

ME 620 - Fundamentals of AI

Lecture 1: Introduction to Artificial Intelligence - I



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Quest for Artificial Intelligence

The quest for Artificial Intelligence began with dreams as all quests do.

People have long imagined machines endowed with human abilities automata that move and devices that reason.

Human-like automatons are described in many stories and are pictured in sculptures, paintings, and drawings.

Dreams and Dreamers



Aristotle (384 - 322 BC)
The Politics

For suppose that **every tool** we had could **perform its task**, either **at our bidding** or **itself** perceiving the need, and if like... self-moved they enter the assembly of gods; **shuttles in a loom** could **fly to and fro** and a plucker play a **lyre** of their **own accord**, then master craftsmen would have no need of servants nor masters of slaves.

Aristotle (384 - 322 BC)
The Politics

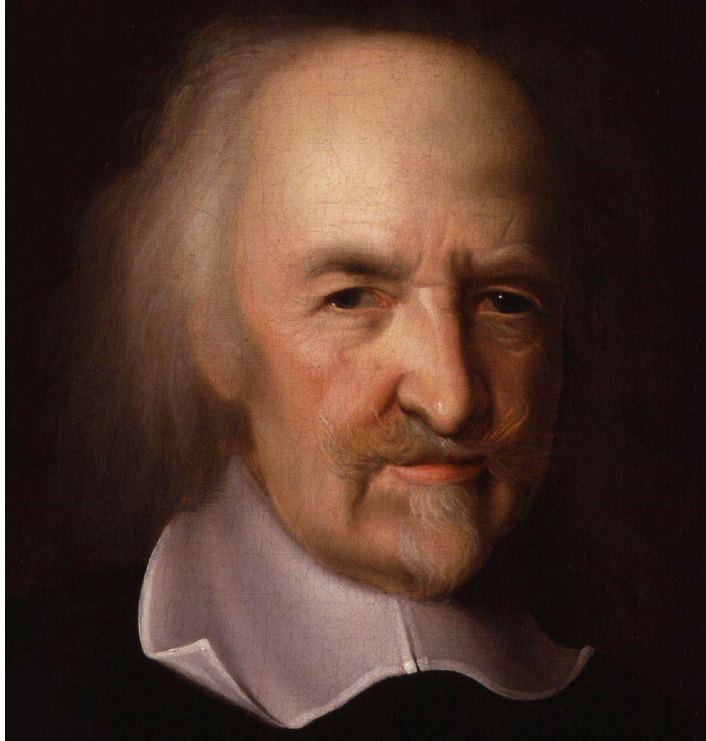
Dreams and Dreamers



Leonardo Da Vinci sketched designs for a humanoid robot in the form of a medieval knight around the year 1495.

No one knows whether Leonardo Da Vinci or his contemporaries tried to build his design. Leonardo's knight was supposed to be able to sit up, move its arms and head, and open its jaw.

Dreams and Dreamers



Thomas Hobbes (1588-1679)
Leviathan

For seeing **life is but a motion of limbs**, the beginning whereof is in some principal part within, **why may we not say that all automata** (engines that move themselves by springs and wheels as doth a watch) **have an artificial life?** For what is the heart, but a spring; and the nerves, but so many strings; and the joints, but so many wheels, giving motion to the whole body.

Thomas Hobbes (1588-1679)
Leviathan

Machines with True Intelligence



In 1950 Alan Turing published a landmark paper in which he speculated about the possibility of creating machines with true intelligence. He noted that "intelligence" is difficult to define and devised his famous Turing Test. The Turing Test was the first serious proposal in the philosophy of artificial intelligence.

A. M. Turing (1950) Computing Machinery and Intelligence. *Mind* 49: 433-460.

Can machines think?

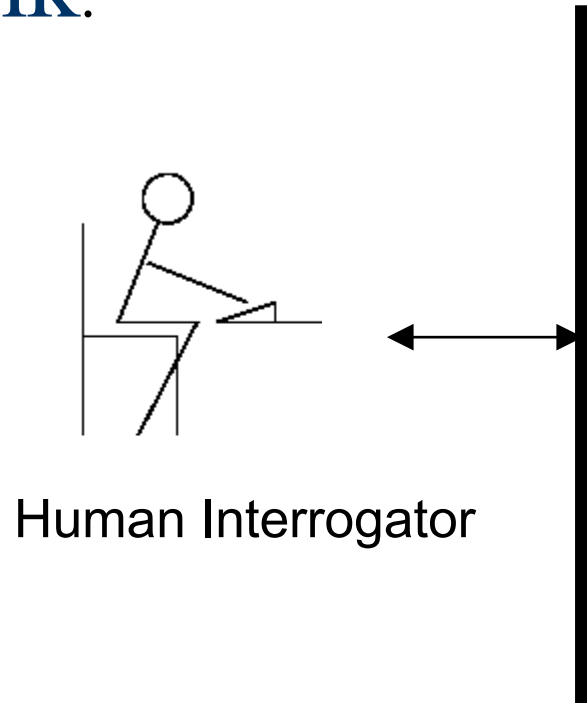
Alan Turing, **laying the ground** for what later became known as **artificial intelligence**, starts his landmark paper *Computing Machinery and Intelligence* with the words:

I propose to consider the question, ‘Can machines think?’

