The Machine With Two Brains

Paths From Computers To Thinking Machines

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Our topics for today...

- Some early history
- The AI cliff
- A digression on flying
- AI's two brains
- Synthesis & hypothesis

40 years ago, we *almost* had thinking machines

1968: Engelbart—First computer mouse
Minsky—Semantic Information Processing

Example: story problems

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(THE PROBLEM TO BE SOLVED IS)
(THE DISTANCE FROM NEW YORK TO LOS ANGELES IS 3000 MILES .
IF THE AVERAGE SPEED OF A JET PLANE IS 600 MILES PER HOUR ,
FIND THE TIME IT TAKES TO TRAVEL FROM NEW YORK TO LOS ANGELES
BY JET .)

(THE TIME IT TAKES TO TRAVEL FROM NEW YORK TO LOS ANGELES BY
JET IS  5 HOURS)
```

Bobrow's *STUDENT* solves a story problem

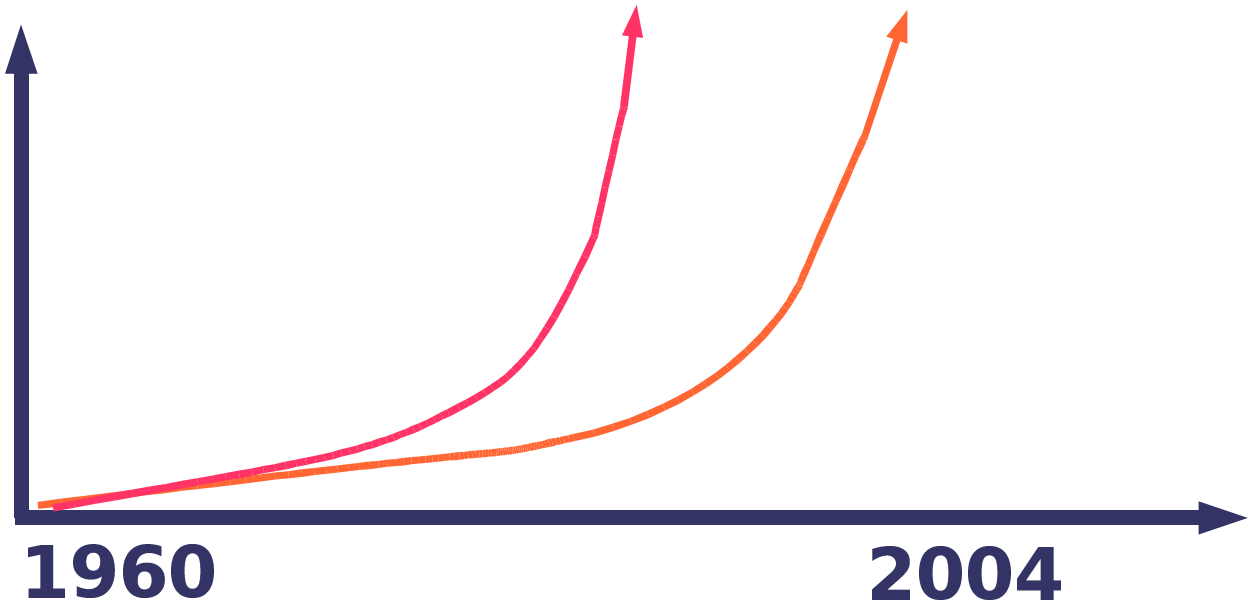
Example: geometric analogies

A geometric analogy solved by Evans' *ANALOGY*

The punch line

