



HI and AI – Contrast and Similarity

11. Pro²Future Partner Conference

Donnerstag, 24. September 2026

13-16 Uhr Aula der TU Graz (Alte Technik), Rechbauerstraße 12, 8010 Graz

Univ.-Prof. Dr. Alois Ferscha



Alan Turing
(1912 – 1954)

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, 'Can machines think?' is to be

ESSAYS and other Communications for the Editor should be addressed to
Prof. G. RYLE, Magdalen College, Oxford.

VOL. LIX. No. 236. OCTOBER, 1950

MIND

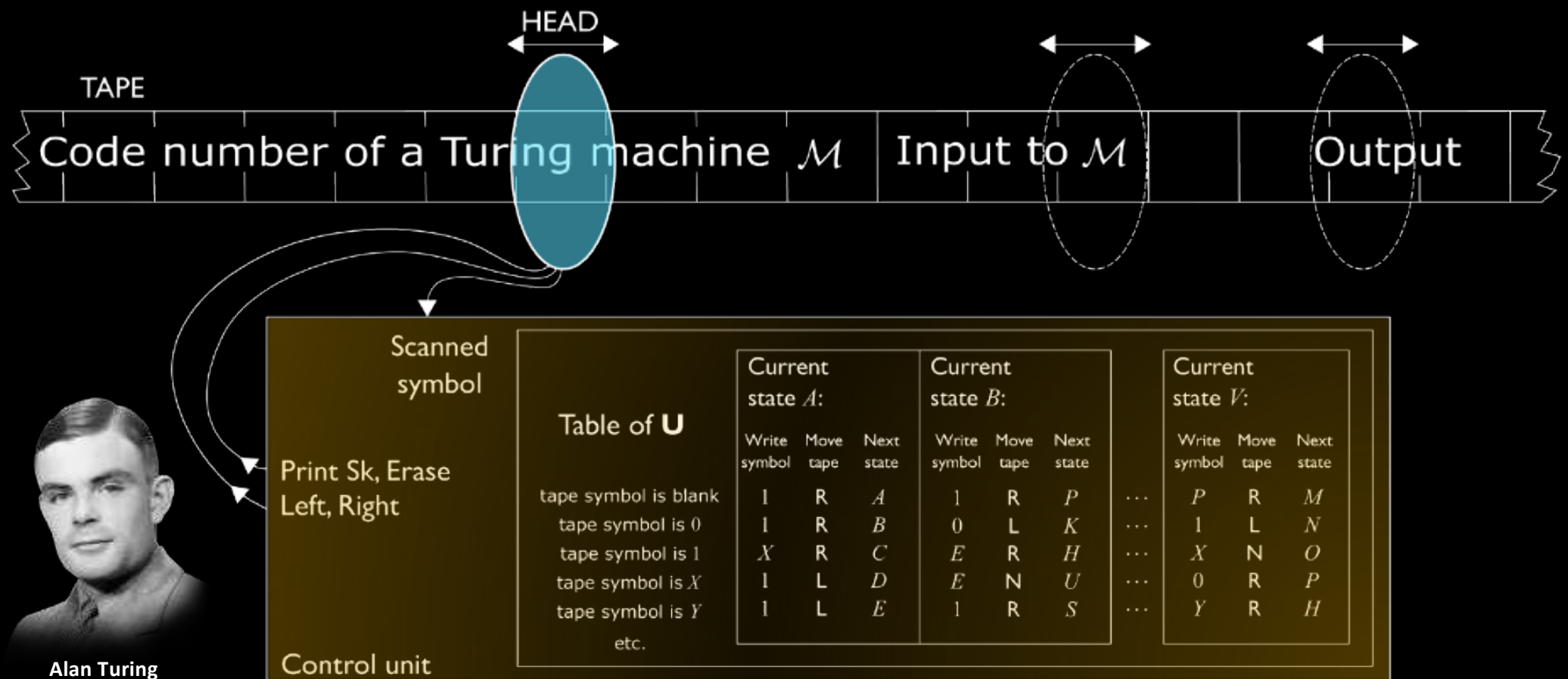
A QUARTERLY REVIEW
OF
PSYCHOLOGY AND PHILOSOPHY
EDITED BY
PROF. GILBERT RYLE
With the Collaboration of PROF. SIR F. C. BARTLETT and PROF. C. D. BRIDGES

CONTENTS.

	PAGE
I.—Computing Machinery and Intelligence: A. M. TURING	433
II.—Subject and Predicate: P. F. GRACE	462
III.—Frege's Sinn and Bedeutung: P. D. WIESFARB	483
IV.—The Theory of Sovereignty Restated: W. J. REES	495
V.—A Note on Verification: P. C. COPELSTON	522
Notes	529
VI.—Discussions:—	

A. M. Turing
Computing Machinery and Intelligence
Mind, Vol. 59, No. 236 (Oct., 1950), pp. 433-460

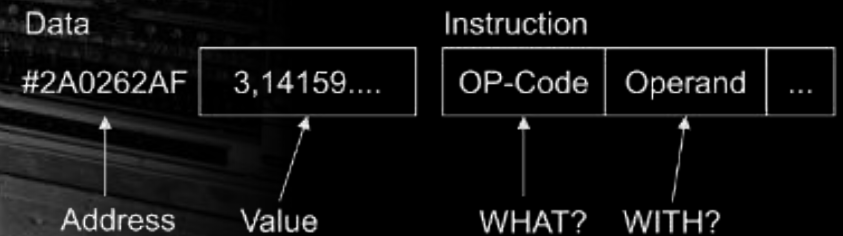
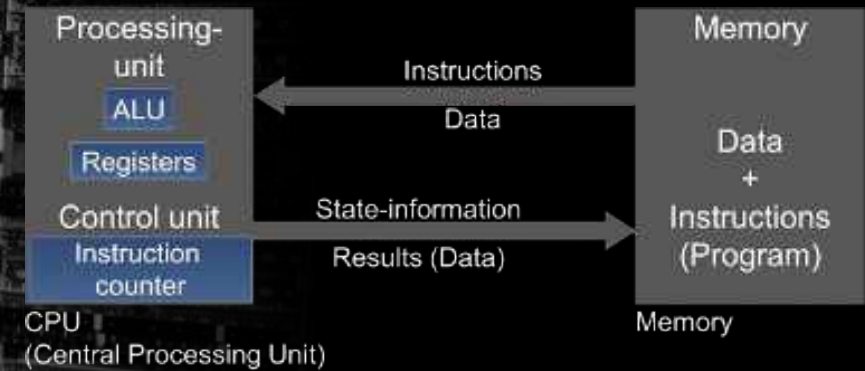
Universal Turing Machine (1937)



Alan Turing
1912 – 1954

von Neumann Architecture (1945)

