Unit 1: Introduction to Artificial Intelligence

Miguel A. Gutiérrez Naranjo

Departamento de Ciencias de la Computación e Inteligencia Artificial
Universidad de Sevilla

Inteligencia Artificial

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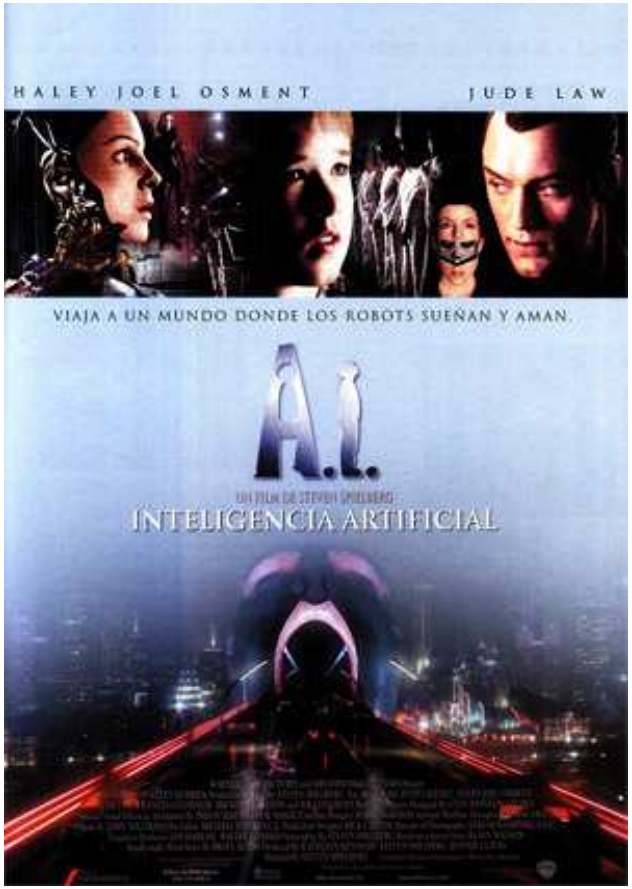
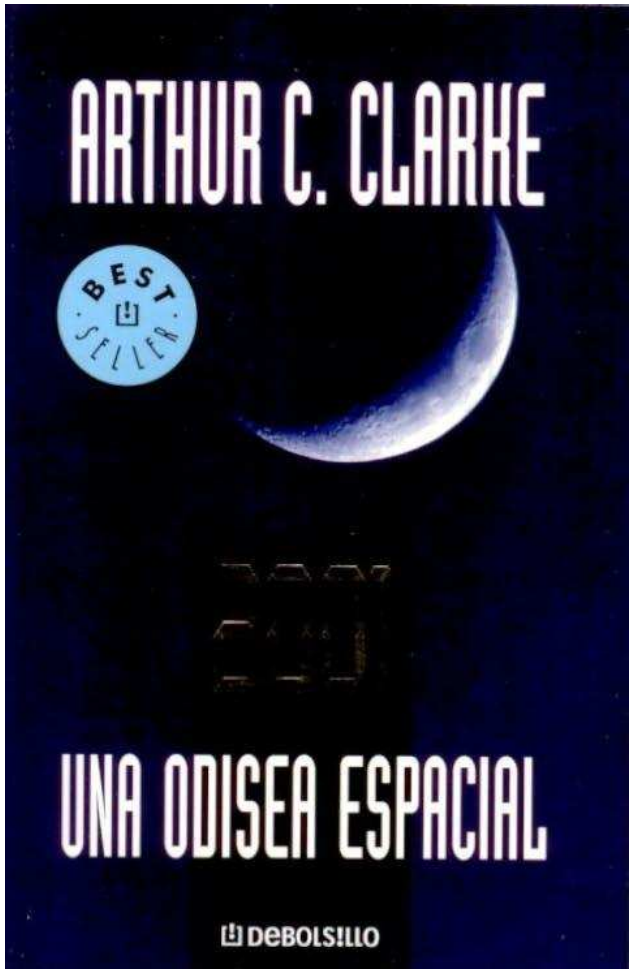
Preliminary notions I

