

# A.I.

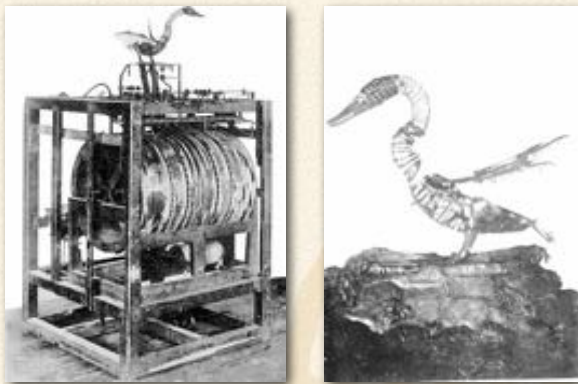
CHRISTIAN BALKENIUS

1560



Wooden Monk Automata, Apr. 1560 (Deutsches Museum, Munich)

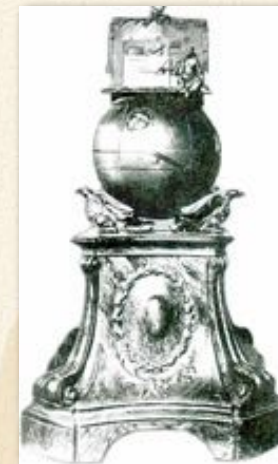
1738



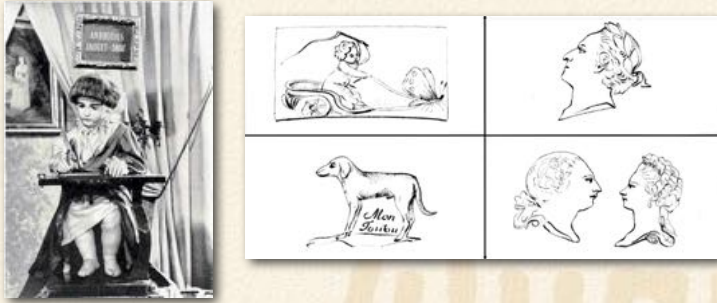
Jacques de Vaucanson, Grenoble, France, 1738

1753

- The first writing automata in the western world was developed by Friedrich von Knauss in 1753.



1773

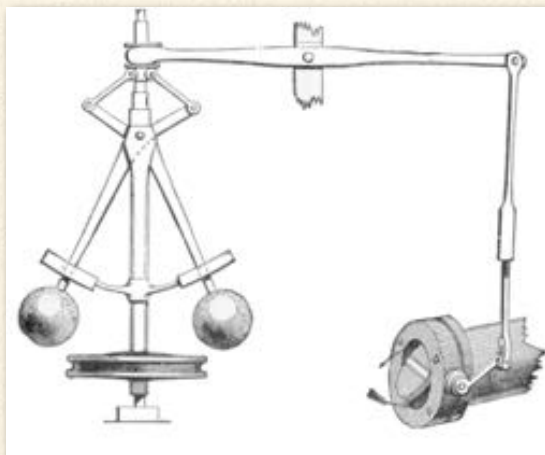


Pierre and Henry Louis Jaquet-Droz, Neuchâtel, Switzerland, 1773



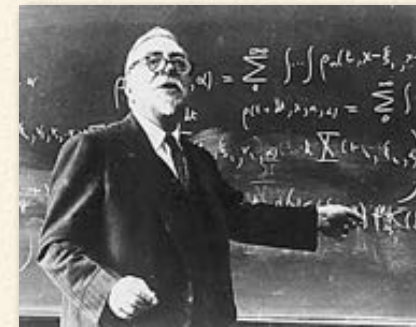
Karakuri Ningyo, Japan, Edo Period (ca 1796)

1788



CENTRIFUGAL GOVERNOR, JAMES WATT (1788)

1948



● NORBERT WIENER, A PROFESSOR AT M.I.T., PUBLISHES **CYBERNETICS**

1804



Joseph Jacquard, Punch Card Controlled Loom

1810



Mechanical Trumpeter, Friedrich Kaufmann, 1810

1921



Rossum's Universal Robots, Karel Capek, 1921

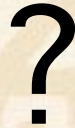
1936

- ALAN TURING INTRODUCES THE CONCEPT OF A THEORETICAL COMPUTER CALLED THE TURING MACHINE.