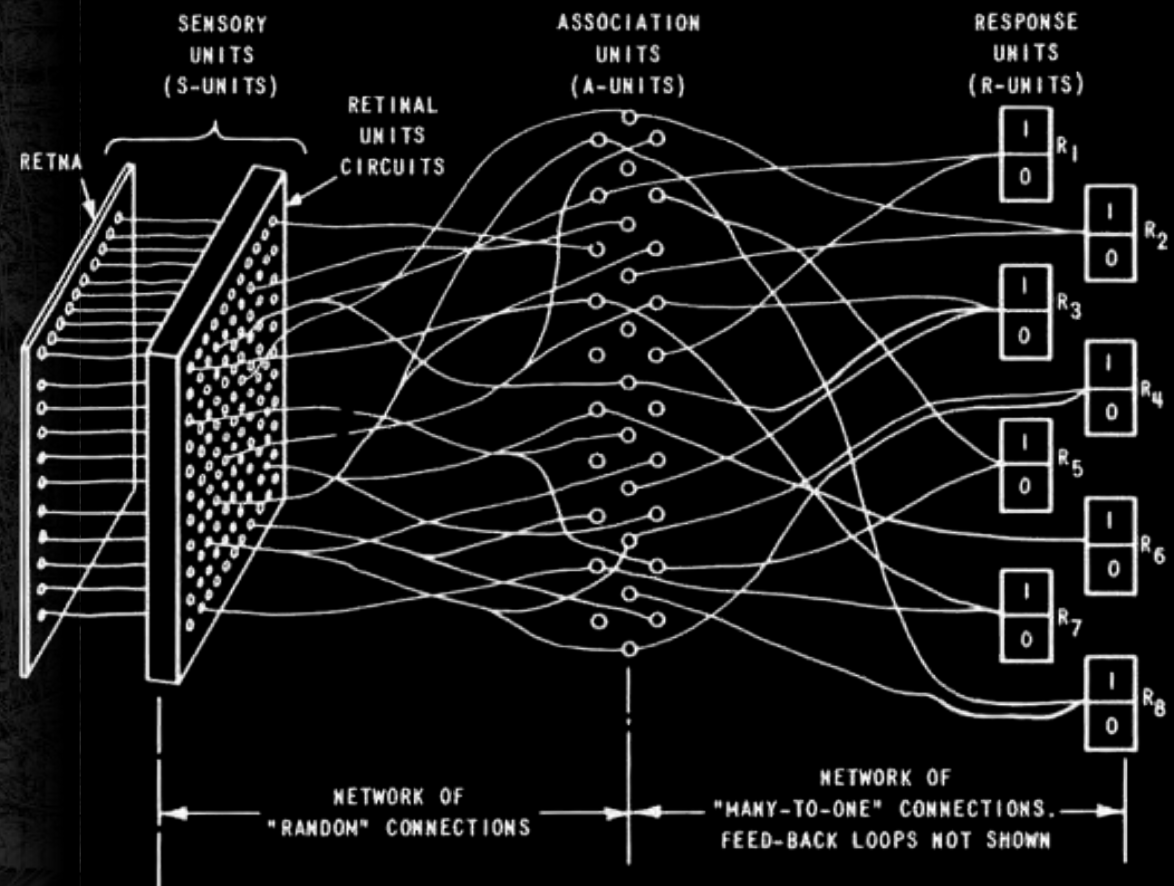
John von Neumann
1903 – 1957



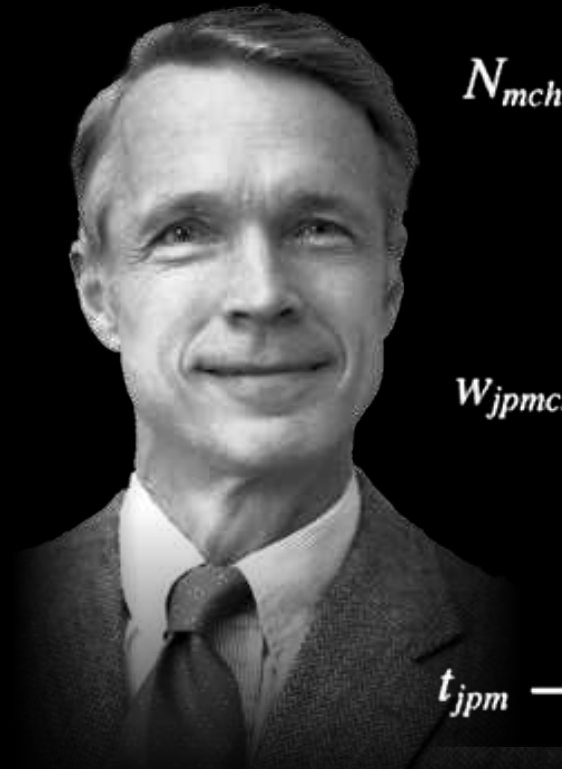


Principles of Neurodynamics: Perceptrons and the Theory of Brain Mechanisms

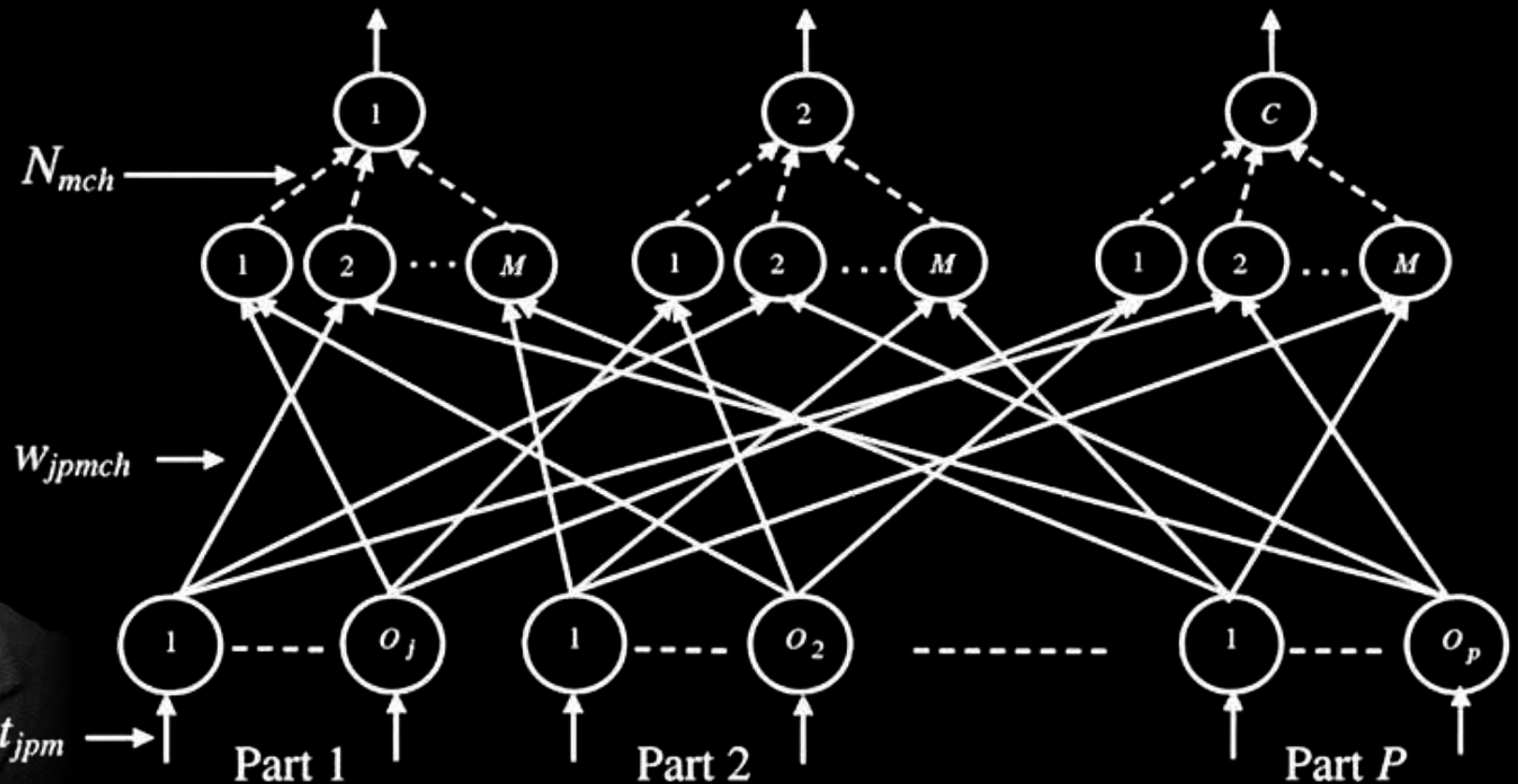
Mark 1 (1958)



Model conforming to the asynchronous Nature of biological Neurons (1982)