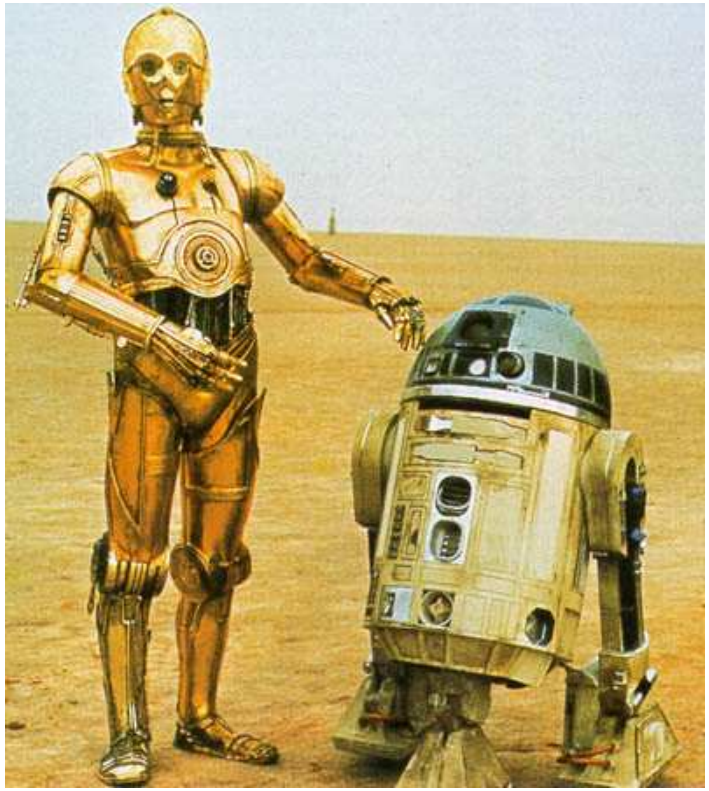


Artificial Intelligence (2001)
Steven Spielberg

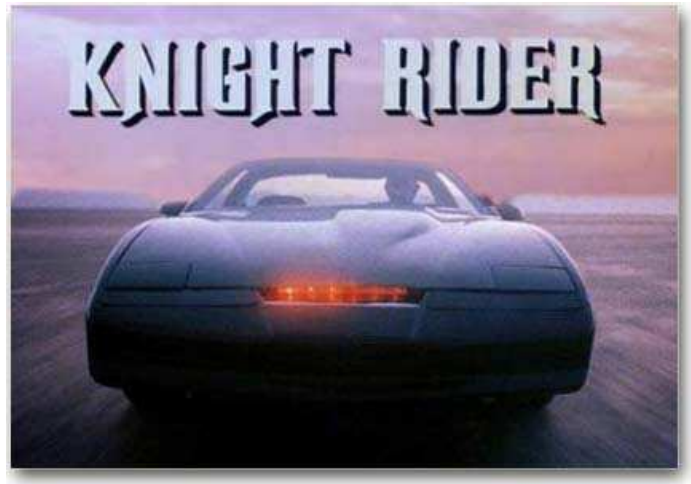


2001 A Space Odyssey (1968)
Arthur C. Clarke

Preliminary notions II



Star Wars (1977)
George Lucas



Knight Rider (1982)
Glen A. Larson

Merriam-Webster Dictionary

Intelligence

1. the ability to learn or understand or to deal with new or trying situations
2. the ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria (as tests)
3. the ability to perform computer functions
4. . . .

Artificial

1. humanly contrived often on a natural model : man-made
2. lacking in natural or spontaneous quality
3. . . .

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Coffee

A beverage made by percolation, infusion, or decoction from the roasted and ground seeds of a coffee plant. Is coffee *natural*?

Stone

A stone used to break open coconuts. Is it a *natural* or an *artificial* tool? What if the stone is used by a scavenger bird to break eggs?

DNA computer

Ehud Shapiro presented in 2004 a microscopic computer (molecular dimension) built out of synthetic DNA and enzimes, and proved to be able to effectively detect chemical signals which precede certain types of cancer *(Nature, 2004)* Is this *natural* or *artificial*?

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- We teach our nephew to play chess. After some time, on a *new* game, he is able to defeat us.
- We claim his *intelligence* made him win.

Our computer

- Our computer, on a *new* game, is able to defeat us.
- Is it because of his *intelligence*?

Intelligent machines

What should they do so that we can say they are *intelligent*?

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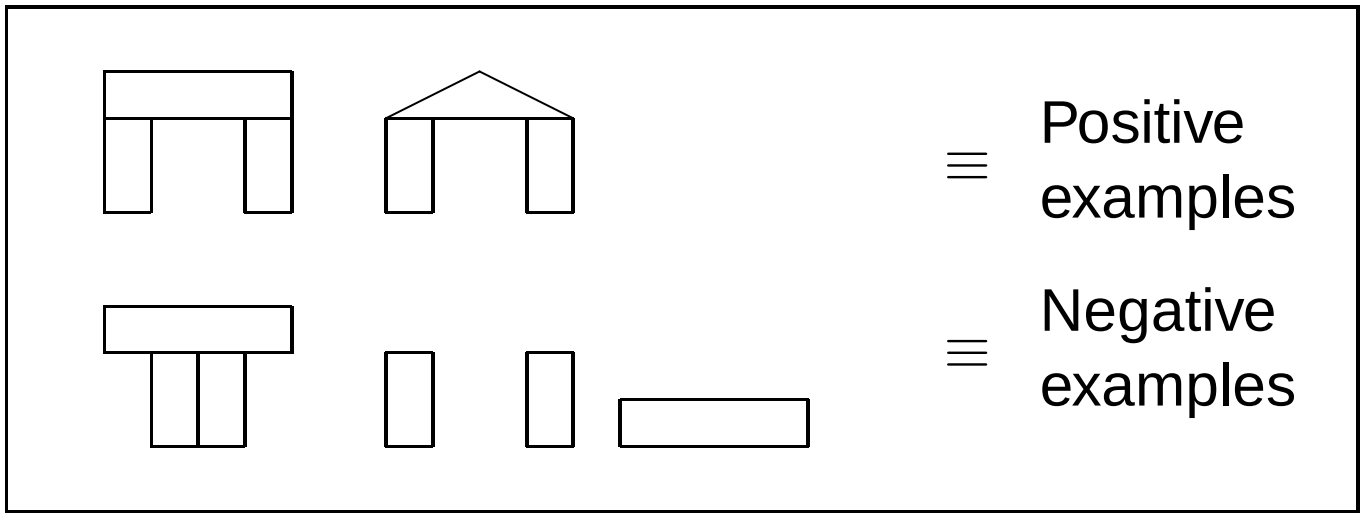
Learning