- **Bobrow: with “a much larger memory machine”, “communicate well in English” over limited domain**
- **Evans: similar comments**

What went wrong?



Moore's Law
vs
Estimated Brute Force Effort

Why think it could *ever* work?

- **Nature is smart**

- **Logic is powerful**

$$\frac{A,\ A \supset B}{B}$$

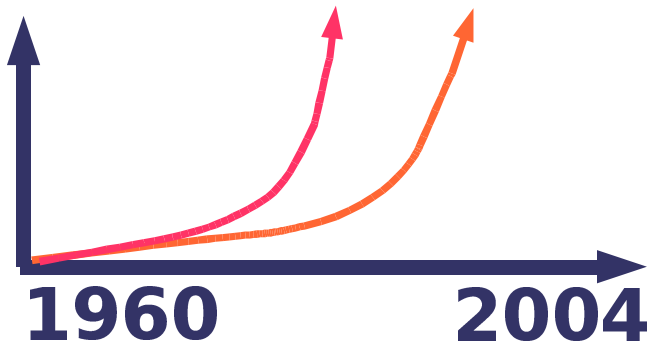
Toward flying machines

Da Vinci's Ornithopter: Fly by flapping mechanical wings

First principles

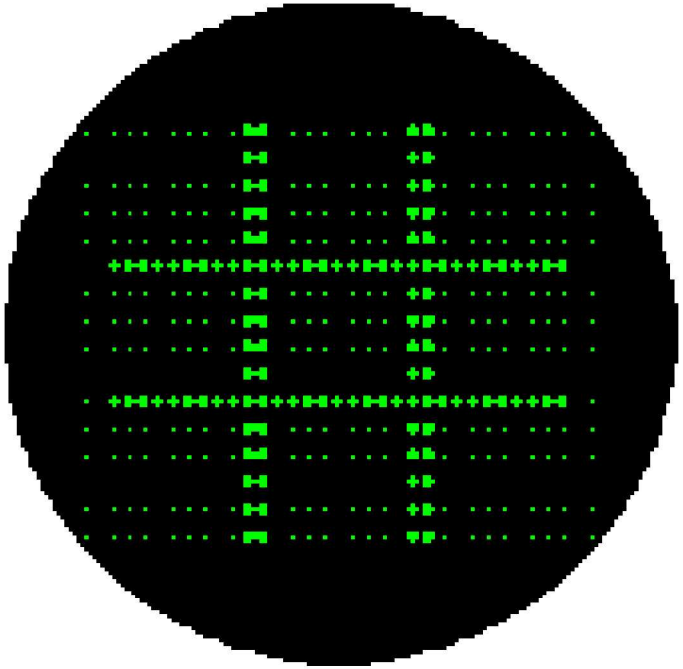
Montgolfier's Balloon: Fly using physics of hot air

Toward thinking machines



- **Logic is powerful: work from first principles?**
- **Nature is smart: emulate natural intelligence?**

Automated Reasoning



1952: A.S. Douglas' *OXO* plays Tic-Tac-Toe on the EDSAC

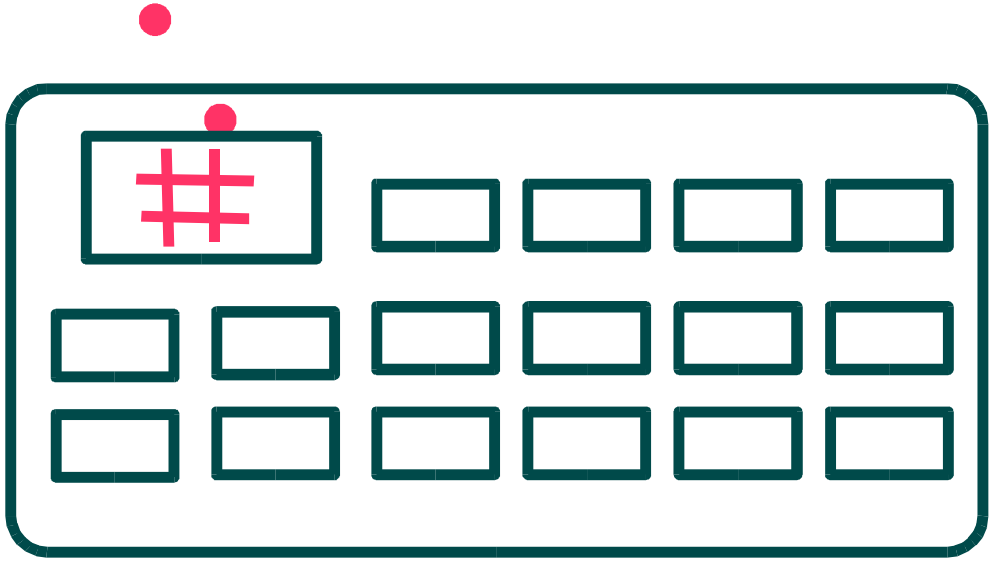
Computer Chess

The IBM Deep Blue Team: Reasoning and heuristic search

CYC

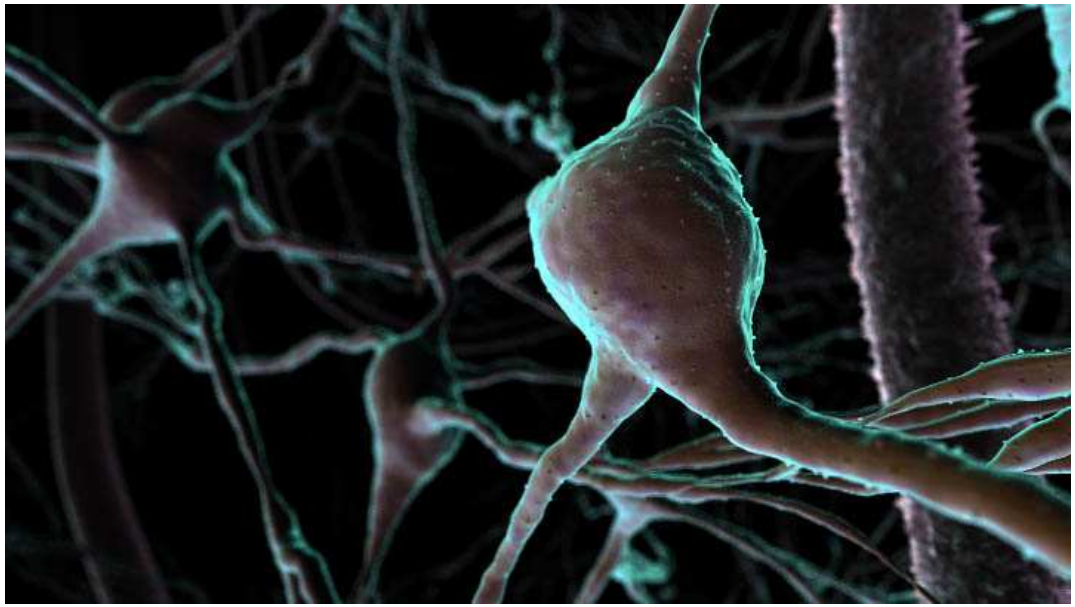
- Lenat, after EURISKO
- 20 years old now
- Giant funding, business