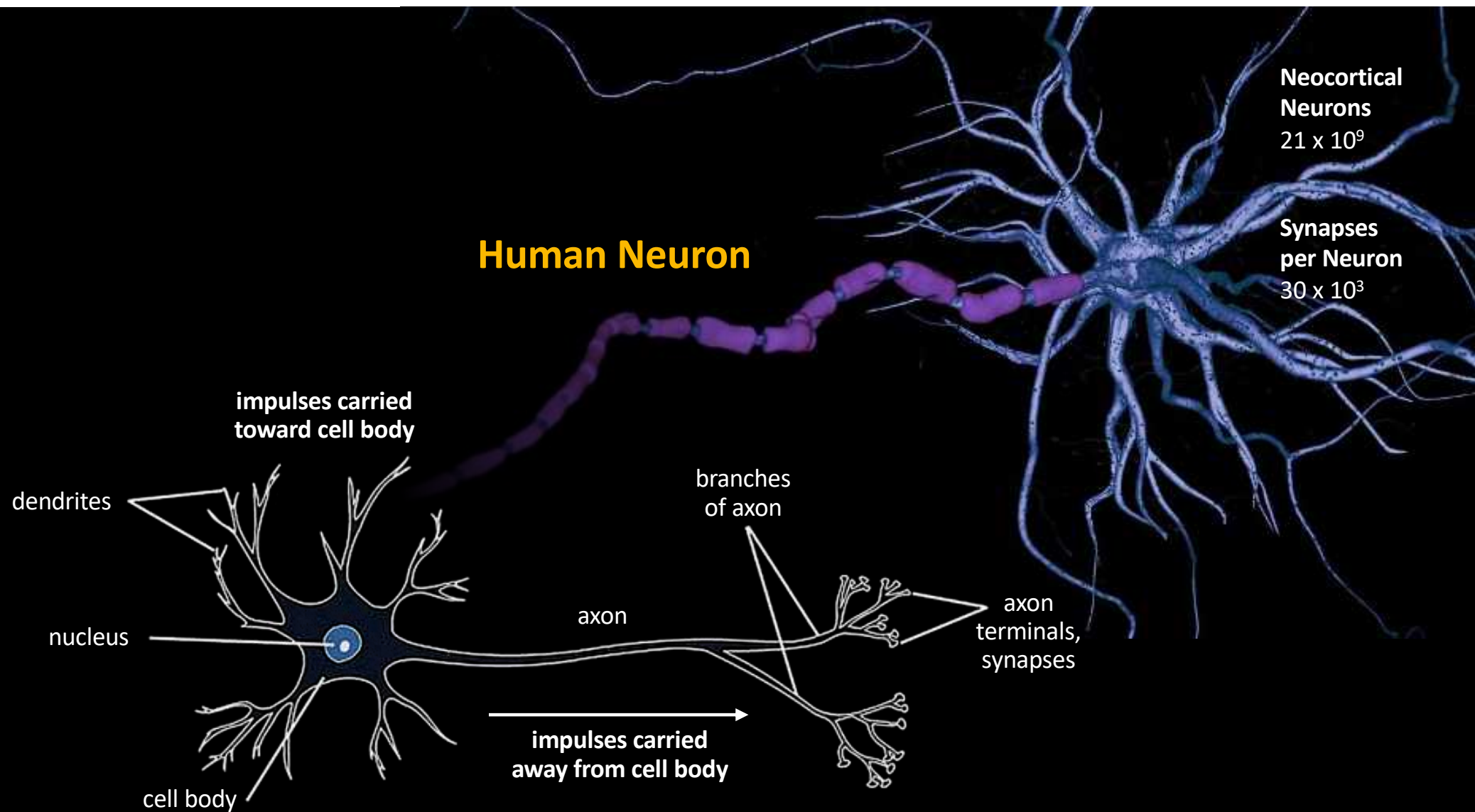


John J. Hopfield
1933*

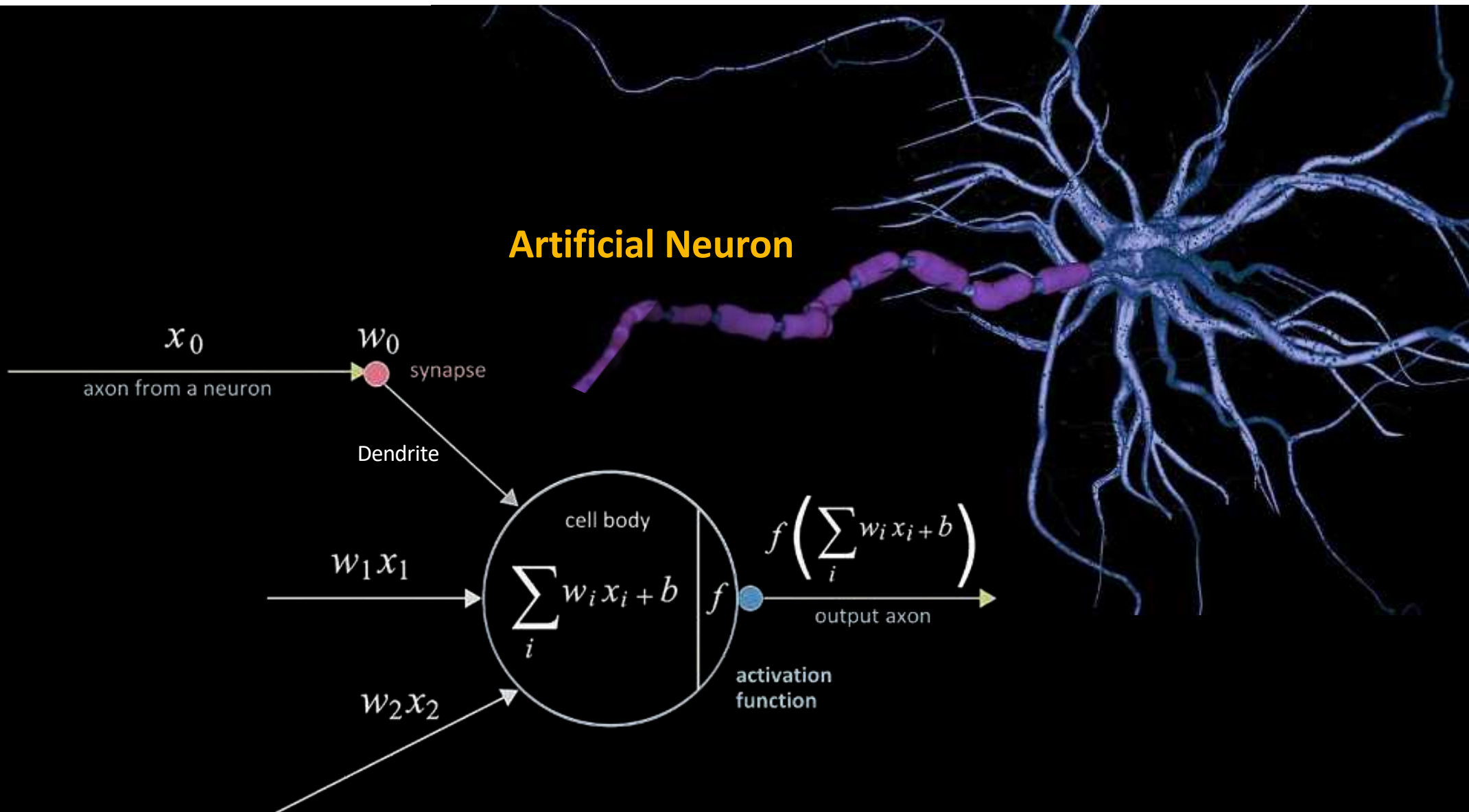


Network input: processing time of part-operation

Human Neuron



Artificial Neuron



Artificial Neural Networks

Feed forward

Input Cell

Hidden Cell

Output Cell

Perceptron (P)



Feed Forward (FF)



Radial Basis Network (RBF)



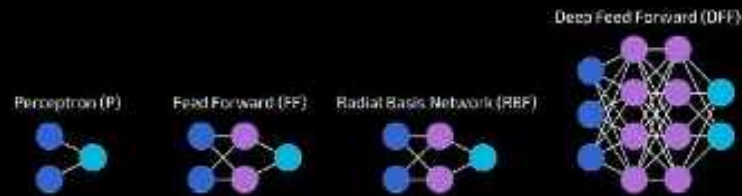
Artificial Neural Networks

Feed forward

Input Cell

Hidden Cell

Output Cell



Deep Learning

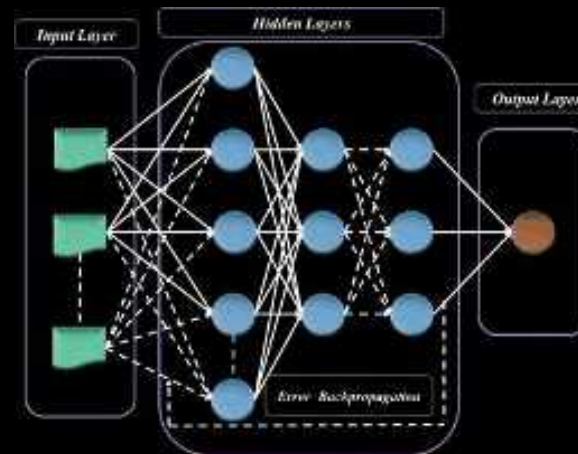


Deep Learning
NATURE, Vol 521, pp. 436-444
LeCun, Bengio, Hinton
May 28, 2015



IMAGENET
95% Accuracy
in Computer Vision
2017

Architecture of a basic
Artificial Neural Network (ANN)



Basic scheme of
a cognitive system.
Wikipedia



Geoffrey Hinton
University of Toronto

Nobel Prize in Physics 2024

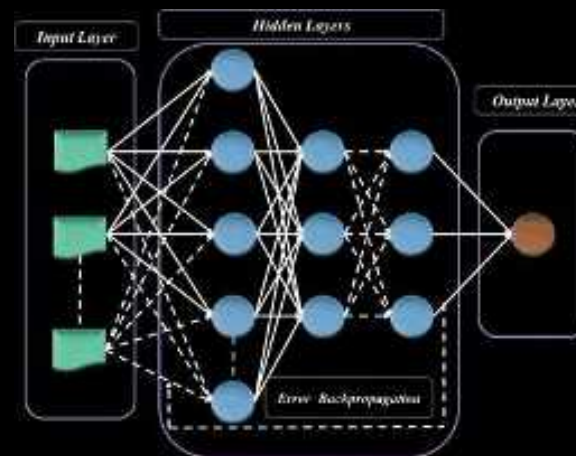


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Basic scheme of
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Wikipedia

*"for foundational discoveries
and inventions that enable
**machine learning with
artificial neural networks.**"*



