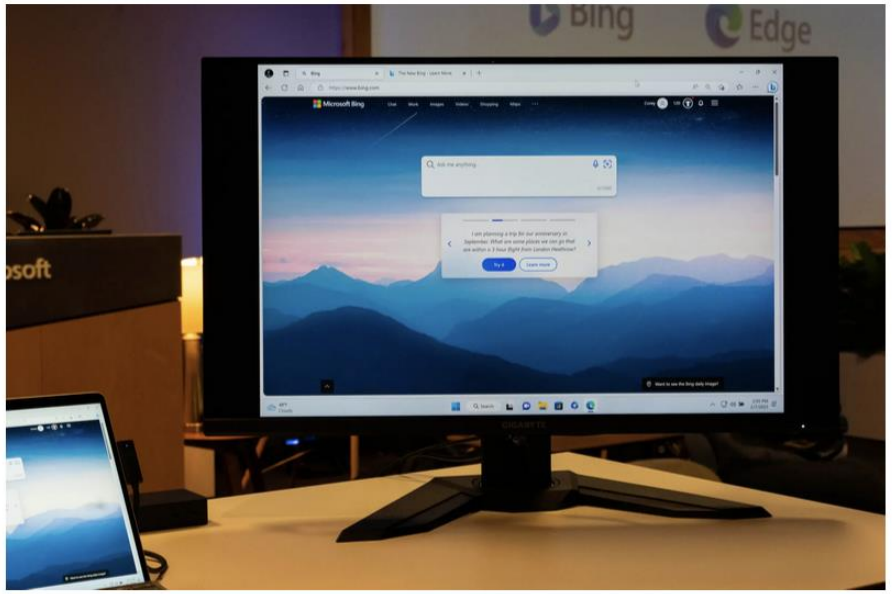


Last week, Microsoft released the new Bing, which is powered by artificial intelligence software from OpenAI, the maker of the popular chatbot ChatGPT. Ruth Fremson/The New York Times

By Kevin Roose

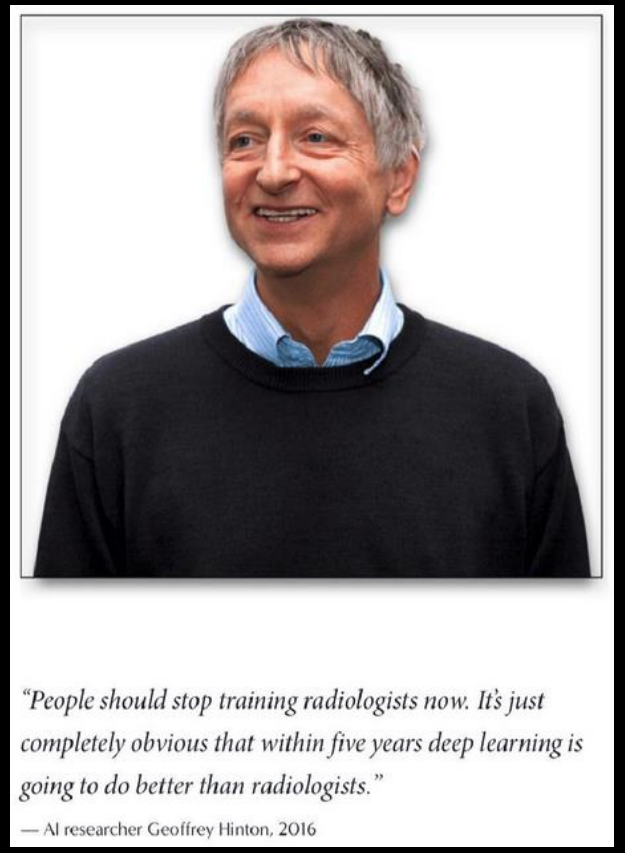
Kevin Roose is a technology columnist, and co-hosts the Times podcast "Hard Fork."

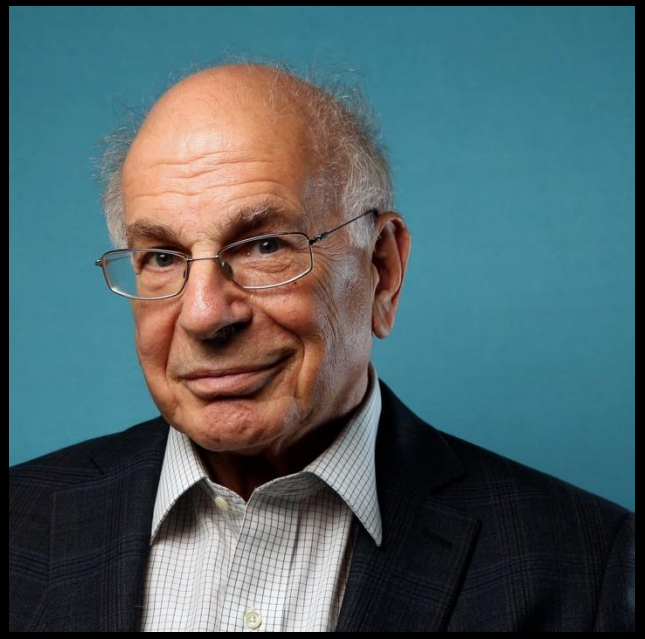
Published Feb. 16, 2023 Updated Feb. 17, 2023

Questionable quotes

Herbert Simon (1960)

”Machines will be capable, within twenty years, of doing any work that a man can do.”