ARCHES - P. Winston 1975

Examples



Learning

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ARCHES - P. Winston 1975

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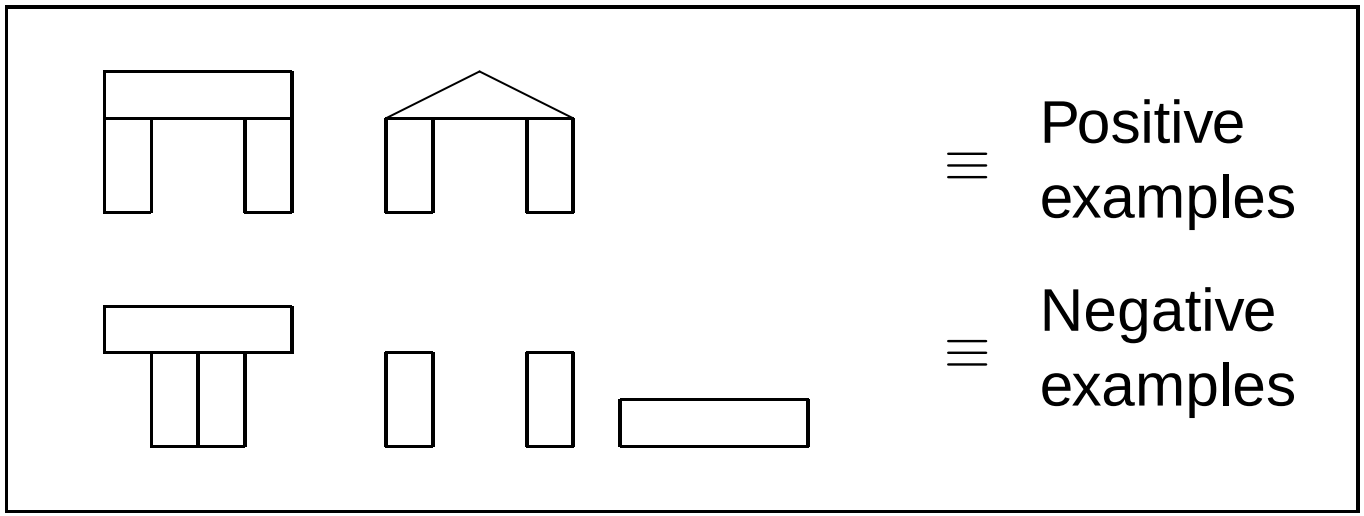
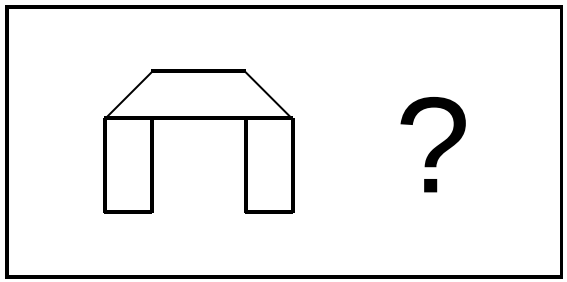


Learning



Learning

Kepler's third law

Kepler's third law (1618)

The square of the orbital period of a planet (time needed to make a complete tour around the Sun) is directly proportional to the cube of the average distance to the Sun.

BACON

BACON automatic learning system

(P. Langley, 1987) *redescovered* Kepler's third law.

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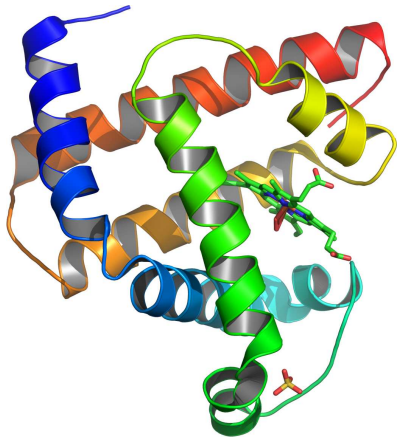
Learning

Proteins

Secondary structure of proteins



- The GOLEM system (Muggleton y Feng, 1992) was used for predicting the secundary structure of proteins.
- Its accuracy over an independient test was 82 %, while the best conventional method got a 73 % accuracy.

Learning

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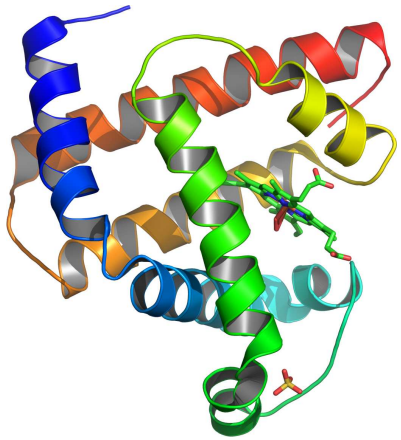

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Origin of aviation

- In 1903 the brothers Wilbur and Orville Wright become the first men to fly on a biplane with an engine; their first short flight takes place on December 17th in USA, Kitty Hawk (North Carolina), and is considered as the origin of the aviation. Prior to that only animals were able to fly by using their wings.
- Do planes actually *fly*?