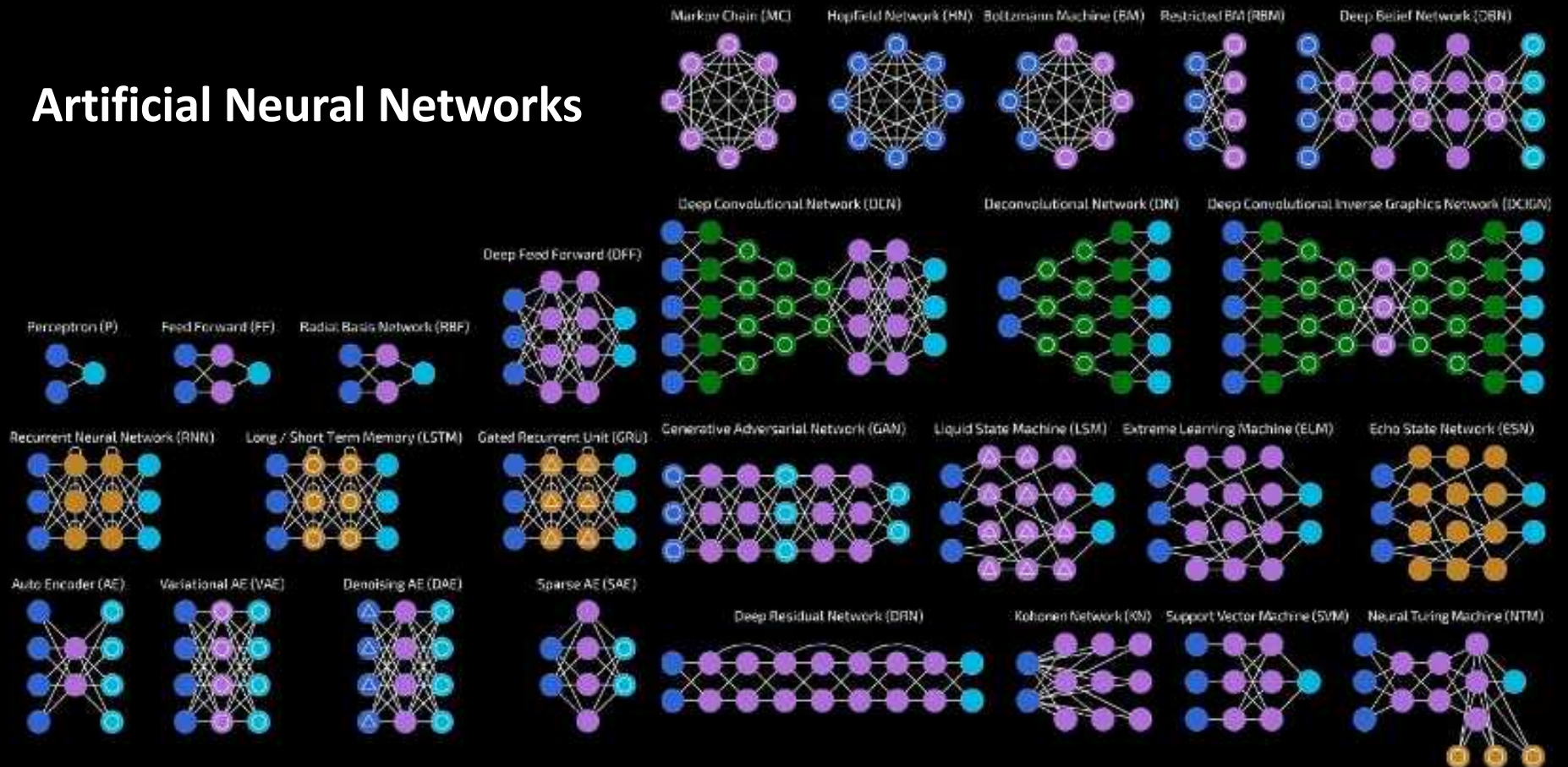
John Hopfield
Princeton University



Geoffrey Hinton
University of Toronto

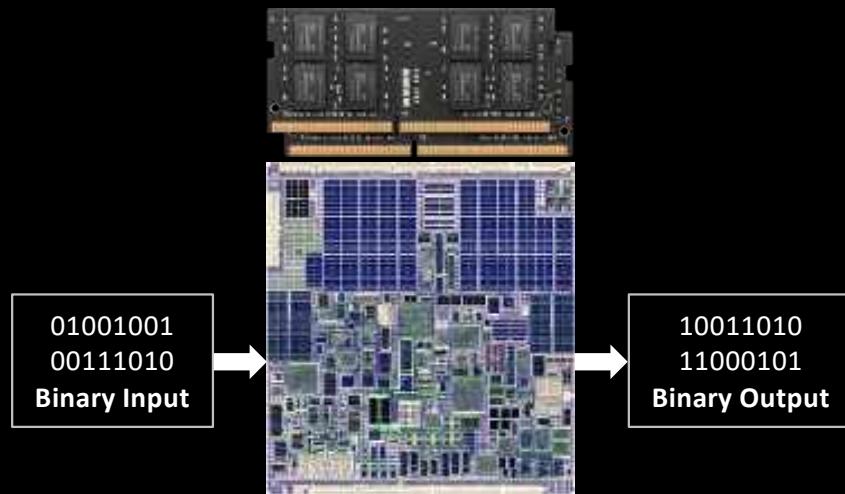
Artificial Neural Networks

-  Backfed Input Cell
-  **Input Cell**
-  Noisy Input Cell
-  **Hidden Cell**
-  Probabilistic Hidden Cell
-  Spiking Hidden Cell
-  **Output Cell**
-  Match Input Output Cell
-  Recurrent Cell
-  Memory Cell
-  Different Memory Cell
-  Kernel
-  Convolution or Pool

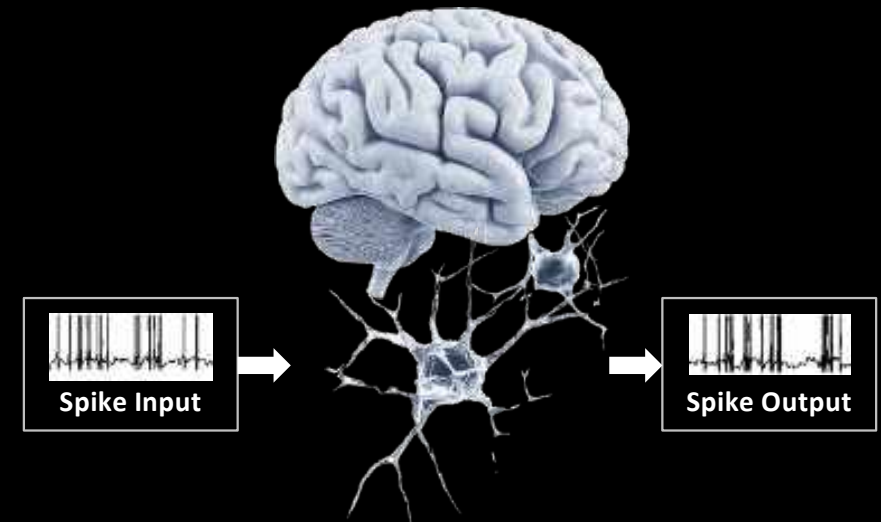


Neuromorphic Computing

Von Neumann Architecture (1945)



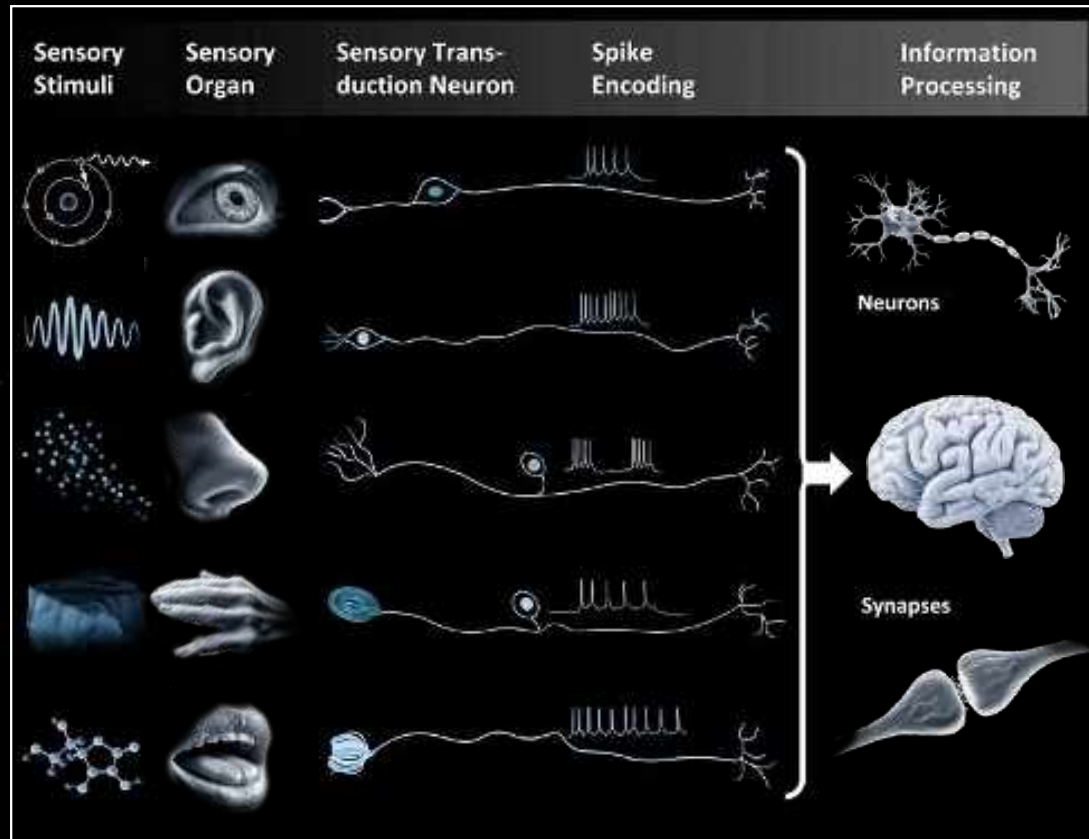
Von Nature Architecture (~ 1 750 000 BC)