Interview with Daniel Kahneman (Nobel Prize 2002) in *Svenska Dagbladet* 2021 (Malin Ekman)

“I don't see what is unique about human intelligence. You know, we have a computer [in our head], and the idea that it's a completely different kind of computer, it doesn't make sense to me.”

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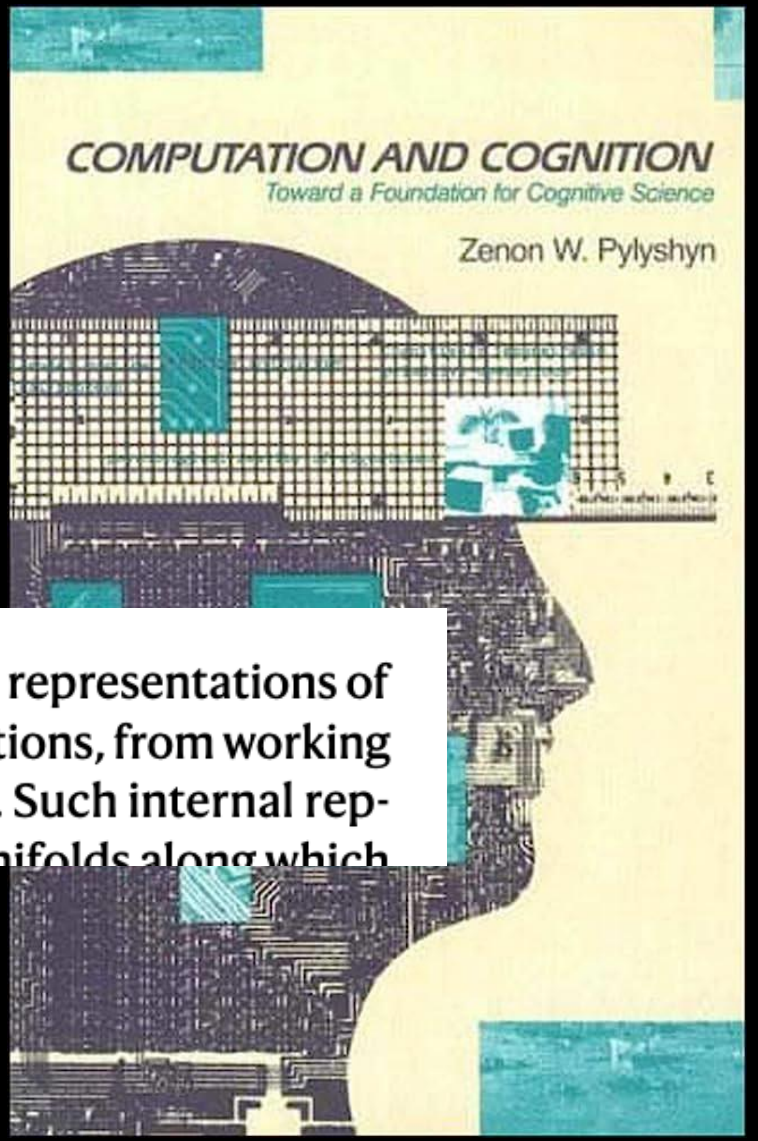
Wikipedia on “cognitive science” [today]:

… One of the fundamental concepts of cognitive science is that *"thinking can best be understood in terms of representational structures in the mind and computational procedures that operate on those structures."*

(quote from Thagard, 2008)

1984



The brain is thought to rely on persistent internal representations of continuous variables for a wide range of computations, from working memory[1–4] to navigation[5–9] to motor control[10–12]. Such internal representations have been described in terms of manifolds along which

nature neuroscience

Article

https://doi.org/10.1038/s41593-024-01766-5

Maintaining and updating accurate internal representations of continuous variables with a handful of neurons

