Introduction to Artificial Intelligence

Introduction

Andres Mendez-Vazquez

December 25, 2018

Outline

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A History of Ideas [1]

Any quest on human history begins with a dream

- After all People have long imagined machines with human abilities.

Human-like machines are described in many stories

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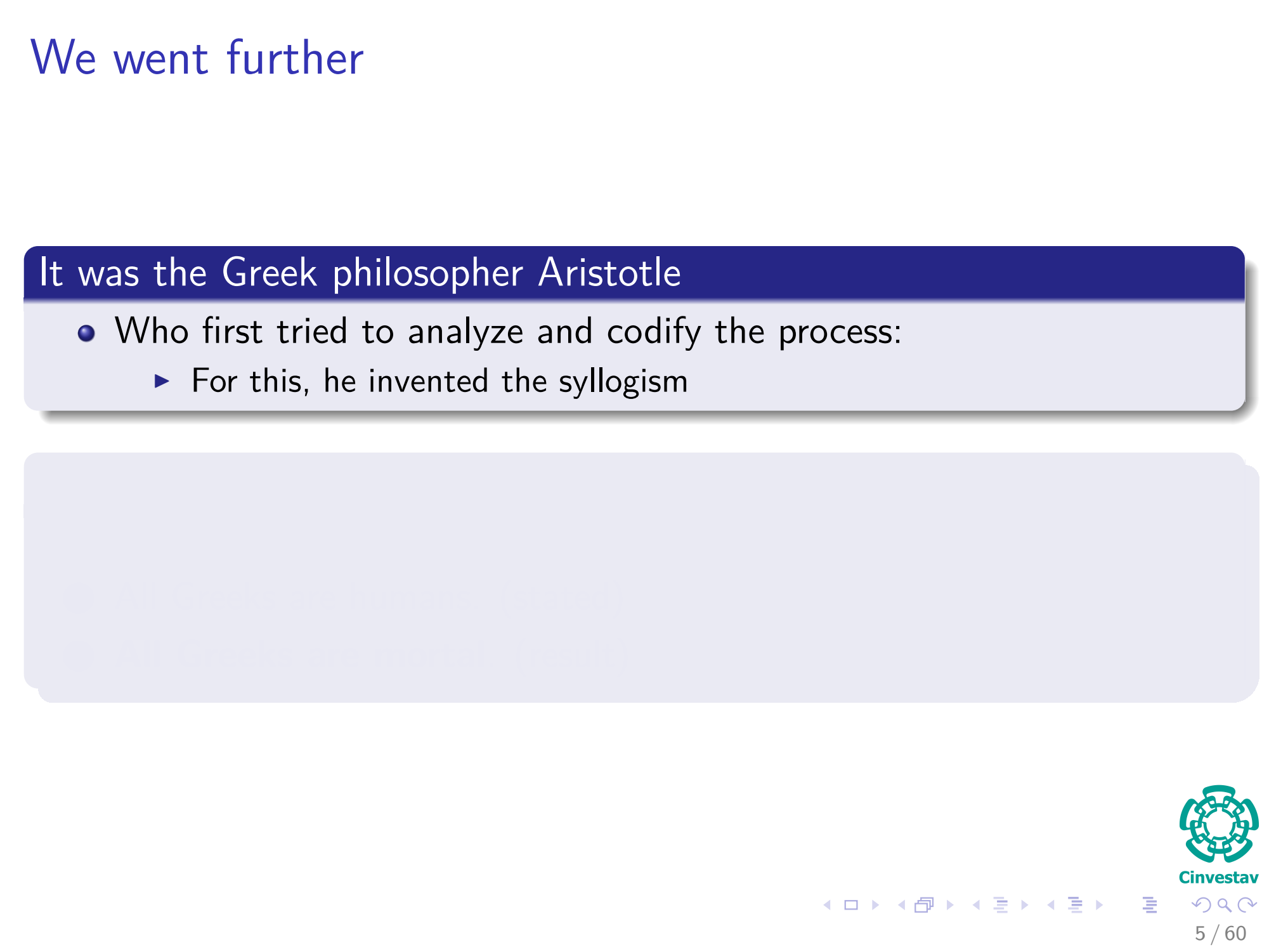
We went further

It was the Greek philosopher Aristotle

- Who first tried to analyze and codify the process:
  - For this, he invented the syllogism



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1. All humans are mortal. (stated)
2. All Greeks are humans. (stated)
3. All Greeks are mortal. (result)

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2. All Greeks are humans. (stated)
3. **All Greeks are mortal**. (result)

This open the door...