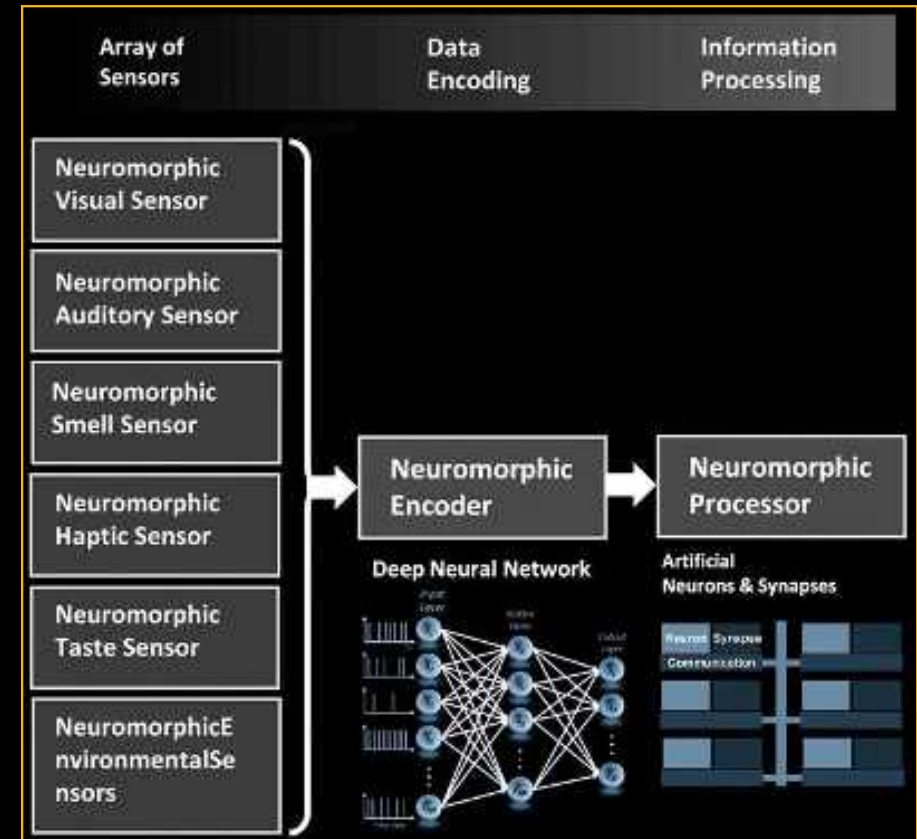
Sequential Processing	Operation	Massively parallel processing
Separated computation and memory	Organization	Collocated processing and memory
Code as binary instructions	Programming	Spiking neural networks
Binary data	Communication	Spikes
Synchronous (clock-driven)	Timing	Asynchronous (event-driven)

Biological vs. Neuromorphic Architecture

Biological Neural Network (BNN)



Bio-inspired Artificial Neural Network



Logic-based AI

→ *recognize*



1956 Dartmouth Conference: The Founding Fathers of AI

Logic-based
AI

1950s - 1980s

Rule-Based Systems
Expert Systems
(MYCIN, DENDRAL)
Reliance on hard-
coded logic and
rules

“Artificial Intelligence” Dartmouth Workshop Proposal 1956

We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

Perceptual AI

→ *perceive*



TIME Magazine (1996)



World Chess Champion Garry Kasparov
defeated by IBM Deep Blue

1997



Logic-based
AI

1950s - 1980s

Rule-Based Systems
Expert Systems
(MYCIN, DENDRAL)
Reliance on hard-
coded logic and
rules

Machine
Learning

1986s - 2010s

Statistical ML
Shift to Learning
from Data
Early Predictive
Engines

IBM Deep Blue

Learning AI

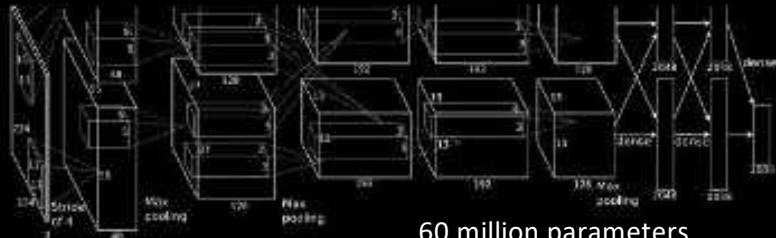
→ *learn*

AlexNet

Convolutional Neural Network (CNN)

Alex Krizhevsky, Ilya Sutskever, Geoffrey Hinton

2012



60 million parameters

650,000 neurons

8 layers



ImageNet Classification with Deep Convolutional Neural Networks:
Alex Krizhevsky, Ilya Sutskever, Geoffrey Hinton

Generative AI → generate



Generative Models
2014

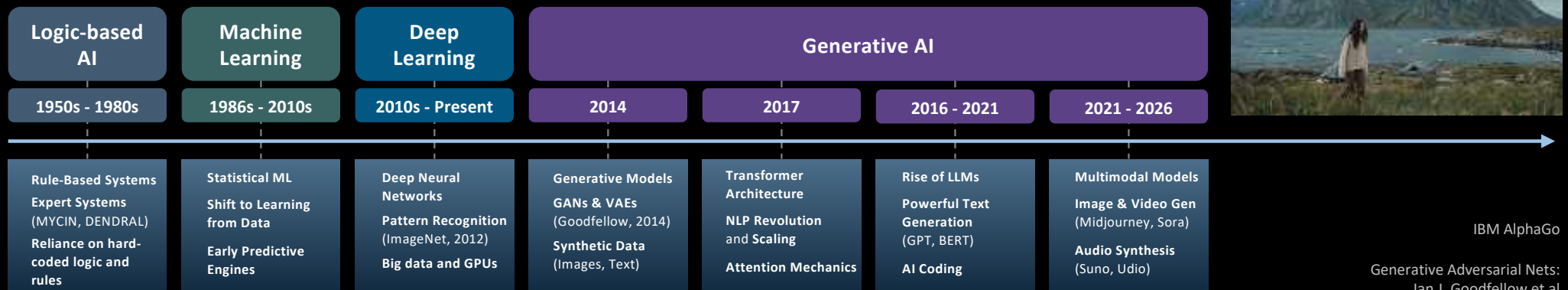


Nature Magazine (2016)

AlphaGo defeats Grandmaster Lee Sedol 2017



Generative AI Videos 2026



IBM AlphaGo

Generative Adversarial Nets:
Ian J. Goodfellow et al

Agentic AI

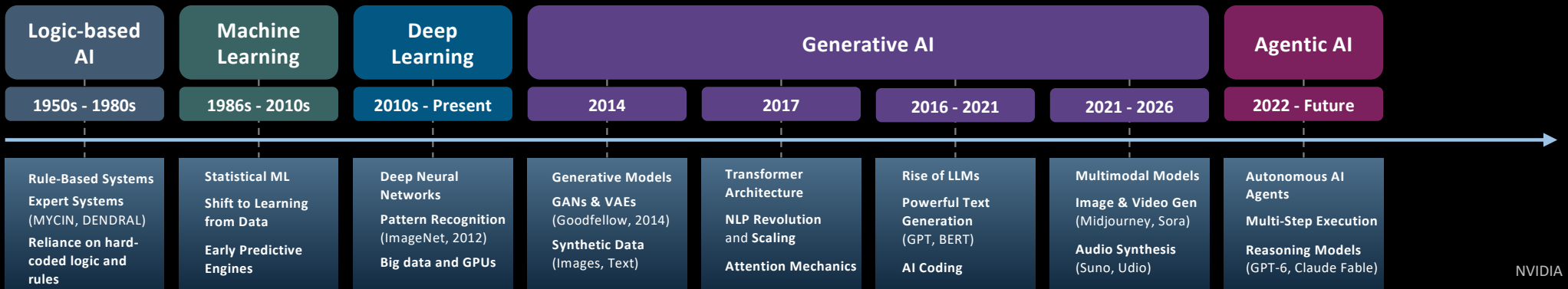
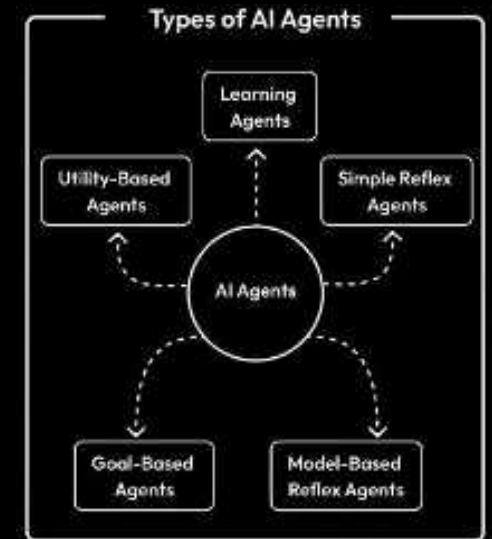
→ *decide & act*



TIME Magazine (2024)



AI Agents 2026



NVIDIA

Physical AI

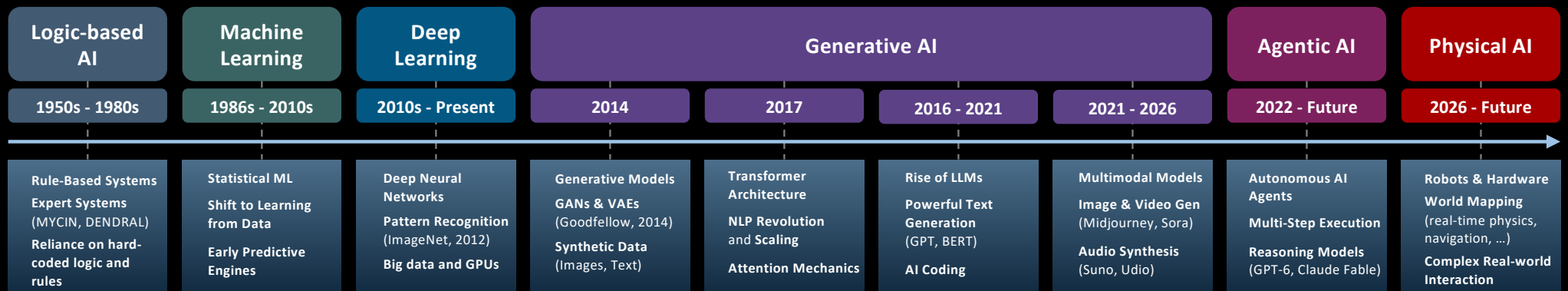
→ *physical interact*



Real-time
Robot Training



Deep Blue (1996/1997) > AlphaGo (2016) > AstraTennis: Humanoid Robot vs. Grand-slam winner Zheng Jie (2026)