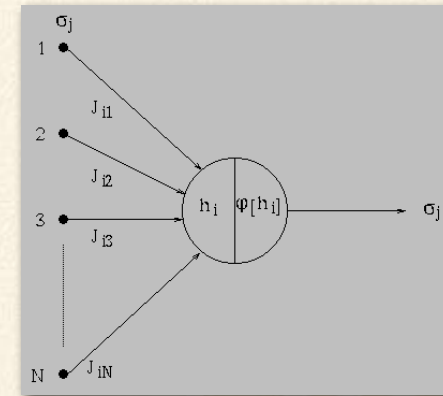


1950

- THE TURING TEST



1943

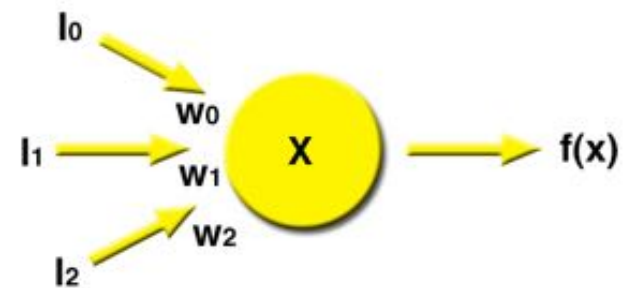


Warren McCulloch and Walter Pitts publish *A Logical Calculus of Ideas Immanent in Nervous Activity*

1957

- THE PERCEPTRON
- FRANK ROSENBLATT

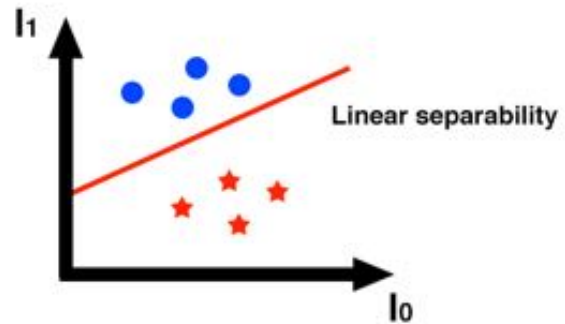
### Perceptron



$$x = I_0W_0 + I_1W_1 + I_2W_2$$

$$f(x) = 1 \text{ if } x > T$$
$$0 \text{ otherwise}$$

## Perceptron



## 1956

- ALAN NEWELL AND HERBERT SIMON CREATE THE **LOGIC THEORIST**, THE FIRST "EXPERT SYSTEM". IT IS USED TO HELP SOLVE DIFFICULT MATH PROBLEMS.
- MARVIN MINSKY AND JOHN MCCARTHY ORGANIZE A CONFERENCE IN DARTMOUTH, MASSACHUSETTS, US. THE CONFERENCE COINS THE PHRASE "ARTIFICIAL INTELLIGENCE".
- GEORGE DEVOL AND JOSEPH ENGELBERGER FORMED THE WORLD'S FIRST ROBOT COMPANY.

## 1958

- LISP
- John McCarthy

```
(defun factorial (n)
  (if (<= n 1)
      1
      (* n (factorial (- n 1)))))
```

## 1966

- AN ARTIFICIAL INTELLIGENCE PROGRAM NAMED **ELIZA** IS CREATED AT MIT BY JOSEPH WEIZENBAUM.
- THE STANFORD RESEARCH INSTITUTE CREATES **SHAKY**, THE FIRST MOBILE ROBOT THAT CAN REASON ABOUT ITS SURROUNDINGS.



# Planning

## World Model

States: s1, s2, s3, s4, s5,...

Actions: a1, a2, a3, a4, a5,...

## Problem

Current State: s3

Goal State: s5

## Plan

Action Sequence: a3, a3, a5

1972

## Prolog

Propositions:

father(sam, sue).

father(steve, sam).

Inference rule:

grandfather(X, Y) :- father(X, Z), father(Z, Y).

Inferred:

grandfather(steve, sue).

# Rule Based Systems

## Rules

has-wheels => vehicle

has-motor & is-vehicle => motor-vehicle

not has-motor & is-vehicle => bike

## Inference

has-wheels

not has-motor

=>bike

How to handle negation?