To automatize thought

1. All B's are A. (stated)
2. All C's are B's. (stated)
3. **All C's are** A. (result)

Talking about Expert Systems

Ramon Llull (circa 1235–1316)

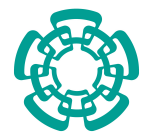
- A Catalan mystic and poet

Produced a set of paper discs called the Ars Magna

- A debating tool for winning Muslims to the Christian faith through logic and reason.

Basically

- An Early Expert System for the Apologetics
  - Remember two religious Empires (Catholics and Muslims) were in open confrontation....



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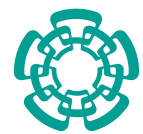

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- He wanted to mechanize reasoning
  - "It is unworthy of excellent men to lose hours like slaves in the labor of calculation which could safely be regulated to anyone else if machines were used"

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Thus, the quest for Artificial Intelligence

It has been always present in the last 2500 years

Question, What is Artificial Intelligence?

Outline

Question

What is Intelligence?

- Anybody has an idea?

Let me tell you how controversial is the term [2]

- From "Mainstream Science on Intelligence" (1994), an op-ed statement in the Wall Street Journal signed by fifty-two researchers (out of 131 total invited to sign)

They gave

- "A very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings-"catching on," "making sense" of things, or "figuring out" what to do."

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Look at this...

Researcher	Quotation
Alfred Binet	Judgment, otherwise called "good sense", "practical sense", "initiative", the faculty of adapting one's self to circumstances ... auto-critique.
Lloyd Humphreys	...the resultant of the process of acquiring, storing in memory, retrieving, combining, comparing, and using in new contexts information and conceptual skills"
Alexander Wissner-Gross	Intelligence is a force, F, that acts so as to maximize future freedom of action. It acts to maximize future freedom of action, or keep options open, with some strength T, with the diversity of possible accessible futures, S, up to some future time horizon, t. In short, intelligence doesn't like to get trapped. $F = T\nabla S_t$

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We have a PROBLEM!!!

Did you notice the following?

- **There is not a single viable Engineering based definition of Intelligence...**
  - **OOPSSS!!!**

Actually the situation is much worse

Something Notable

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  - Chomsky contends that many AI theorists have gotten bogged down with such things as statistical models and fMRI scans.

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Sydney Brenner

- Geneticist and Nobel Prize

He went to say that

- He was equally skeptical about new system approaches to understanding the brain.

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- The new AI and neuroscientist approach is some "form of insanity"

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An unlikely pair

- System Biology - a computational and mathematical modeling of complex biological systems
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  - Only a fraction of it is relevant!!! Question Which one?

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The Controversy

It will keep raging for the foreseeable future!!!

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Systems that think like humans	Systems that think rationally
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I propose something different

Thus, I propose a new hierarchy [4]

Mimicking how humans solve problems	**Mimicking how solving problems rational works**
Basically Mimicking how to Solve Problems	