Skill AI S1

Data needed per new Task: 1 video prompt

Deployment Time: Instant

Max Task Horizon: 10+ Minutes

Physical AI

AI that interacts with the Physical World



Physical AI

AI that interacts with the Physical World



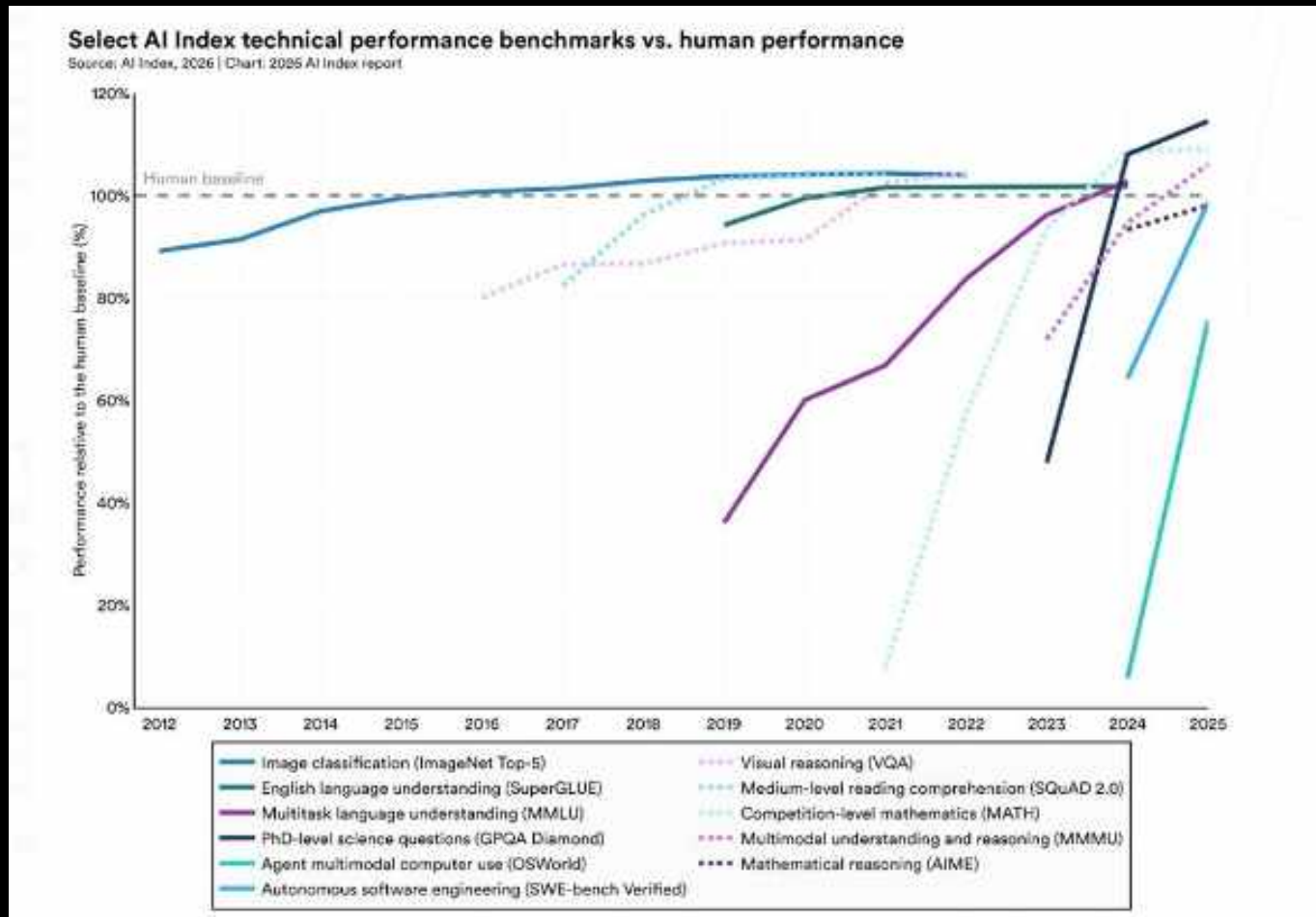
Physical AI: Bringing Intelligence into the Real World



The Global Frontier: Benchmarking the Top 10 AI Systems of 2026

Manufacturer, Model	Country	Strengths	Weaknesses	Best Use Case	€ / M	Mio. User/M	CII %
OpenAI GPT-6 Astra	USA	Autonomous computer control, advanced agentic workflows, excellent logical reasoning and coding	Very high resource consumption, restrictive safety filters, limited initial availability	Autonomous software agents, complex office and web automation, advanced system control	21-25	200 - 250	97,8
Anthropic Claude Mythos 5	USA	Text understanding, nuanced writing, complex documents	Higher latency in responses, stricter safety filters	Complex text analysis, contracts, nuanced academic writing	22-24	30 - 40	92,4
Alibaba Qwen Qwen3.8-Thinking	USA	Complex mathematical problems, logic	Significantly slower response times due to intensive "Thinking" process	Complex mathematics, science, deep logical puzzles	5,50	90 - 100	91,1
DeepSeek DeepSeek-R1	CN	Extremely efficient, low-cost reasoning	Lower performance on purely creative text compared to logic benchmarks	Cost-effective reasoning, logical chains, budget-conscious deployments	0	60 - 80	89,7
Google Gemini 3.1 Pro	USA	Massive context window for analyzing hours of video / entire codebases	Occasional hallucinations during extremely long content/text tasks	Multimodal large-scale projects, video analysis, massive document collections	21,99	250	88,5
SpaceXAI Grok 4.6	USA	Real-time information access, mathematics	Outputs unfiltered raw data from social media, lowering data quality	Real-time research, social media trends, fast fact-checking	33	25 - 35	87,2
Mistral AI Large 4	FR	High multilingual efficiency in European languages	Smaller ecosystem of native developer tools compared to US competitors	GDPR-compliant EU projects, multilingual European translations	17,99	10 - 15	83,1
Zhipu AI GLM-5	CN	Bilingual (Engl./Chin.), versatile tool usage	Drop in performance within purely Western cultural contexts	Cross-border projects, translation, Asian market contexts	18	35 - 45	81,4
Moonshot AI Kimi K3	CN	Extremely fast processing and structuring of massive text amounts	Weaknesses in complex, multi-step mathematical calculations	Extremely long text parsing, rapid report summaries	7	40 - 50	79,8
Meta Muse Spark 1.2	USA	Multimodal content, intuitive creative assistance	Weaknesses in purely logical programming tasks, deep analyses	Creative brainstorming, marketing copy, multimedia content	0	200	74,5

The 2026 AI Index Report



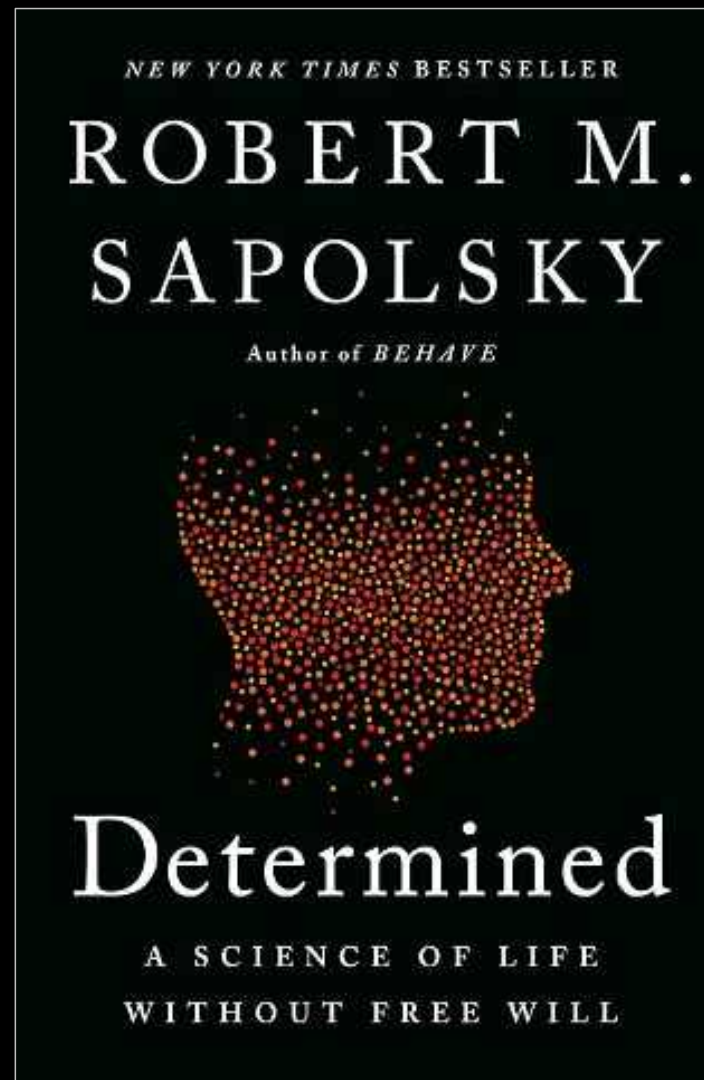


Robert M. Sapolsky
Professor of biology and
neurology at Stanford University
and the recipient of a MacArthur
Foundation 'Genius Grant'.