1986

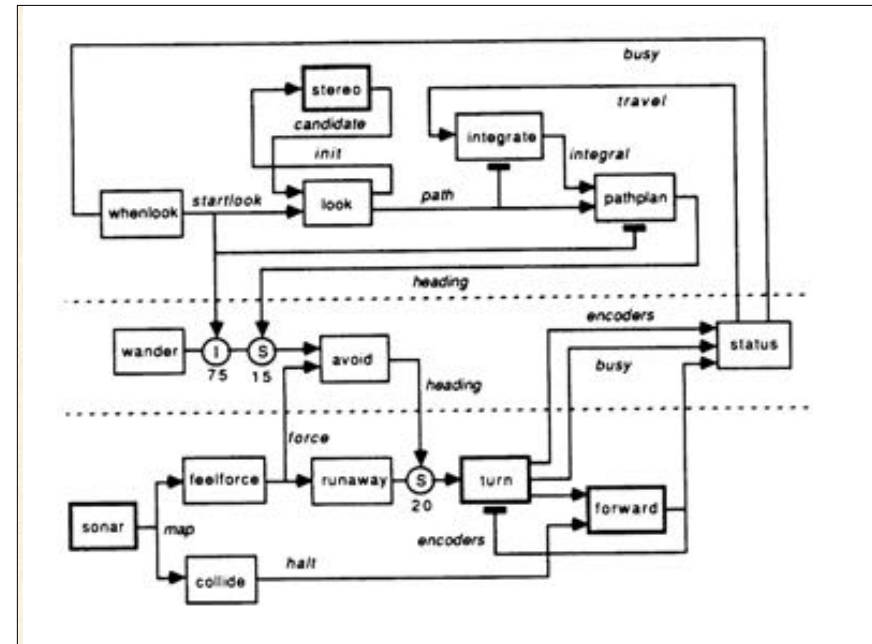
- **HONDA BEGINS A ROBOT RESEARCH PROGRAM THAT'S STARTS WITH THE PREMISE THAT THE ROBOT "SHOULD COEXIST AND COOPERATE WITH HUMAN BEINGS."**
- **PARALLEL DISTRIBUTED PROCESSING**
- **THE NEURAL NETWORK REVOLUTION**

## 1989

- A WALKING ROBOT NAMED GENGHIS IS UNVEILED BY THE MOBILE ROBOTS GROUP AT MIT.
- RODNEY BROOKS AND A. M. FLYNN PUBLISH THE PAPER "FAST, CHEAP AND OUT OF CONTROL: A ROBOT INVASION OF THE SOLAR SYSTEM". ACADEMICS START TO CONCENTRATE ON SMALL, SMART USEFUL ROBOTS RATHER THAN SIMULATED PEOPLE.

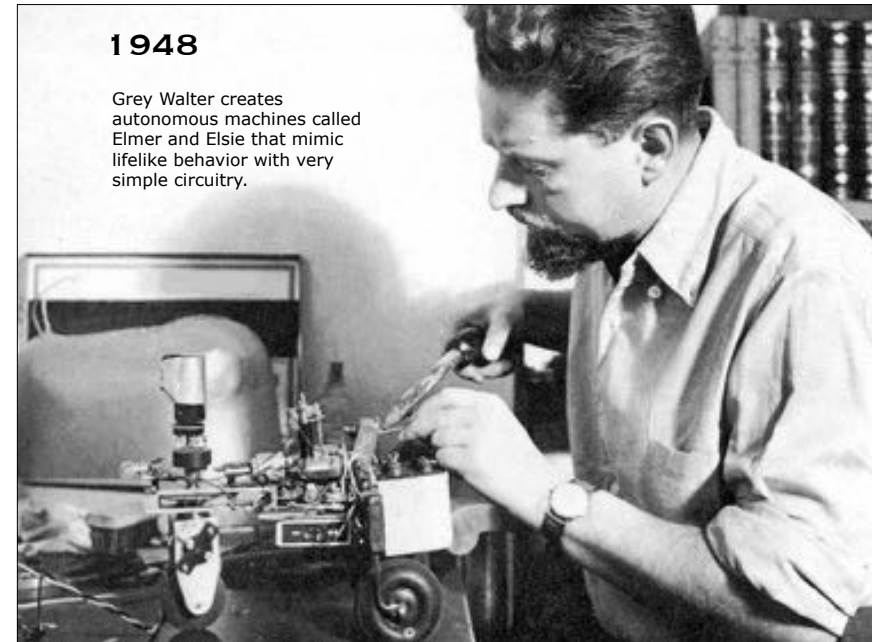


elephants  
don't play  
chess!



## 1948

Grey Walter creates autonomous machines called Elmer and Elsie that mimic lifelike behavior with very simple circuitry.





2003

- SONY RELEASES THE AIBO ERS-7 IT'S 3RD GENERATION ROBOTIC PET.



QRIO







## RHEX



## COG



## 1996

- HONDA UNVEILS THE P-2, A HUMANOID ROBOT THAT CAN WALK, CLIMB STAIRS AND CARRY LOADS.



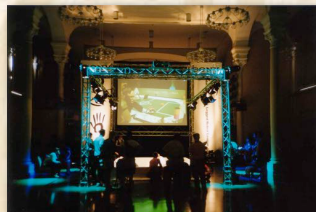
## 1997

- The first RoboCup football tournament is held in Nagoya, Japan.