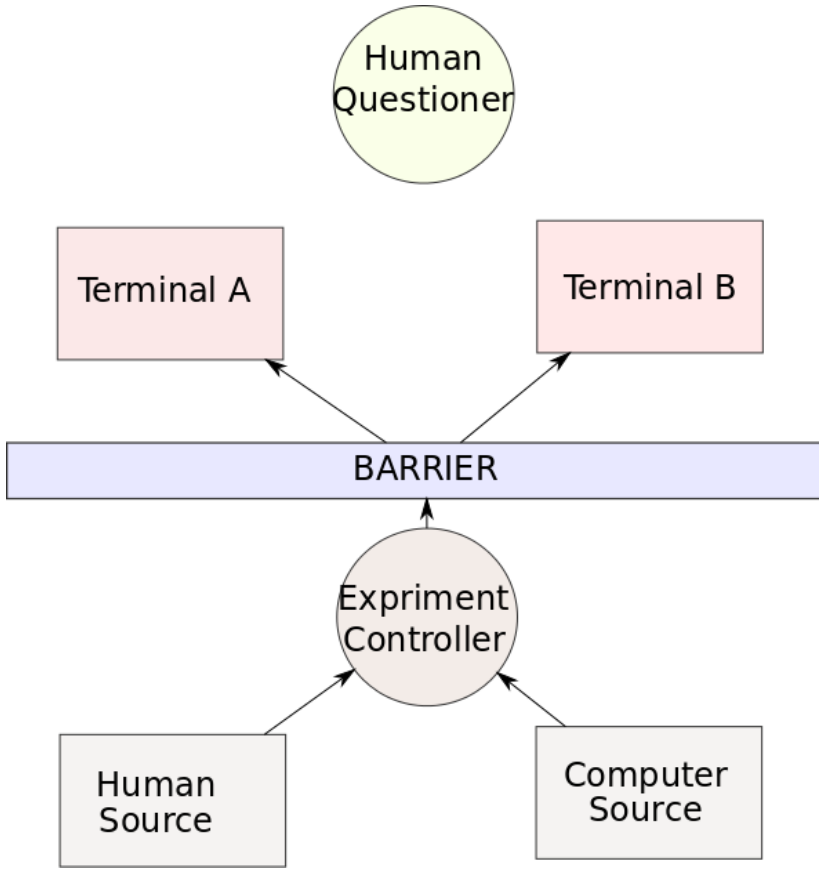
⇓ **"Imitation is the sincerest form of flattery"**
Oscar Wilde

Systems that look acting as humans	**Systems that look acting rationally**
Resulting of mimicking how humans act	Resulting of mimicking how how humans are rational

Outline

The Turing Test

- You have...
  - A human judge engages in a natural language conversation with one human and one machine, each of which tries to appear human.
  - All participants are placed in isolated locations.
  - If the judge cannot reliably tell the machine from the human, the machine is said to have passed the test.



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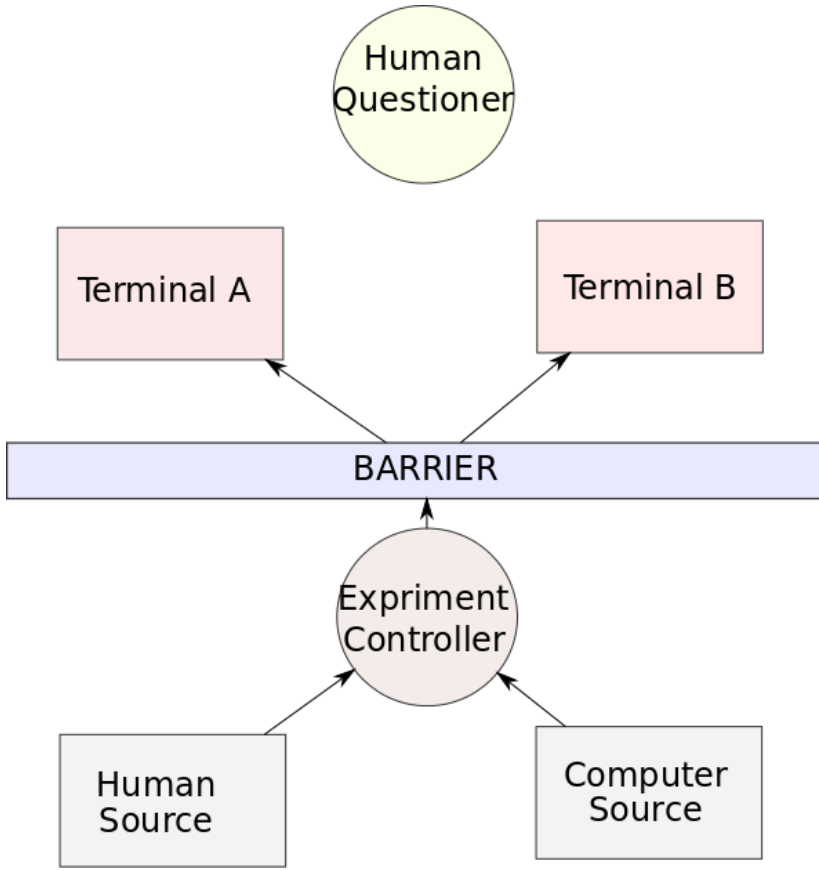