Determined

A Science of Life
Without Free Will

528 pages
Publisher: Penguin Press
(October 17, 2023)
ISBN-10 : 0525560971
ISBN-13 : 978-0525560975



One of our great behavioral scientists, the bestselling author of *Behave*, plumbs the depths of the science and philosophy of decision-making to mount a devastating case against free will, an argument with profound consequences.

Robert Sapolsky's *Behave*, his now classic account of why humans do good and why they do bad, pointed toward an unsettling conclusion: we may not grasp the precise marriage of nature and nurture that creates the physics and chemistry at the base of human behavior, but that doesn't mean it doesn't exist. Now, in *Determined*, Sapolsky takes his argument all the way, mounting a brilliant (and, in his inimitable way, delightful) full-frontal assault on the pleasant fantasy that there is some separate self telling our biology what to do.

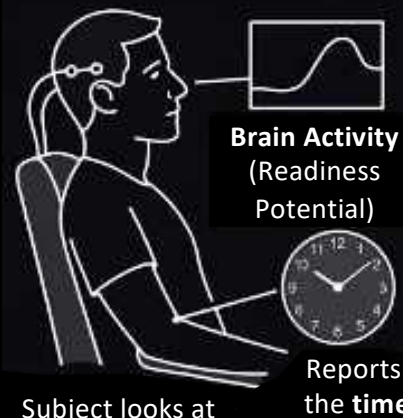
Determined offers a marvelous synthesis of what we know about how consciousness works—the tight weave between reason and emotion and between stimulus and response in the moment and over a life. One by one, Sapolsky tackles all the major arguments for free will and takes them out, cutting a path through the thickets of chaos and complexity science and quantum physics, as well as touching ground on some of the wilder shores of philosophy. He shows us that the history of medicine is in no small part the history of learning that fever and fever things are somebody's "fault"; for example, for centuries we thought seizures were a sign of demonic possession.

Yet, as he acknowledges, it's very hard, and at times impossible, to unscoble from our zeal to judge others and to judge ourselves. Sapolsky applies the new understanding of life beyond free will to some of our most essential questions around punishment, morality, and living well together. By the end, Sapolsky argues that while living our daily lives recognizing that we have no free will is going to be monumentally difficult, doing so is not going to result in anarchy, pointlessness, and existential malaise. Instead, it will make for a much more humane world.



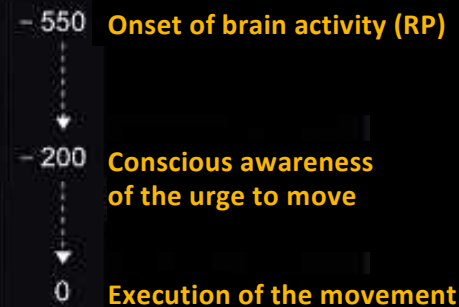
The Libet-Experiment (1985)

Experimental Setup



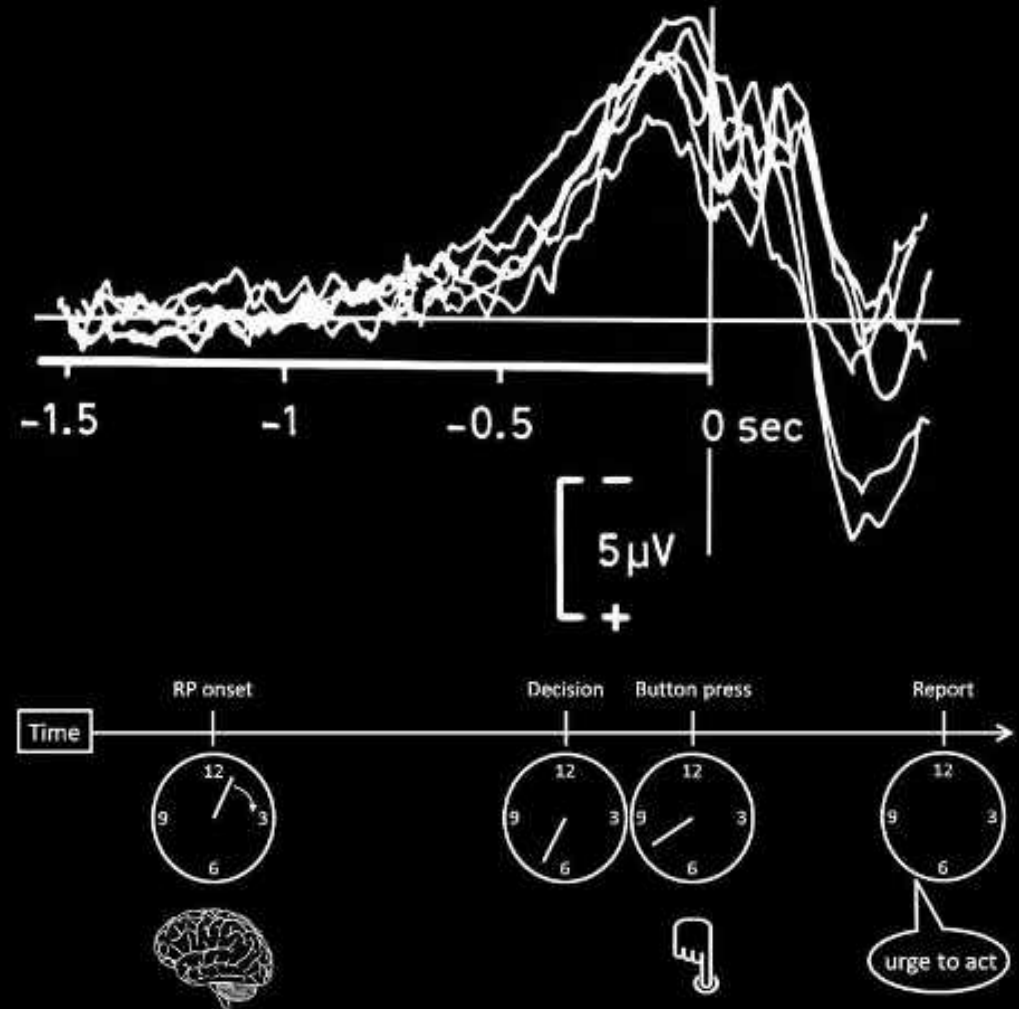
Subject looks at a clock with a moving dot when the movement became conscious

Timeline of EEG Readout (Readiness Potential)

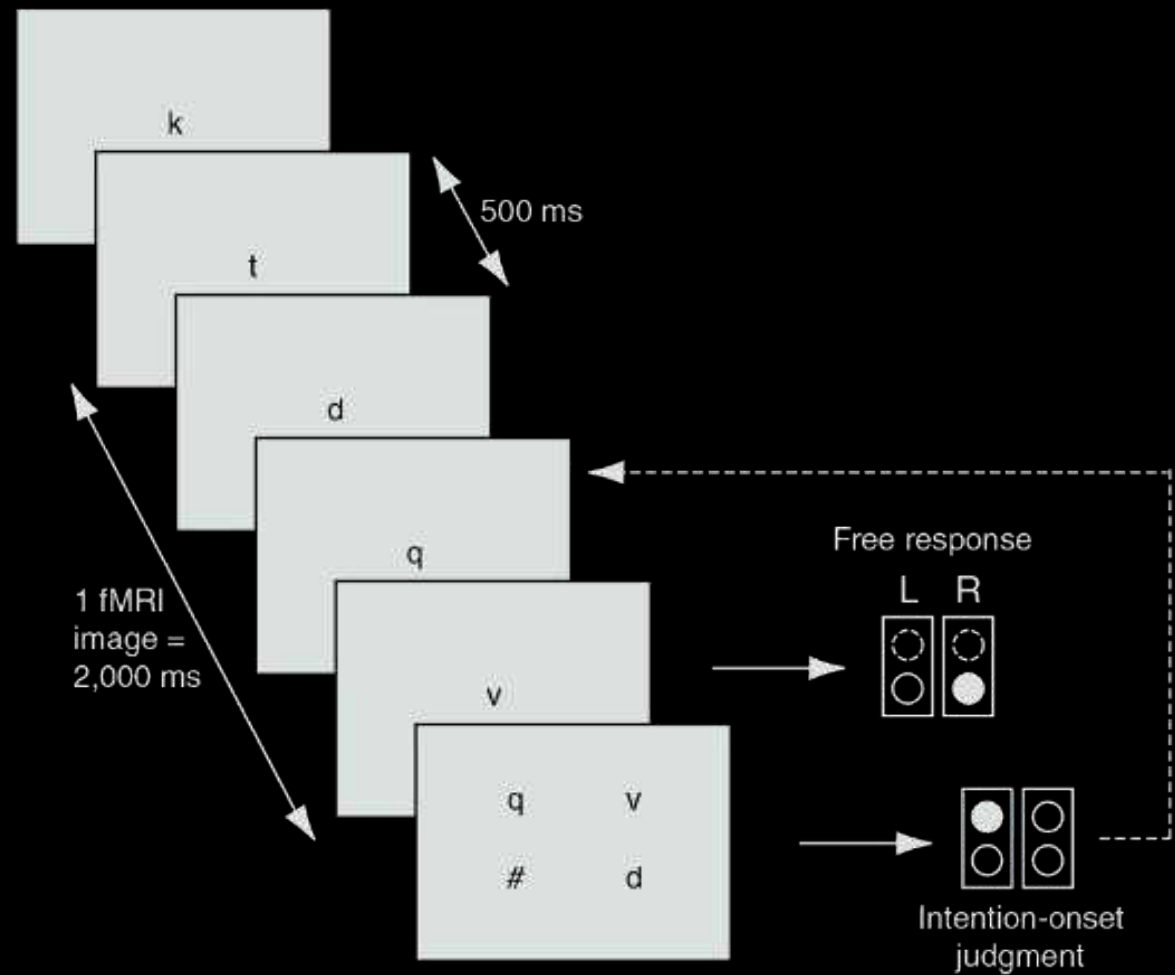
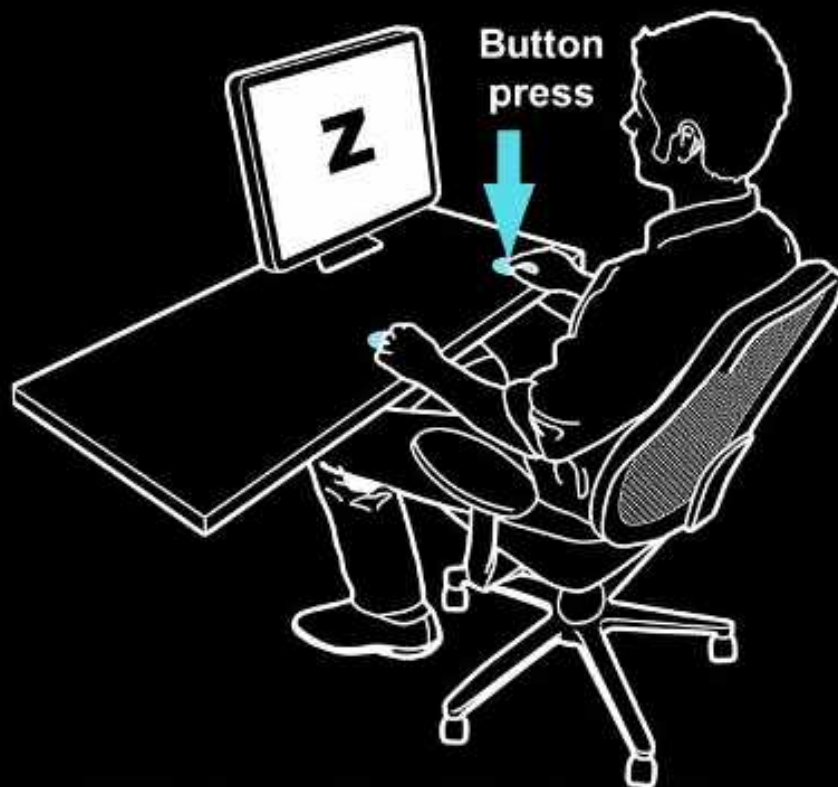