## 1999

- May, Sony builds Aibo, K9 the next generation. One of the first robots intended for the consumer market. It reacts on sounds and has preprogrammed behavior. It sells out within 20 minutes of going on sale.
- RoboCup in Stockholm

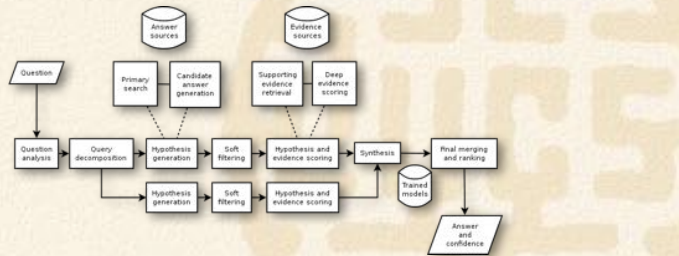


## 1997

- May, World chess champion Garry Kasparov loses to IBM's Deep Blue supercomputer.

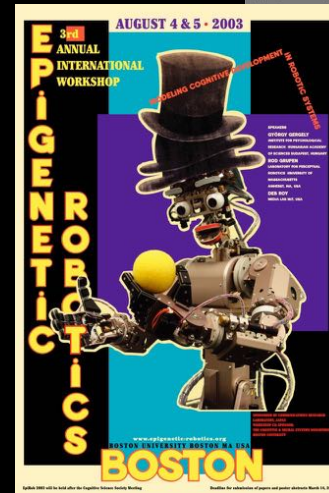
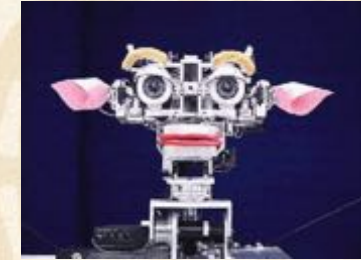