Received: 5 February 2023

Accepted: 14 August 2024

Published online: 03 October 2024

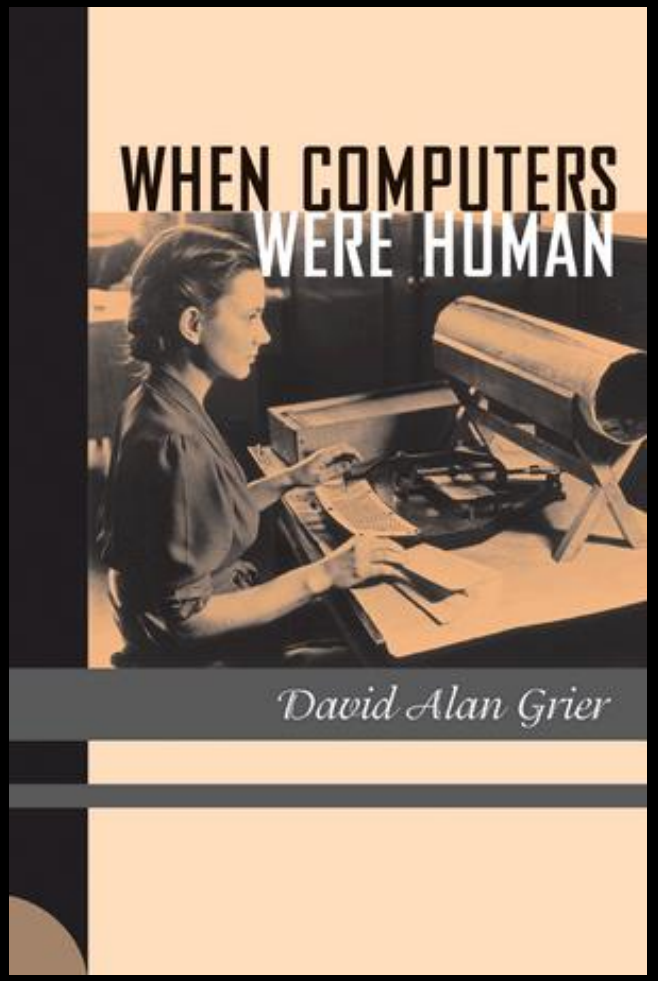
Check for updates

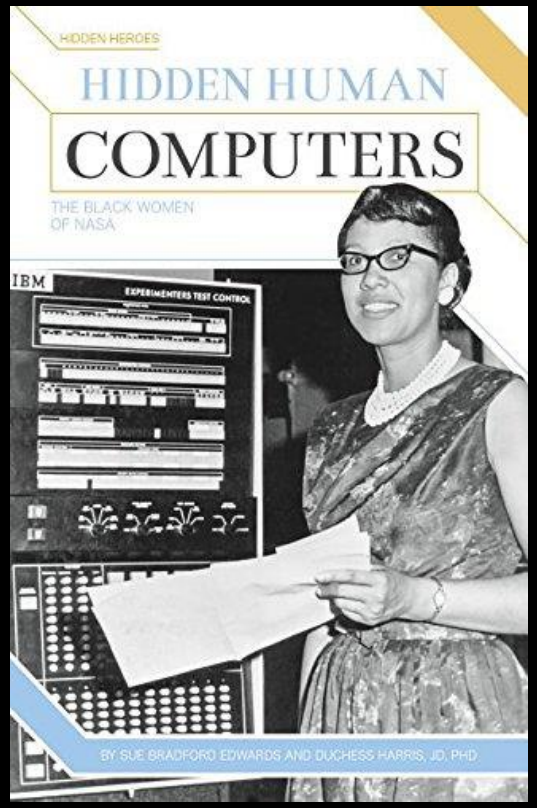
Marcella Noorman, Brad K. Hulse, Vivek Jayaraman, Sandro Romani & Ann M. Hermundstad

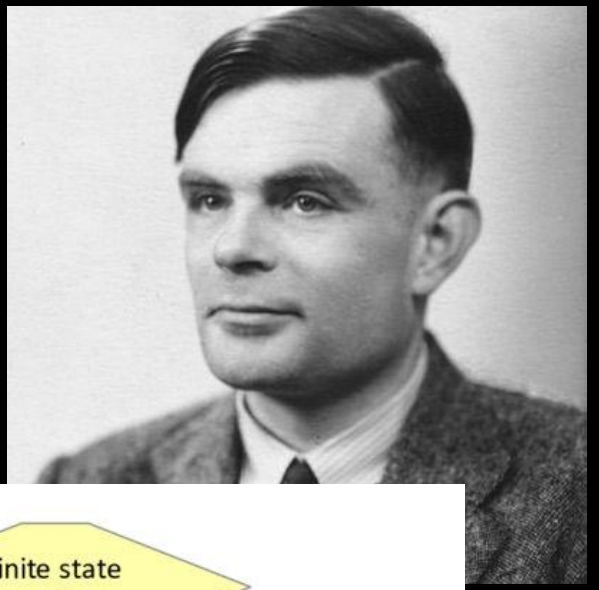
Many animals rely on persistent internal representations of continuous variables for working memory, navigation, and motor control. Existing theories typically assume that large networks of neurons are required to maintain such representations accurately; networks with few neurons