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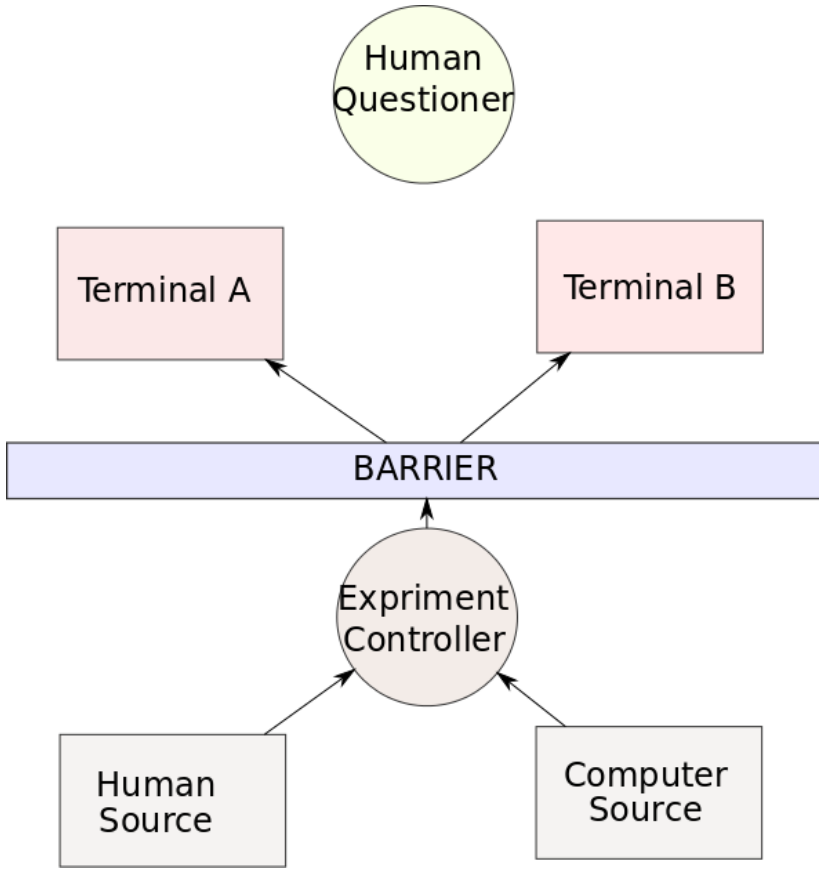

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Implications on several fields of the Turing Test

Natural Language Processing

- The machine needs to understand what you are saying.

Knowledge representation

- A precise talk needs a good knowledge representation of the subject.

Automated Reasoning

- Without logic who cares what are you saying

Machine Learning

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Total Turing Test's Implication

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Computer Vision

- It is used to perceive objects.

Robotics

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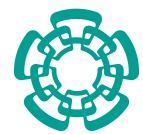
- He claimed that Strong AI is not even possible!!!



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- The computer program designed by a team of Russian and Ukrainian programmers.

Against 30 Judges

- It was able to fool them 33% of the time

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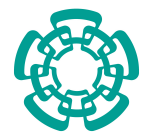

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- Resolution problem
  - PET and MRI work at the range of mm, but you have in a cubic mm 1,000,000 neurons!!!
- Difference Between Individuals
- Reproducibility and Replication Problems

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Use of Logic

- Development of the formal logic in the late 19th and early 20th century has give us:
- PROBLEM!!!

What?

A precise notation about all kinds of thing in the world and their relations between them.

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- PROBLEM!!!

What?

- It is not easy to take informal knowledge and state in the way the logical system need it.
- There is a big a difference between being able to solve a problem in principle and doing in practice.

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Strong AI vs. Weak AI

Strong AI

- **Strong AI is artificial intelligence that matches or exceeds human intelligence.**

Weak AI

- **Weak AI system which is not intended to match or exceed the capabilities of human beings.**

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AI founder John McCarthy writes

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He coined the term Artificial Intelligence

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Arguments Against Strong AI

Arguments

- **The first argument against strong AI is that it is impossible for them to feel emotions.**
- The second argument against strong AI is that them cannot experience consciousness.
- The third argument against strong AI is that machines never understand the meaning of their processing.
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David Cole, Philosophy Professor at University of Minnesota Duluth

"The Chinese Room argument has probably been the most widely discussed philosophical argument in cognitive science to appear in the past 25 years"

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What is this?