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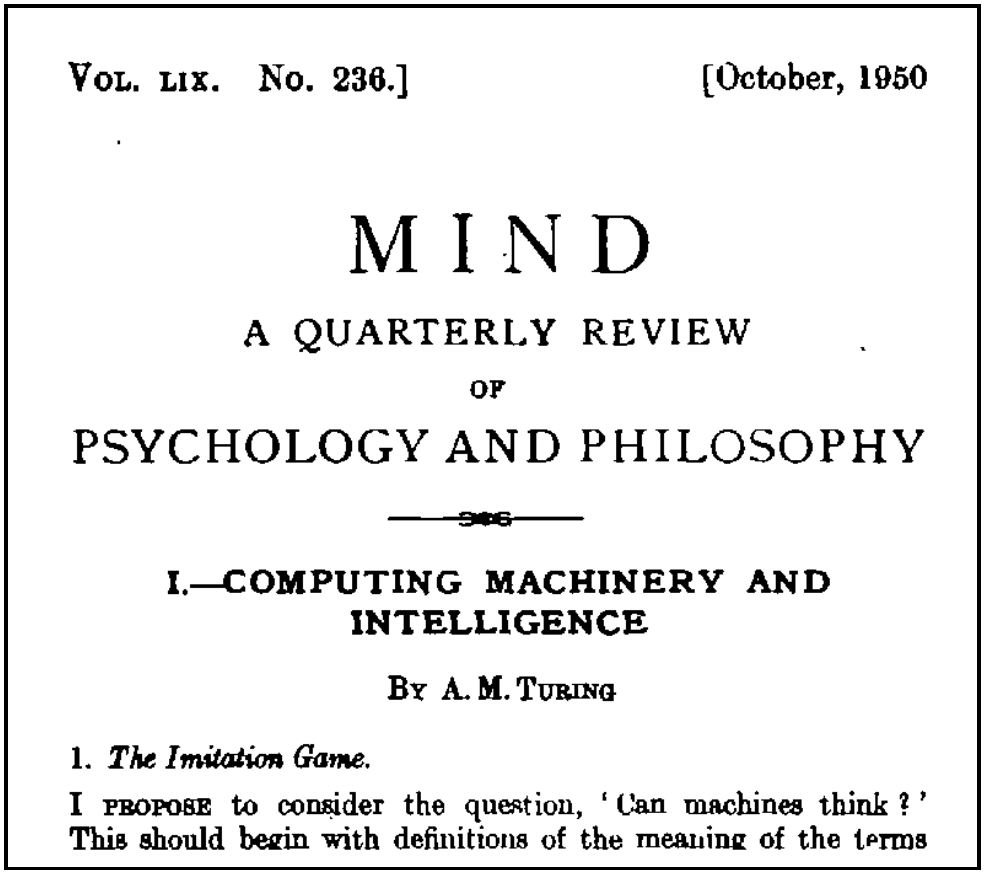
Alan Turing



VOL. LIX. No. 236.] [October, 1950

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND INTELLIGENCE

BY A. M. TURING

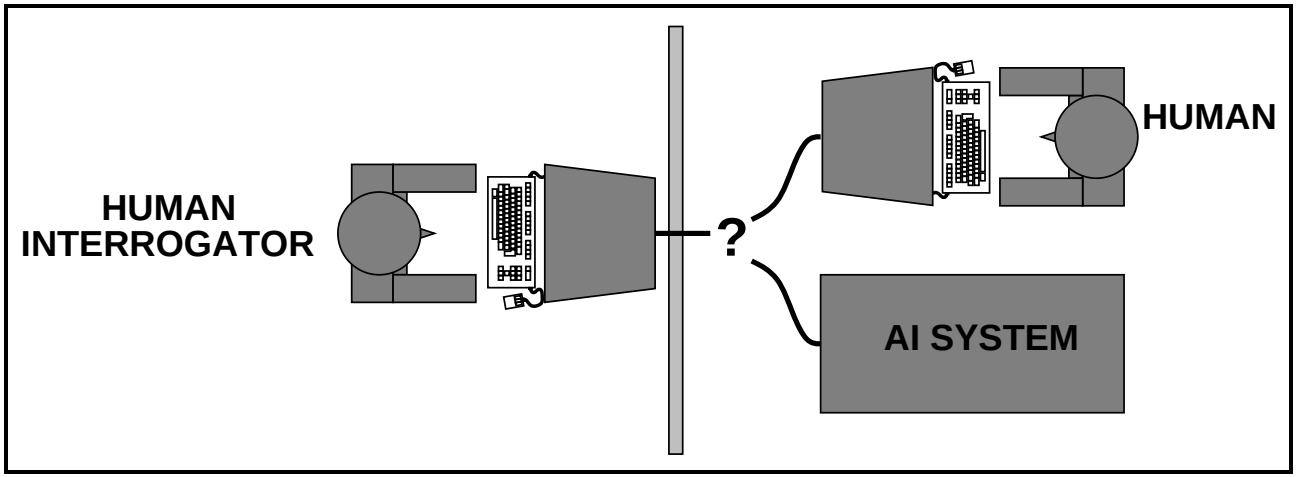
1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms

Alan M. Turing, (1950). Computing machinery and intelligence. *Mind*, 59, 433-460.

I propose to consider the question, Can machines think?

Turing Test



Turing test is not *reproducible*, *constructive*, and it cannot be subject of *mathematical analysis*.

Turing Test

- In 1990 the Loebner prize was created for the first machine able to pass the Turing Test.
- No machine has won the prize yet.

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Turing Test

September 26th, 2012

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Artificially intelligent game bots pass the Turing test on Turing's centenary

September 26, 2012

UT^2 game bot faces off against an opponent. Credit: Jacob Schrum

An artificially intelligent virtual gamer created by computer scientists at The University of Texas at Austin has won the BotPrize by convincing a panel of judges that it was more human-like than half the humans it competed against.

Roots

- Philosophy: Logic, reasoning systems
- Mathematics: Formal representation, algorithms, decidability, tractability, provability, . . .
- Linguistics: Formal languages, study of grammars, . . .
- Psicology: Adaptation, perception,. . .
- . . .

- Associated to the technological development of the phisical support.