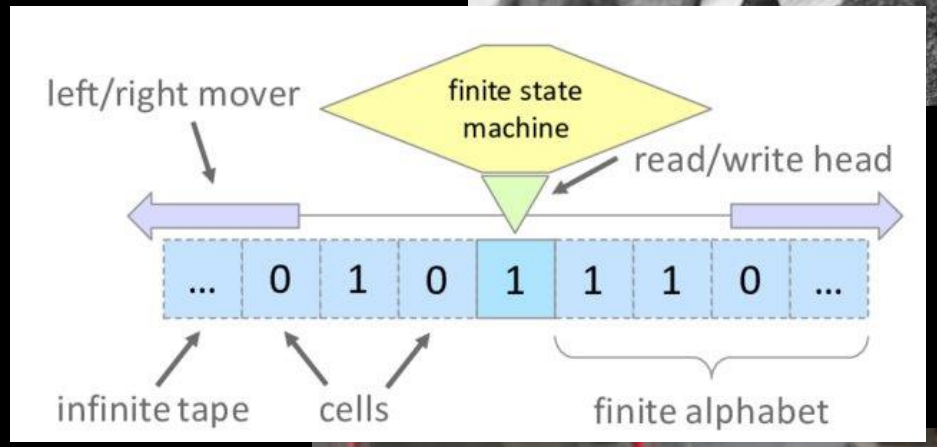
2024

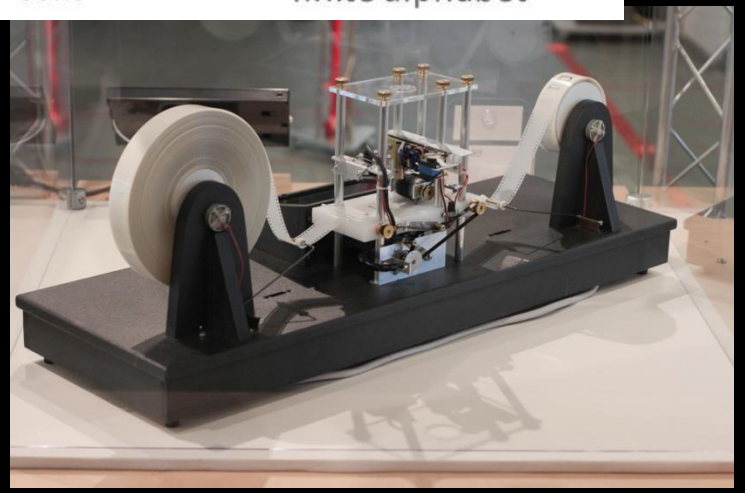
“Computers” vs. computability











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