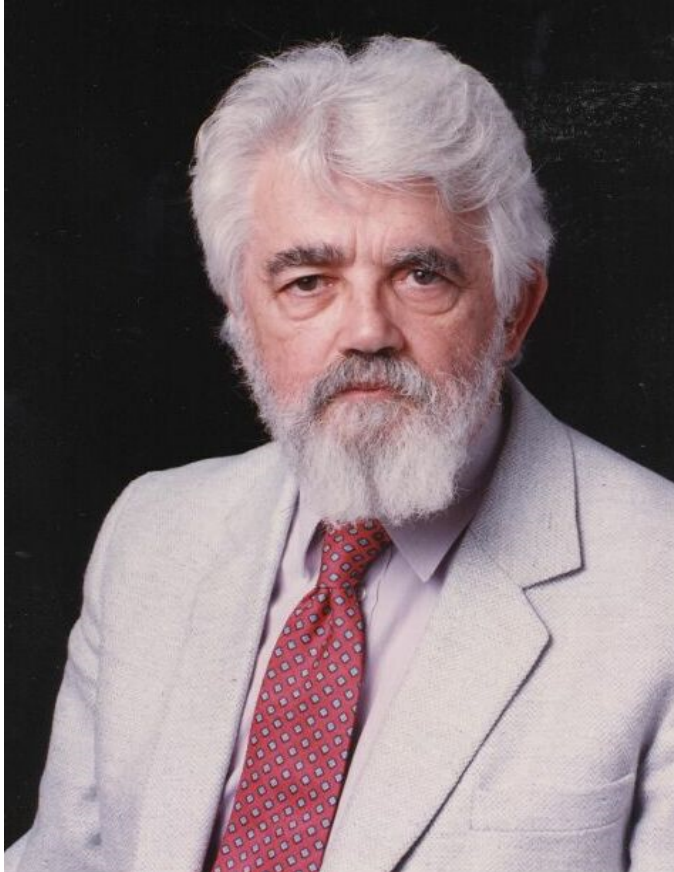
A. M. Turing (1950) Computing Machinery and Intelligence. *Mind* 49: 433-460.

Imitation Game

Turing test or *Imitation Game* as it was called in the paper, was put forth as a simple test that could be used to **prove that machines could think.**



Early Days of AI



In 1956 John McCarthy organized a conference to draw the talent and expertise in machine intelligence for a month of brainstorming. He invited them to Vermont for **The Dartmouth Summer Research Project on Artificial Intelligence**. From that point on, the field would be known as Artificial intelligence. The Dartmouth conference served to **lay the groundwork for the future of AI research.**

Term 'Artificial Intelligence'

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.