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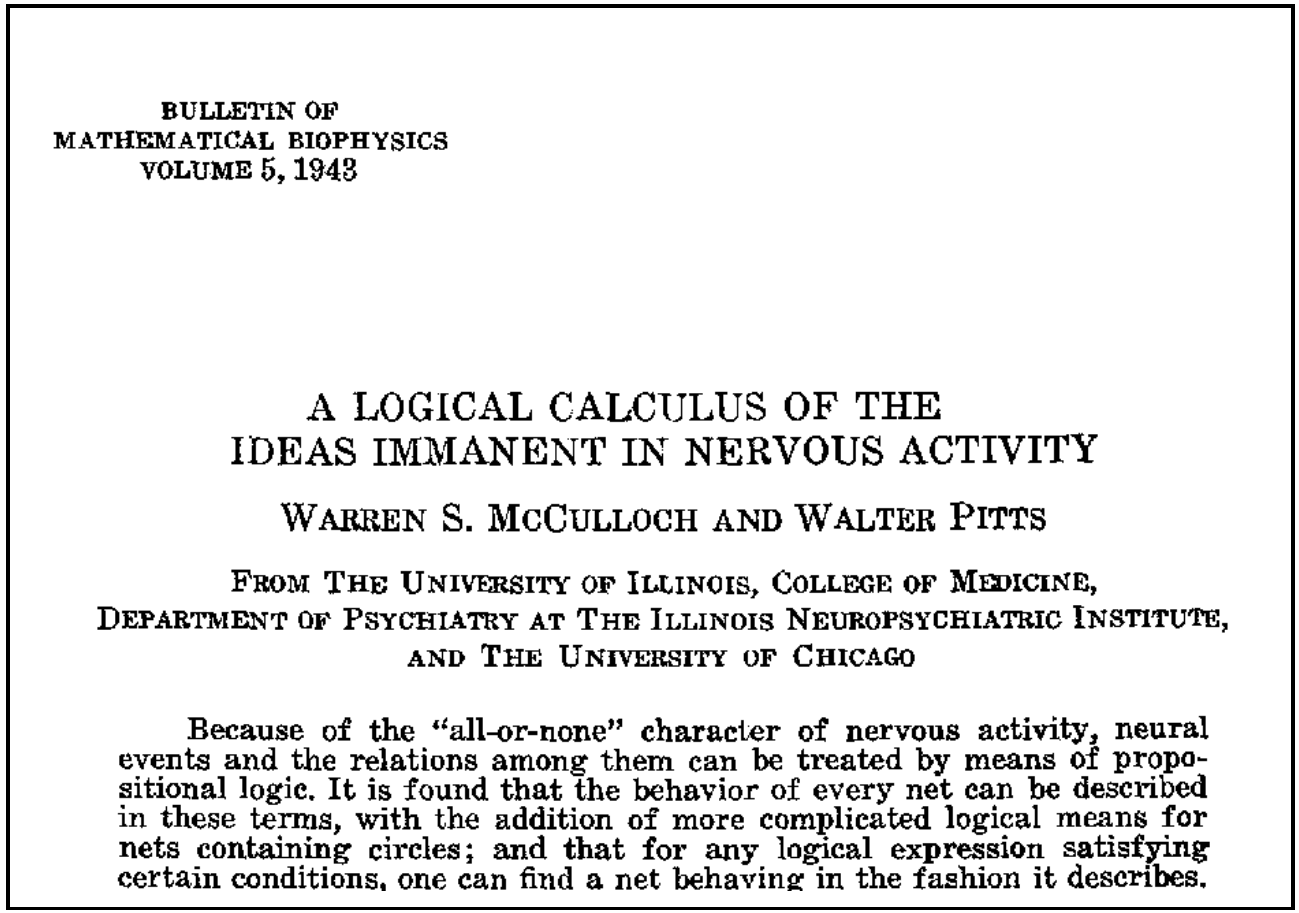
McCulloch y Pitts

McCulloch, W. S. and Pitts, W. H. (1943).
A logical calculus of the ideas immanent in nervous activity.
Bulletin of Mathematical Biophysics, 5:115-133.



BULLETIN OF
MATHEMATICAL BIOPHYSICS
VOLUME 5, 1943

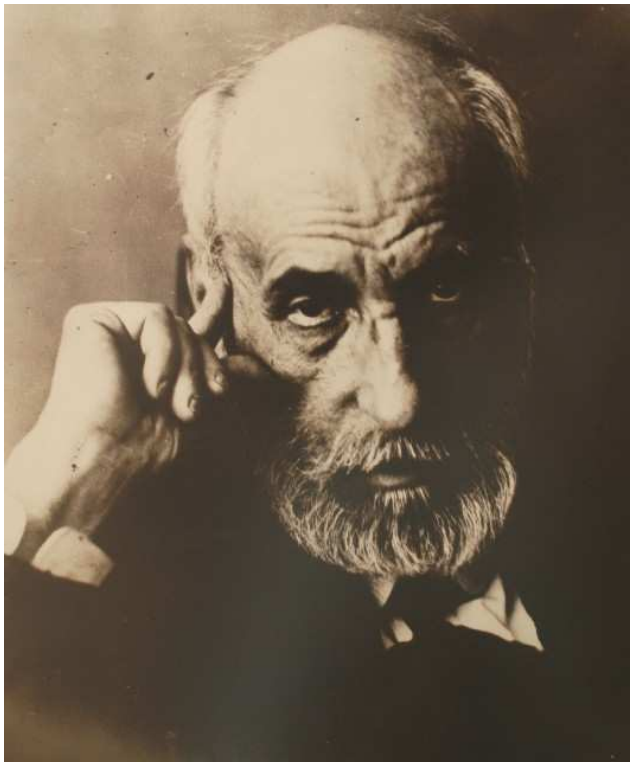
A LOGICAL CALCULUS OF THE
IDEAS IMMANENT IN NERVOUS ACTIVITY

WARREN S. MCCULLOCH AND WALTER PITTS

FROM THE UNIVERSITY OF ILLINOIS, COLLEGE OF MEDICINE,
DEPARTMENT OF PSYCHIATRY AT THE ILLINOIS NEUROPSYCHIATRIC INSTITUTE,
AND THE UNIVERSITY OF CHICAGO