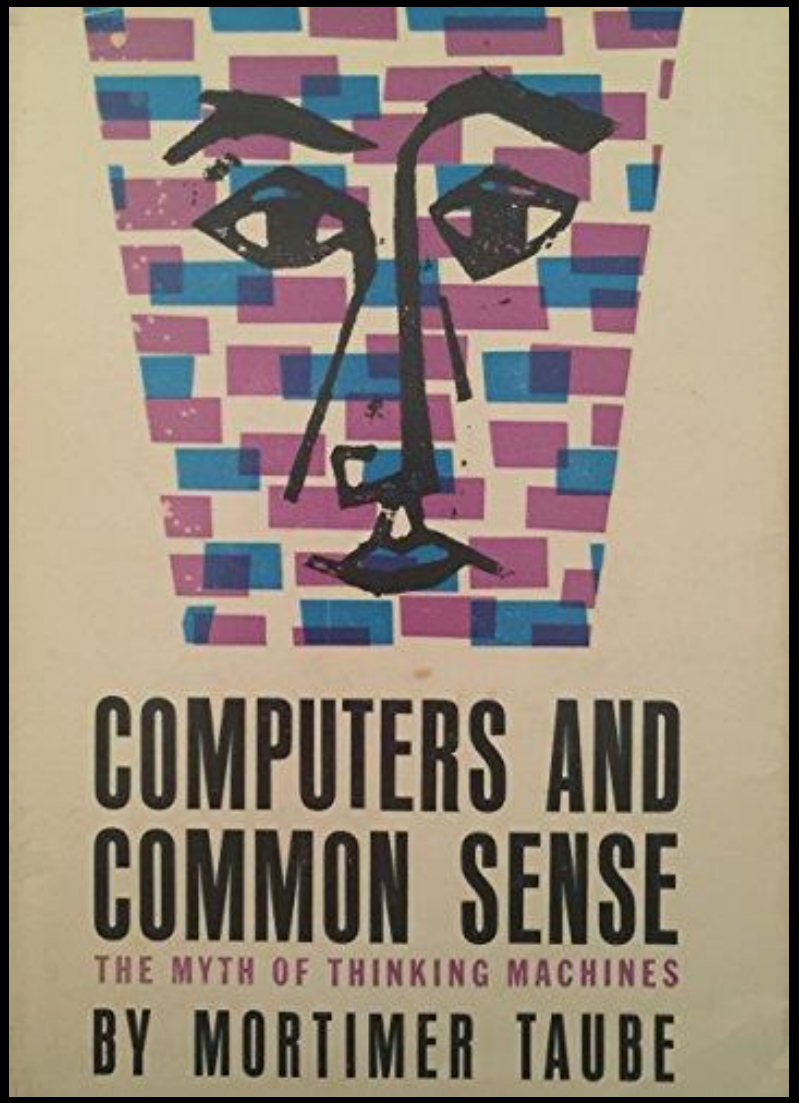
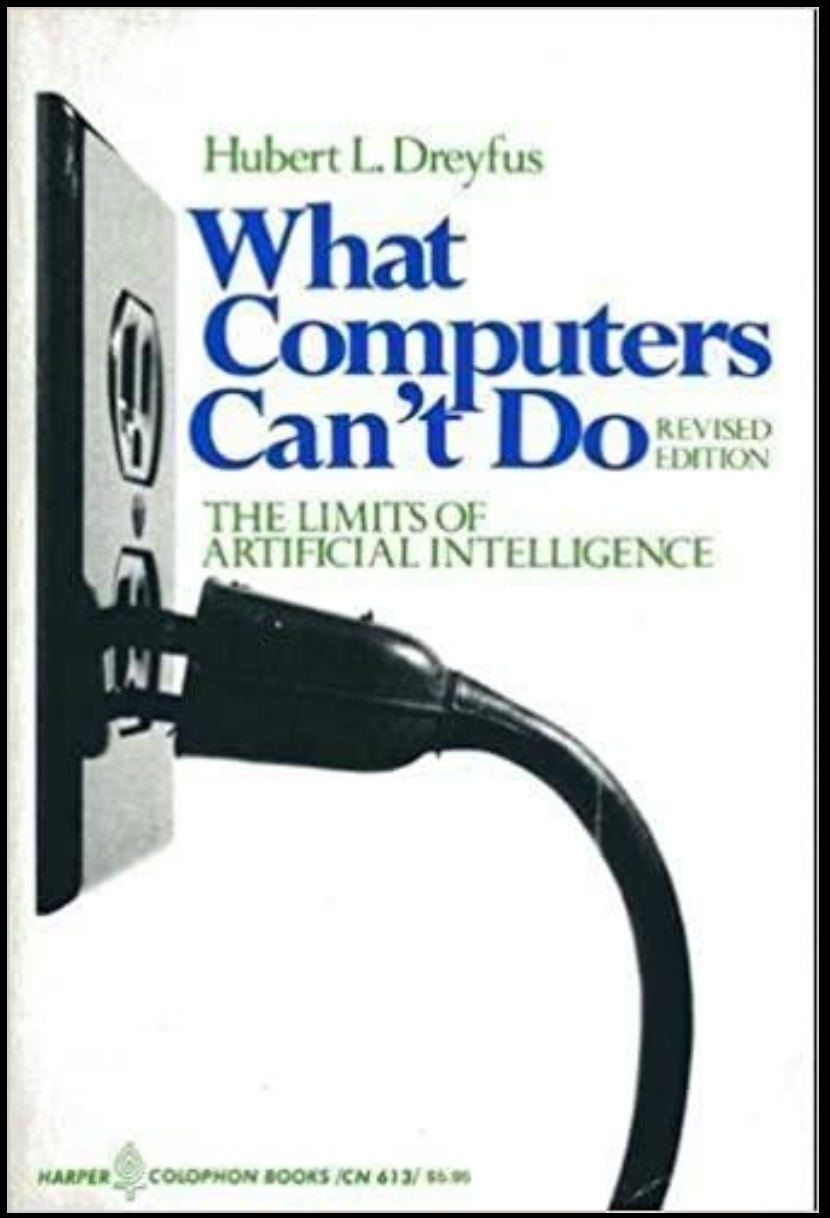
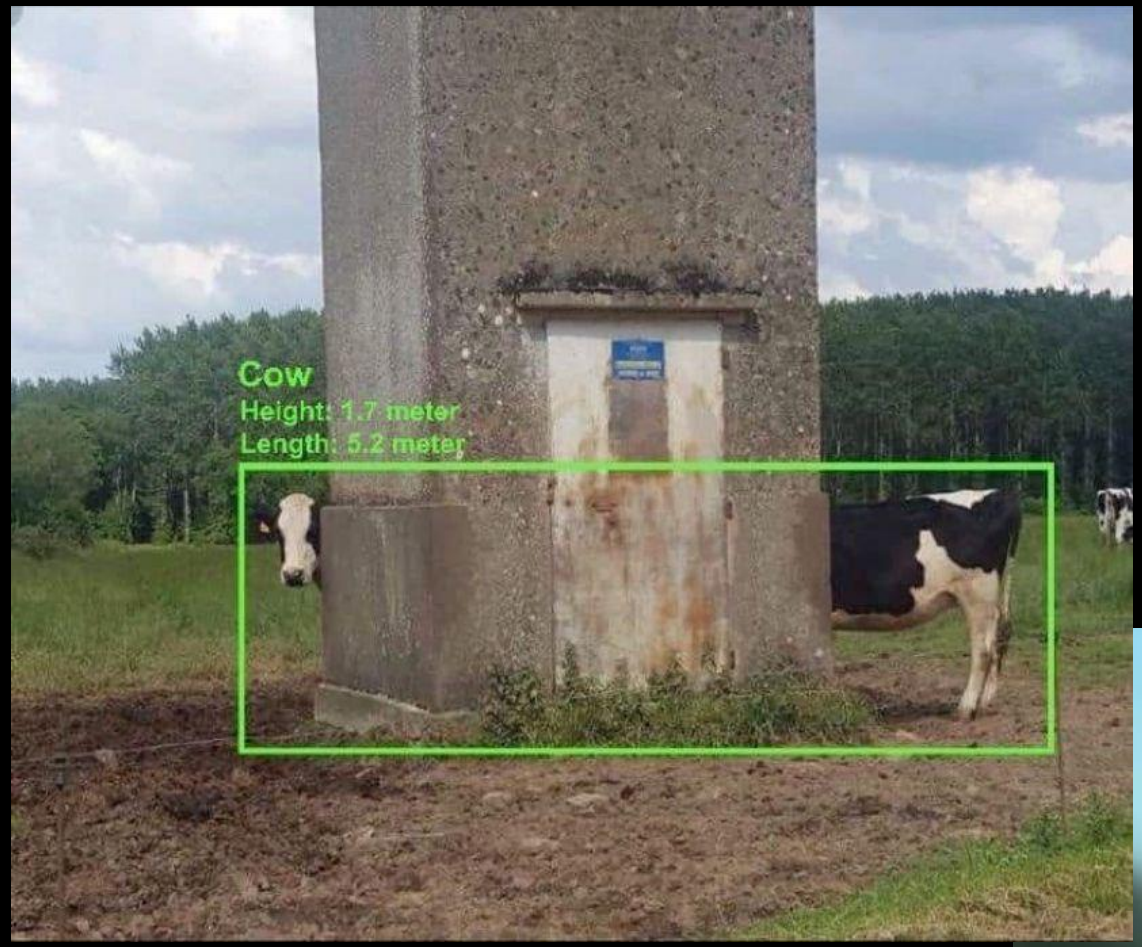
Common sense