Result:

The brain begins preparing the action long before the person is consciously aware of the intention.

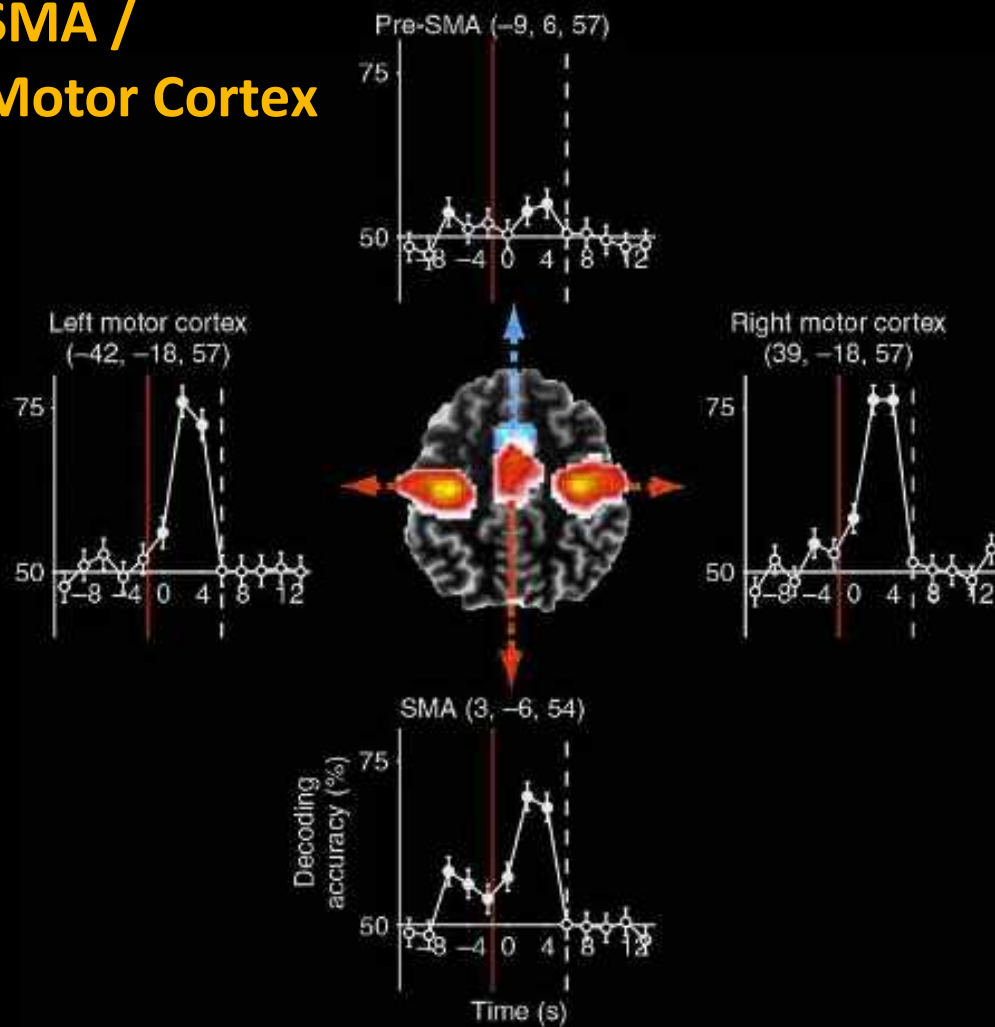


The Haynes-Experiment (2008)

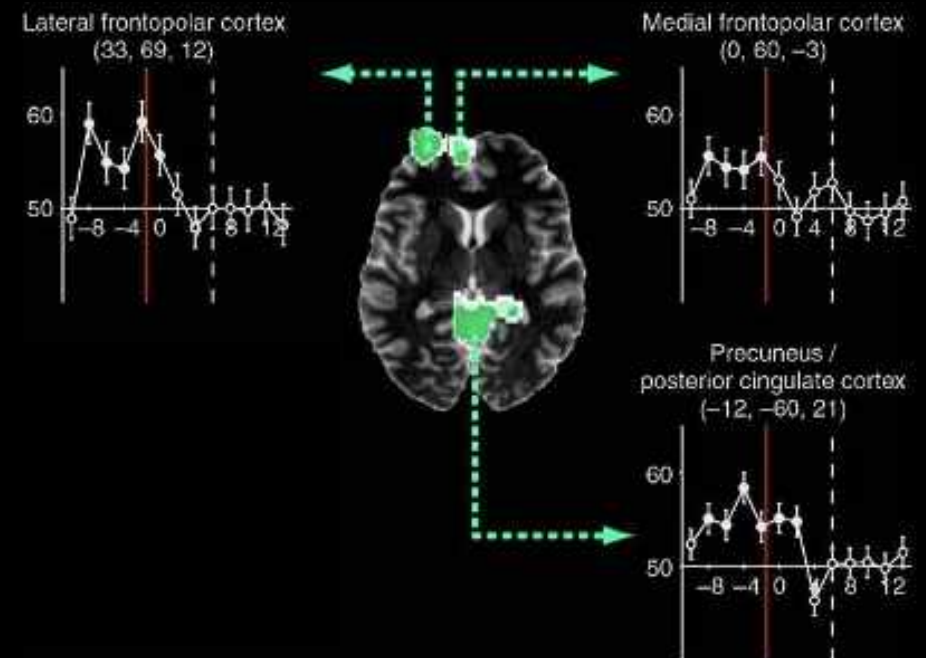


Chun Siong Soon^{1,2}, Marcel Brass^{1,3}, Hans-Jochen Heinze⁴ & John-Dylan Haynes:
Unconscious determinants of free decisions in the human brain. *nature Neuroscience*, 2008.

SMA / Motor Cortex



Frontopolar Cortex Parietal Cortex



Chun Siong Soon^{1,2}, Marcel Brass^{1,3}, Hans-Jochen Heinze⁴ & John-Dylan Haynes:
Unconscious determinants of free decisions in the human brain. *nature Neuroscience*, 2008.

Free Will is an Illusion ...

Neural Determinism

Brain activity initiates decisions fractions of a second **before we become consciously aware** of making them, as demonstrated by Benjamin Libet's experiments.

Role of Genetics and Environment

Overlapping **biological factors** and **lifelong experiences** shape our personalities and thoughts, forming the **unchosen foundation for every decision**.

The Illusion of Free Will

The feeling of free will is a **trick of the mind**; the brain generates a sensation of intent even though **choices are entirely dictated by prior, unconscious causes**.

Compassion and Understanding

Because **no one has ultimate control** over their actions, society should **abandon retributive punishment** and pivot toward **prevention, rehabilitation, and understanding**.

"All we are is the outcome of what came before."

...

Univ.-Prof. Robert M. Sapolsky, interview at
SMERCONISH BOOK CLUB on CNN, Dec 30, 2023





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