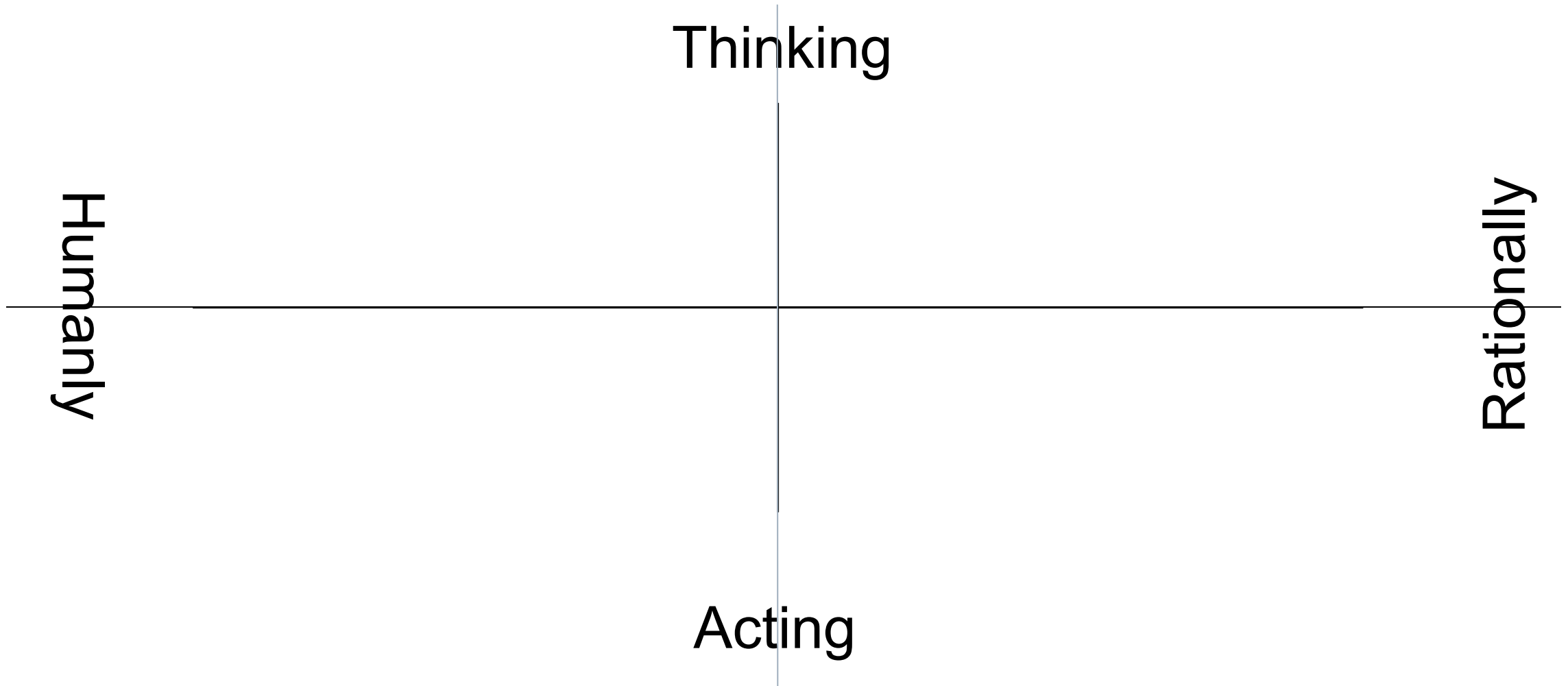
J. McCarthy, M. L. Minsky, N. Rochester, and C.E. Shannon. August 31, 1955.

John McCarthy is one of the "founding fathers" of artificial intelligence, together with Marvin Minsky, Allen Newell, and Herbert A. Simon.

What is Artificial Intelligence?

Artificial Intelligence is the ability of machines to seemingly think for themselves. Artificial Intelligence is demonstrated when a task performed by a human and thought of as requiring the ability to learn, reason and solve problems can be done by a machine.

Dimensions of Artificial Intelligence



Dimensions of Artificial Intelligence

1. Think like Human

- model human cognition

1960s "cognitive revolution": information-processing
psychology

Requires **scientific theories** of internal activities
of the **brain**

Thinking Humanly

The General Problem Solver, developed in 1957 by Alan Newell and Herbert Simon, embodied a grandiose vision: a single computer program that could solve *any* problem, given a suitable description of the problem.

The General Problem Solver caused quite a stir when it was introduced, and some people in AI felt it would sweep in a grand new era of intelligent machines.

Dimensions of Artificial Intelligence

2. Think Rationally

- formalize the inference process.

Several **Greek schools** developed various forms of *logic: notation* and *rules of derivation* for **thoughts**; may or may not have proceeded to the idea of mechanization

Line through **mathematics and philosophy** to modern AI.

Thinking Rationally

Aristotle was one of the firsts to attempt to codify "thinking". His syllogisms provided patterns of argument structure that always gave correct conclusions, given correct premises.

Example:

All computers use energy.

Using energy always generates heat.

Therefore, All computers generate heat.

Dimensions of Artificial Intelligence

3. Act Rationally

- doing the right thing

Rational behavior: **doing the right thing** - one which is expected to maximize goal achievement, given the available information

Does **not necessarily involve thinking**
– e.g., bionic reflex.

Acting Rationally

It is more general than the logical approach.

Amenable to scientific development than approaches based on human behavior or human thought

Achieving perfect rationality in complex environments is not possible because the computational demands are too high.

Dimensions of Artificial Intelligence

4. Act like Human

- exhibit human behaviour

Creating machines that perform functions that require intelligence when the same tasks are performed by people.

Underlines the Turing Test approach to define intelligence.

Intelligence requires Knowledge

Knowledge accrues through a process of **learning**.

Machines need the **ability to explore the world** and **acquire the requisite knowledge** they need, for problem solving **on their own**.

Drives the idea of **Machine Learning**.