1961



1972


Cow
Height: 1.7 meter
Length: 5.2 meter


CAUGHT ON CAMERA
WAYMO STRUGGLES TO STAY IN ITS LANE
INSTAGRAM VIDEO SHOWS SELF-DRIVING CAR SWERVING BACK AND FORTH ON 15TH AVE.
ARIZONA FAMILY
6:18
89°

2024


MIT Technology Review
Volume 127
Number 3
May/June
2024
A brief, weird history of brainwashing
Office space in space
AI comes for bodycams
The robots are coming
And they're here to help
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TECH NEWS

Self-driving Uber car that hit and killed woman did not recognize that pedestrians jaywalk

The automated car lacked "the capability to classify an object as a pedestrian unless that object was near a crosswalk," an NTSB report said.

WIRED SECURITY POLITICS GEAR MORE SIGN IN SUBSCRIBE

AARIAN MARSHALL BUSINESS OCT 24, 2023 4:31 PM

GM's Cruise Loses Its Self-Driving License in San Francisco After a Robotaxi Dragged a Person

The California DMV says the company's autonomous taxis are "not safe" and that Cruise "misrepresented" safety information about its self-driving vehicle technology.


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Clever Hans

German horse around 1904 who “could calculate”

New York Times 1904

"CLEVER HANS" AGAIN.

Expert Commission Decides That the Horse Actually Reasons.

From The London Standard.

BERLIN, Sept. 13.—The remarkable horse called "Clever Hans" has just been examined by a special commission of experts, in order that a decision might be arrived at whether it is a horse possessed of extraordinary brain power or merely, like many others of its tribe, peculiarly adapted to learning tricks from patient trainers. The commission consisted of the well-known circus proprietor, Herr Paul Busch; Count Otto zu Castell Ruedenhausen, a retired army Captain; Dr. Grabow, a retired schoolmaster; Dr. Ludwig Heck, Director of the Berlin Zoological Gardens; Major von Keller, Major Gen. Koering, Dr. Miessner, a veterinary surgeon; Prof. Nagel of the Physiological Institute of the University of Berlin, and several other prominent men.

The commission has issued a statement declaring that it is of opinion that there is no trickery whatever in the performances of the horse, and that the methods employed by

BERLIN'S WONDERFUL HORSE

He Can Do Almost Everything but Talk—How He Was Taught.