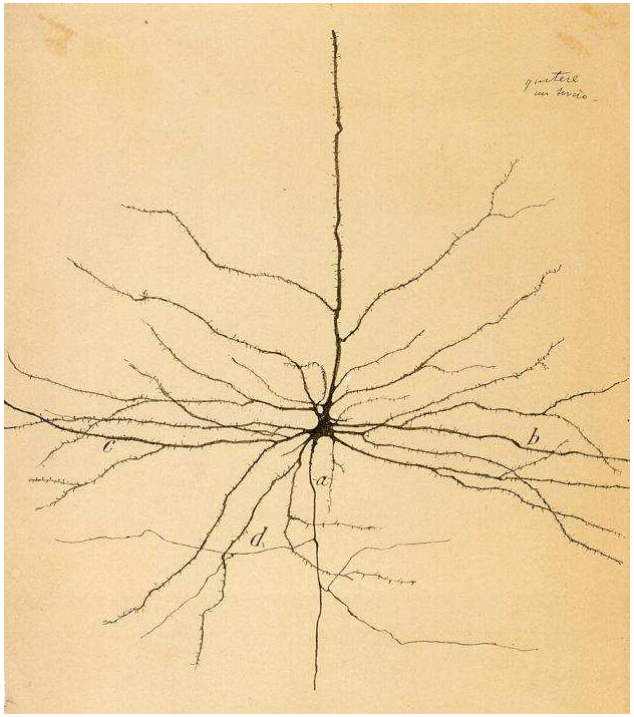
Because of the "all-or-none" character of nervous activity, neural events and the relations among them can be treated by means of propositional logic. It is found that the behavior of every net can be described in these terms, with the addition of more complicated logical means for nets containing circles; and that for any logical expression satisfying certain conditions, one can find a net behaving in the fashion it describes.

Santiago Ramón y Cajal



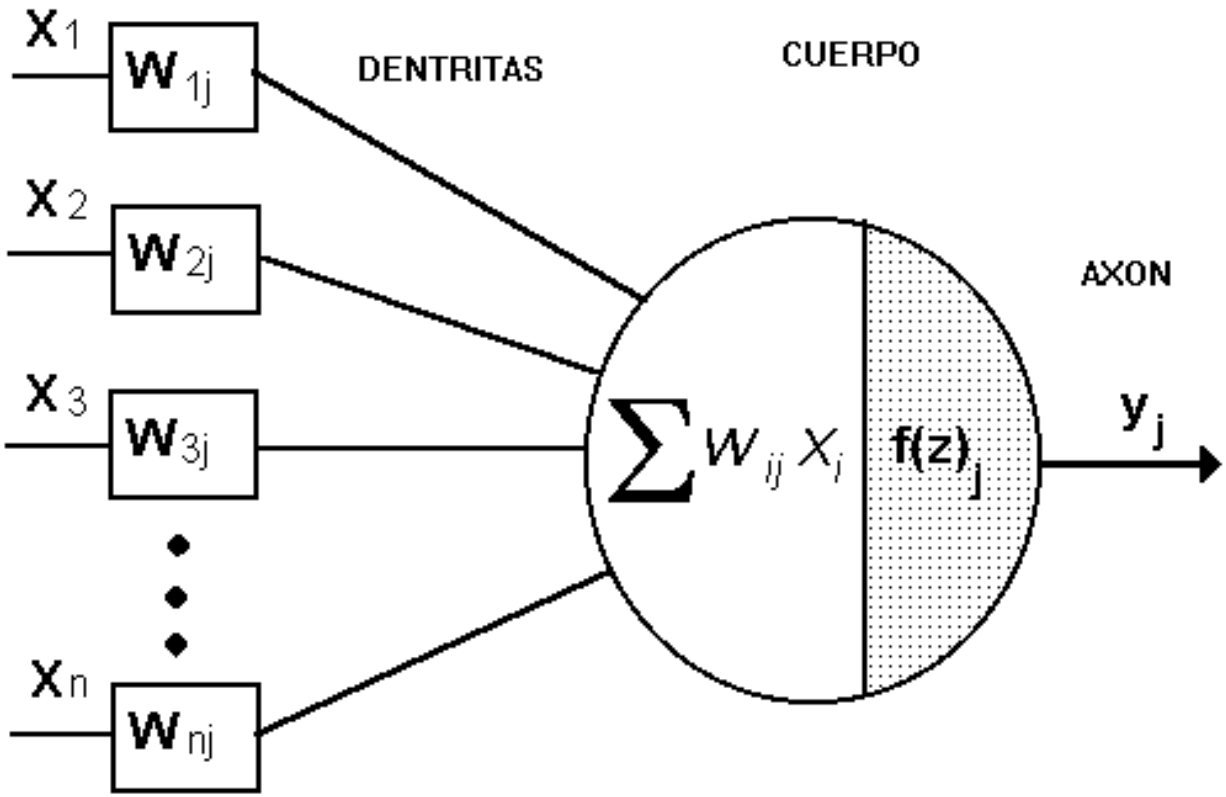
Santiago Ramón y Cajal (1852 - 1934)

Nobel Prize in Medicine in 1906



Drawing of a neuron by Ramón y Cajal (1899)

Artificial Neuron



Artificial Models of the Brain

November 30th, 2012

Science 30 November 2012:
Vol. 338 no. 6111 pp. 1202-1205
DOI: 10.1126/science.1225266

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Read Full Text for Comments (0)

REPORT

A Large-Scale Model of the Functioning Brain

Chris Eliasmith*, Terrence C. Stewart, Xuan Choo, Trevor Bekolay, Travis DeWolf, Charlie Tang, Daniel Rasmussen

Author Affiliations

*To whom correspondence should be addressed. E-mail: celiasmith@uwaterloo.ca

ABSTRACT

A central challenge for cognitive and systems neuroscience is to relate the incredibly complex behavior of animals to the equally complex activity of their brains. Recently described, large-scale neural models have not bridged this gap between neural activity and biological function. In this work, we present a 2.5-million-neuron model of the brain (called "Spaun") that bridges this gap by exhibiting many different behaviors. The model is presented only with visual image sequences, and it draws all of its responses with a physically modeled arm. Although simplified, the model captures many aspects of neuroanatomy, neurophysiology, and psychological behavior, which we demonstrate via eight diverse tasks.