- Does not appear to actually do anything useful
- “More research is needed”

Machine Learning



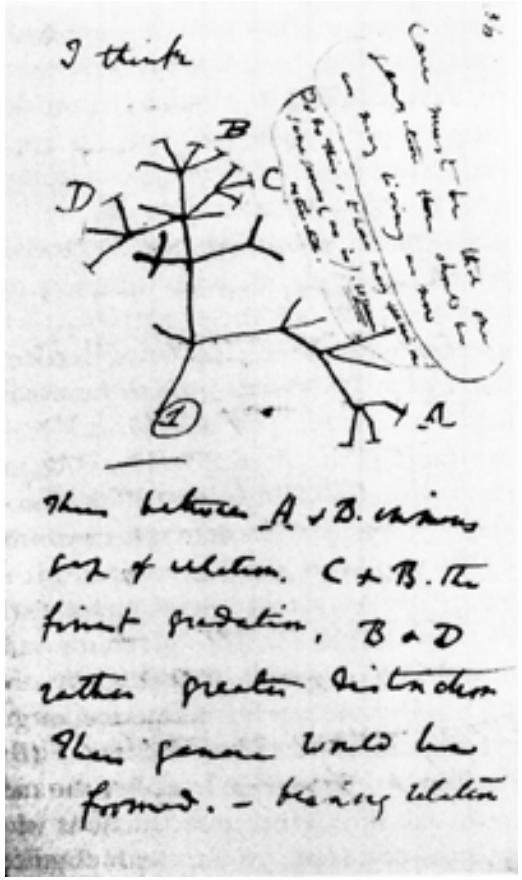
1959: Michie's MENACE learns to play “noughts-and-crosses” on a set of matchboxes

Brain cells



Minsky & Papert's *Perceptrons*:
ANNs learn “like brain cells”

Selective learning



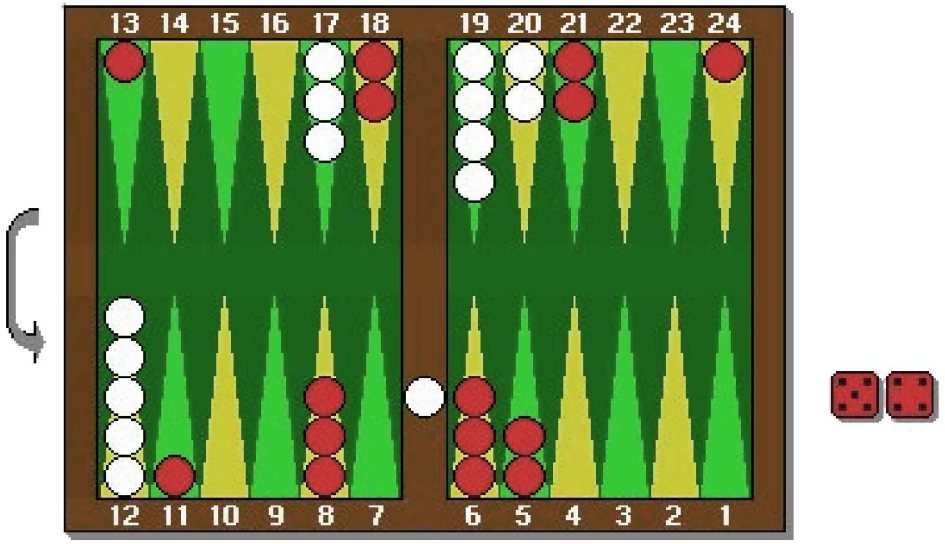
Slightly altering a model in different ways, then keeping those that work best = "learning" through Genetic Algorithms

Let's do both!

- **The dichotomy just presented is false**
  - **Modern flying machines use bird-inspired wings and physics inspired engines**
  - **Modern AI systems use heuristics, search, ML, and many modeling techniques**

Modern AI: Games

- **Backgammon**
- **Bridge**
- **Scrabble**
- **Crosswords**



Modern AI: Language

- **Speech recognition**
- **Language translation**

Ladder to the moon

How to build a ladder to the moon?
One step at a time?
Or in one giant leap?