Special Correspondence THE NEW YORK TIMES.

BERLIN, Aug. 23.—In an out-of-the-way part of the German capital a horse is now shown which has stirred up the scientific, military, and sporting world of the Fatherland. It should be said at the very outset that the facts in this article are not drawn from the imagination, but are based upon true observations and can be verified by Dr. Studt, Prussian Minister of Education; by the famous zoologist, Prof. Moebius, director of the Prussian Natural History Museum, and by other eminent scientific and military authorities. I had occasion to-day to see a performance of the animal which was given in the presence of the young Duke of Sachse-Coburg-Gotha.

Hans, the wonderful stallion, is nine years old and is the property of a Herr von Osten, a retired school teacher. The horse has never been used for riding or driving. For over four years Herr von Osten has given the animal systematic instruction such as he would give to a child. The industrious pedagogue is the owner of a tenement house in the northern part of Berlin, and there he lives. The animal is quartered in a small shed adjoining a court where he is shown.

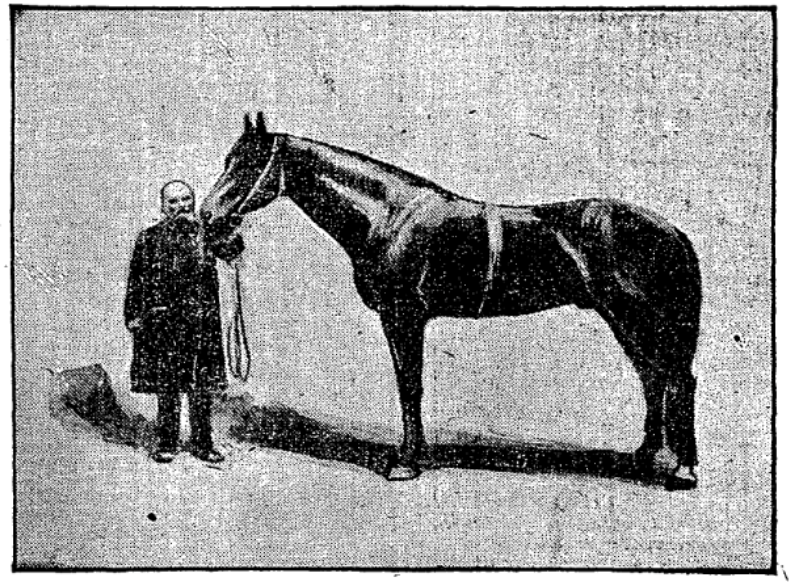
Some years ago the neighborhood was astonished by observing the training which Herr von Osten gave his animal. They beheld him and Hans at a certain hour of the day standing in the court before a blackboard and counting machine. Herr von Osten, undismayed by ridicule, (for by his method he had gained the reputation of being an old crank,) instructed the stallion by showing him the balls on the machine, and influencing him to indicate a number by stamping down his right hoof. At the same time, while the horse was doing this, his instructor spoke the name of the number. Then every time Hans put down his foot correctly he would be rewarded by a carrot or a piece of sugar. All other things the intelligent animal learned by seeing certain objects and at the same time hearing their names. In this way words to him became signs for visible objects, and he used footsteps as signs for his perceptions, according to the same psychic laws as we use a language to make others understand.

After Herr von Osten had taught Hans this simple sign language, the foundation for further education was established. He put before him gold, silver, and copper coins, and taught him to indicate gold pieces by one movement of the foot, silver with two, and copper with three steps. When, for example, three coins were placed in a row, Hans stamped down his foot three times when asked the number. He is also able to distinguish coins according to signs. When asked to give the value of a one-mark piece touched by his teacher, he moves his foot once, for a two-mark piece twice, &c.

Hans is an expert in numbers, even being able to figure fractions. He answers correctly the number of 4's in 8, in 16, in 30, &c. When asked how many 3's there are in 7 he stamps down his foot twice and for the fraction once. Then, when 5 and 9 are written under each other on the blackboard and he is asked to add the sum, he answers correctly.

Hans is also capable of distinguishing persons. He told the number of girls and officers standing in a line.

A remarkable thing happened yesterday. An officer was pointed out, and Hans was told, "That is Count Dohna." Half an hour later the same man was pointed out to him, and when asked for his name the horse picked out the letters D-o from the blackboard. Herr von Osten, however, having the name Doenhof in mind, wanted to help the animal by uttering "Do." Uninfluenced, however, Hans spelt out correctly "Dohna." In the same manner today Hans was introduced to the Prince of



HANS AND HIS OWNER, HERR VON OSTEN.

The New York Times
Published: September 4, 1904

Clever Hans

German horse around 1904 who "could calculate"

Roitblat (2023):

- "The public wanted to believe that Hans was cognitively sophisticated.
- Hans was clever, but not in the way that he was credited. The problem that Hans was solving was different from the nominal problem that his audience thought he was solving.
- It took careful analysis and experimentation to find out what the horse was doing and not doing."