The gestation of AI

McCulloch and Pitts (1943)

A logical calculus of the ideas immanent in nervous activity

Alan M. Turing (1950)

Computing Machinery and Intelligence

Dartmouth AI Conference (1956)

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Claude Shannon
Alan Newell
Arthur Samuel
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Initial Enthusiasm (1952-1969)

Herbert Simon (1957)

It is not my aim to surprise or shock you – but the simplest way I can summarize is to say that there are now in the world machines that think, that learn and that create. Moreover, their ability to do these things is going to increase rapidly until – in a visible future – the range of problems they can handle will be coextensive with the range to which the human mind has been applied.

General Problem Solver (1959)

Newell, A.; Shaw, J.C.; Simon, H.A. (1959). Report on a general problem-solving program. Proc. of the Int. Conference on Information Processing. pp. 256-264.

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Session

I am the psychotherapist. Please, describe your problems (...).

```
- I am scared of flying
```

Why do you say you are afraid of flying?

```
- Because I have anxiety attacks when I need to
travel by plane
```

Is it because you have anxiety attacks when you need to travel by plane that you came to me?

```
- Yes, I need help because the fear does not allow me
to enjoy the journey
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Does it bother you that the fear does not allow you to enjoy the journey?

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...
- Bye
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My secretary will send you a bill.

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Teleology

Teleology (Merriam-Webster)

a doctrine explaining phenomena by final causes

The chinese room (Searle, 1980)