Chinese Room [5]

The Chinese room was introduced in Searle's 1980 paper "Minds, Brains, and Programs", published in Behavioral and BrainSciences.

Something Notable

- It eventually became the journal's "most influential target article".
- It is still generating an enormous number of commentaries and responses.

David Cole, Philosophy Professor at University of Minnesota Duluth

"The Chinese Room argument has probably been the most widely discussed philosophical argument in cognitive science to appear in the past 25 years"

Cinvestav

Against Strong AI

Searle's Experiment

- **Suppose that artificial intelligence research has succeeded in constructing a computer that behaves as if it understands Chinese.**
- Suppose, says Searle, that this computer performs its task so convincingly that it comfortably passes the Turing test in Chinese.
- Now, a human is in a closed room and that he has a book with an English version of the aforementioned computer program.

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The Chinese Room

It is the most damaging argument against "Strong AI"!!!

Even with the criticism against it

It is still a lingering question that the people in AI still cannnot answer!!!

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Funny Observations

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- Most of the discussion consists of attempts to refute it.

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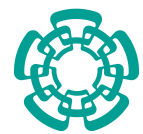
- "The overwhelming majority," notes BBS editor Stevan Harnad, "still think that the Chinese Room Argument is dead wrong."

It is more, Pat Hayes – An important AI researcher pointed out that

- Cognitive science ought to be redefined as "the ongoing research program of showing Searle's Chinese Room Argument to be false"



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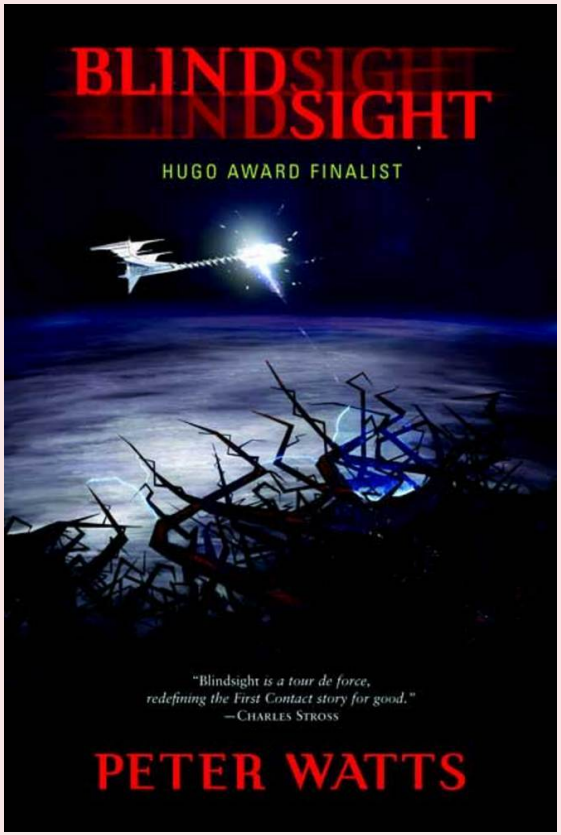
There is even a novel (Hugo Award Finalist)

Blindsight

- A hard science fiction novel
- By PhD Marine-Mammal biologist Petter Watts

Cover



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- Conscious is not necessary... and the universe is full with non-conscious intelligence!!!
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  - In "The Emperor's New Mind (1989)," he argues that known laws of physics are inadequate to explain the phenomenon of consciousness.
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For more, read...

Article

Hameroff, Stuart; Roger Penrose (2014). "Consciousness in the universe: A review of the 'Orch OR' theory". Physics of Life Reviews 11 (1): 39–78.

Outline

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Antiquity:

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Cinvestav

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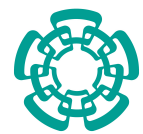

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The Fragmentation Years 1993-2009

AI was still going through a Winter

- **The Fragmentation Years**
  - Computer Vision
  - Robotics
  - Machine Learning
  - Fuzzy Logic
  - Bayesian Networks
  - Evolutionary Methods
  - etc

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Finally, 2010 to the present

Machine Learning

- It Becomes Mainstream....
- Even Computer Vision is using it...

Deep Learning

- It makes inroads thanks to the huge databases and GPU systems...

Massive Information Processing

- The new algorithms are allowing information retrieval at large scale...

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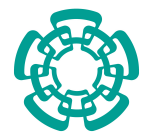

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