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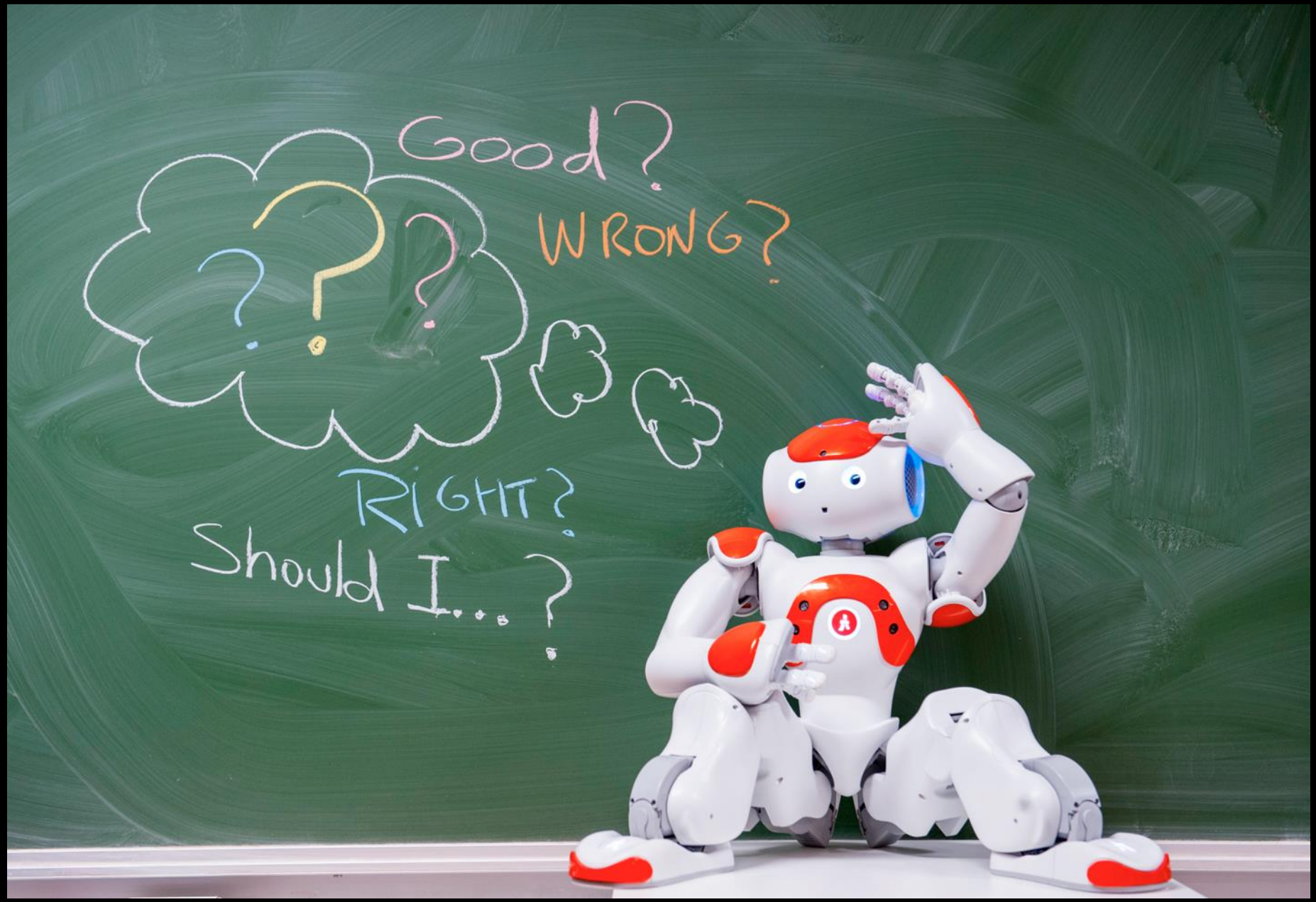
Conclusion – the relation between AI and human cognition

- for historical reasons, many people in AI and cognitive science believe that "cognition is computation" – and that therefore *human-like* AI is possible
  - but there are good reasons to think both those claims are questionable
- humans are biological creatures, and the way we perceive the world and interact with it depends on our *biological embodiment* and our *social situatedness*
  - AI, robots, etc. have *some* access to the human world through data, sensors, etc., but they will always have a fundamentally different perspective on things
  - which is a good thing if you view human-AI interaction in terms of *complementarity*
- in interactions with AI / computers / robots people often attribute *human-like cognitive, perceptual, etc. capacities* to such technologies
  - people need help with *expectation management*

Questions?

tom.ziemke@liu.se



Ongoing project (2023-26) on *"Social Cognition in Human-Robot Interaction"*

Investigating the <u>cognitive mechanisms</u> underlying how people interpret, explain and predict robot behavior