Searle J. (1980) Minds, Brains and Programs. *The Behavioral and Brain Sciences* 3, 417-424.

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- Weak AI - Computers seem to be intelligent

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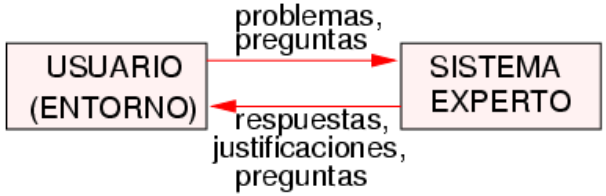
Weak methods (1969-1993)

- Knowledge based systems
- Expert systems
  - **Dendral** (Feigenbaum, 1975). Inference of molecular structures.
  - **XCON** (McDermott, 1978) Selection of components for the VAX computer systems.
  - **Mycin** (ShortLiffe, $\sim$1970) Diagnosis of infectious blood diseases.
  - **CADUCEUS** (Pople, $\sim$1970) Extension of Mycin.
  - . . .

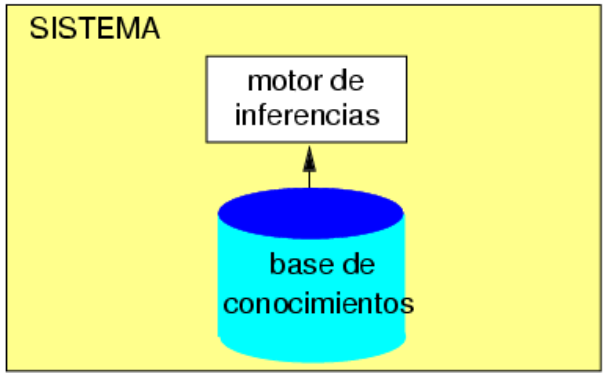
KBS

Basic structure of KBS

SE: punto de vista funcional (conductista)

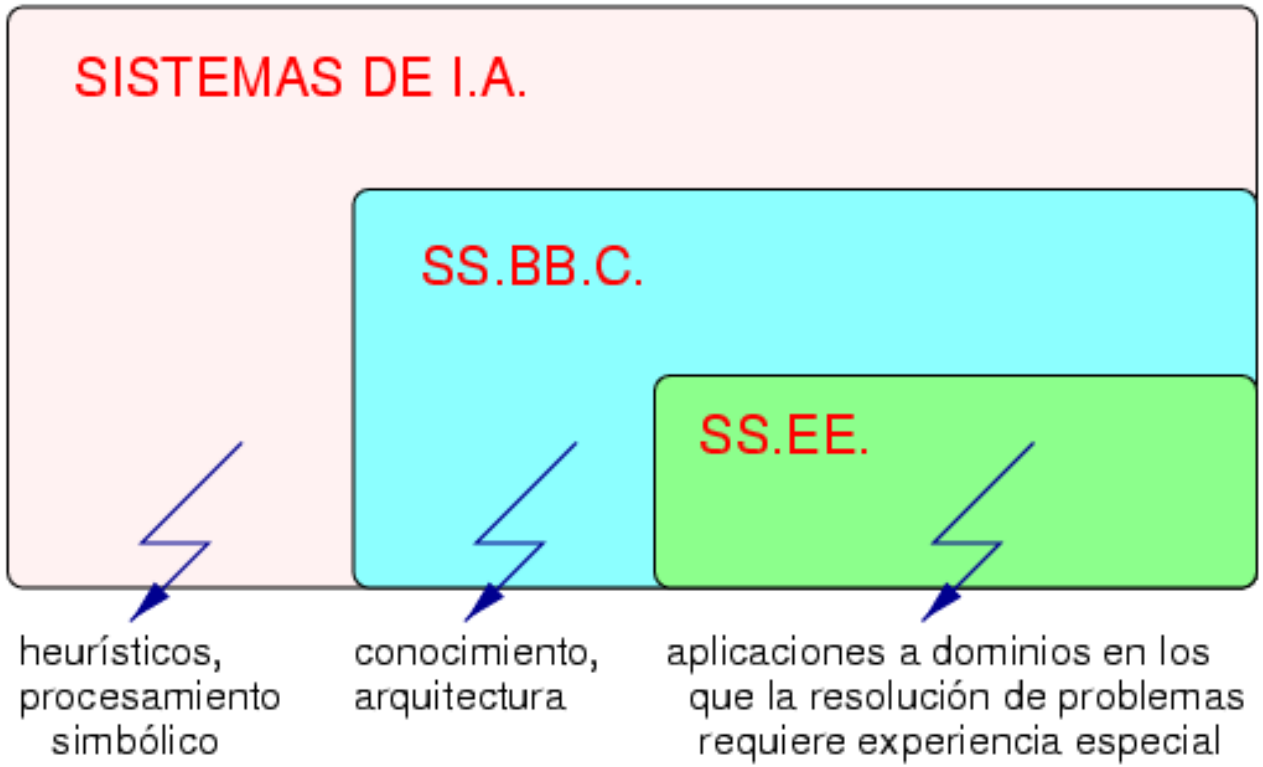


SBC: punto de vista estructural (cognitivo)



KBS = Knowledge + Reasoning

Expert Systems

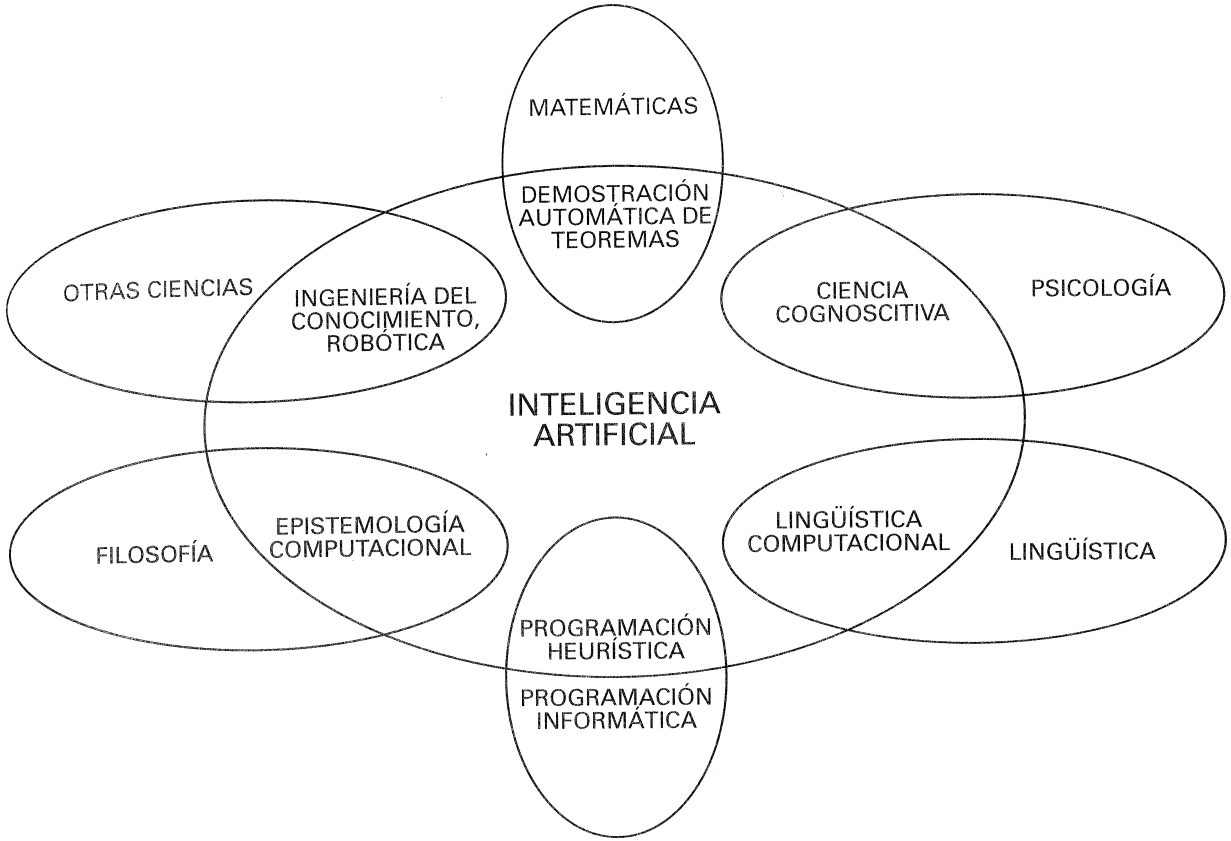


Diversification (1993-)

- Genetic algorithms
- Artificial life
- Learning
- Robotics
- Agent theory
- . . .

- Man-machine interaction
- Access to a huge amount of data

Relationship with other sciences



Artificial Intelligence today

Problems

- Knowledge representation
- Deduction, reasoning, and problem solving
- Planing
- Machine Learning
- Natural language processing
- Movement and manipulation
- Perception
- Social Intelligence
- Creativity
- Intelligence in general
- ...

Artificial Intelligence today

Stuart Rusell. AIMA

- Playing table tennis (ping pong)
- Driving on a road with turns
- Driving on a road with traffic
- Shopping online
- Shopping at a marketplace
- Performing surgery
- Inventing a joke

Artificial Intelligence today

Stuart Rusell. AIMA

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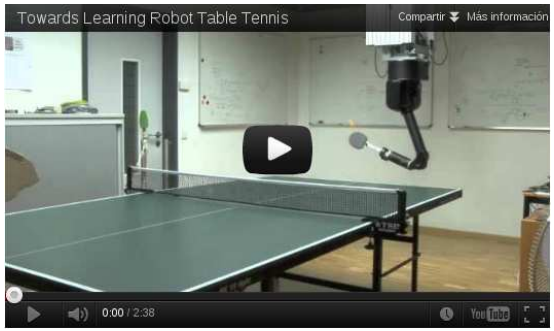
October 29th, 2012



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