# IBM WATSON



# 1998

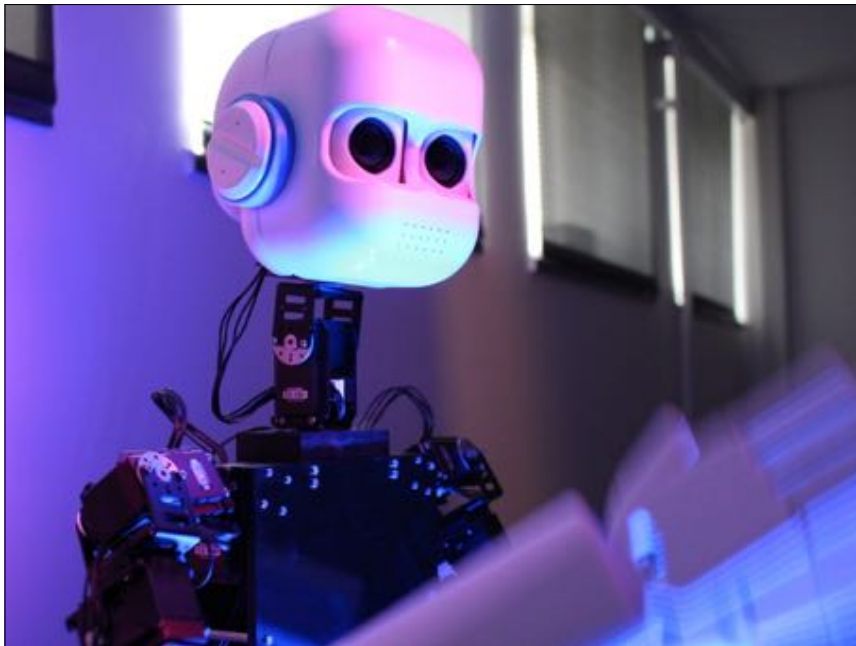
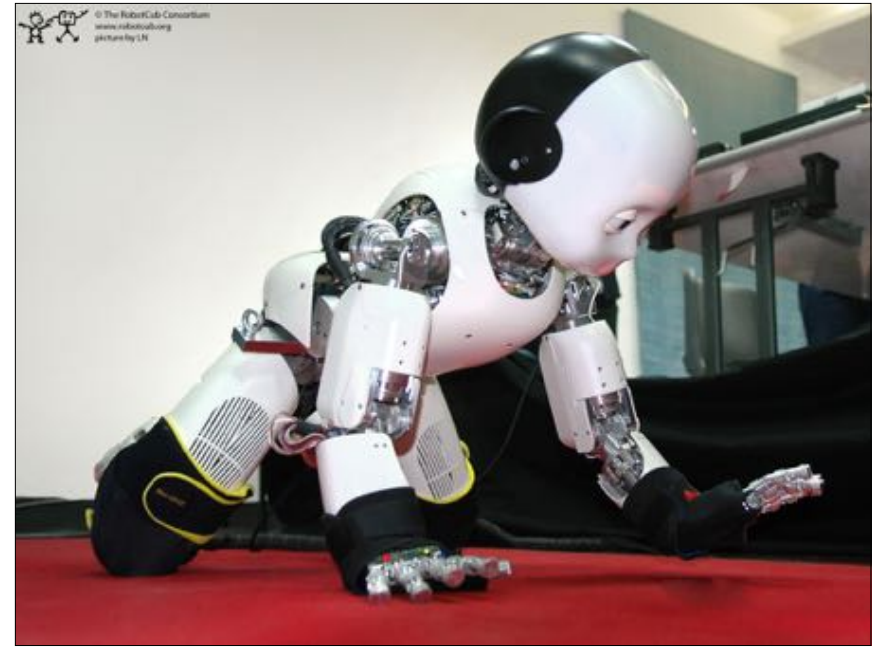
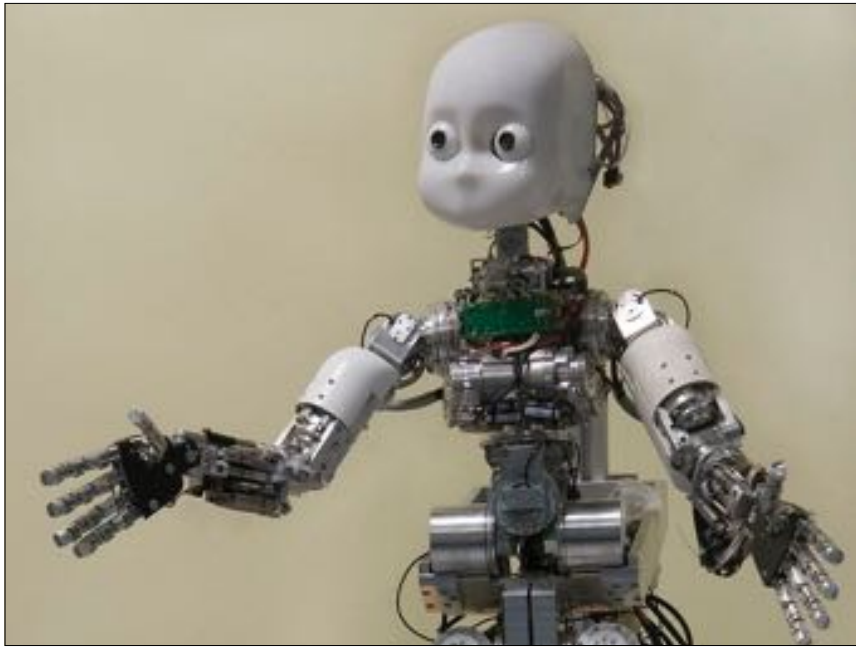
- CYNTHIA BREAZEL AT MIT STARTS WORK ON THE KISMET ROBOT, WHICH CAN MIMIC THE EMOTIONAL RANGE OF A BABY.



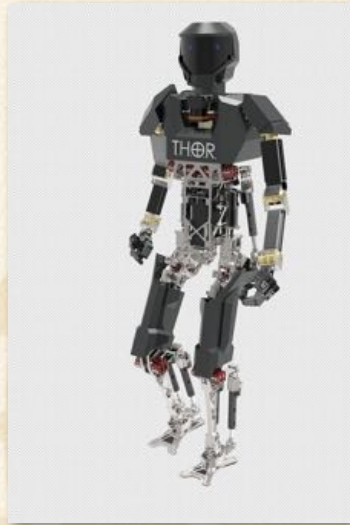
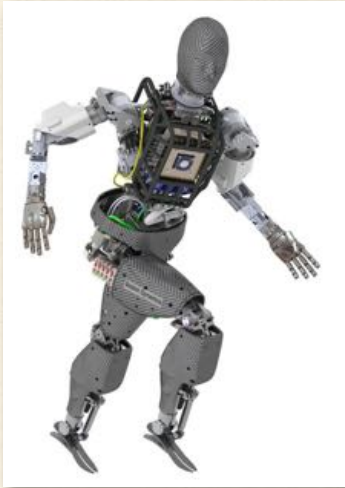
4th Annual  
Robotics



R6b



## DARPA ROBOTICS CHALLENGE 2012-



## SUMMARY

- PROBLEM SOLVING
- KNOWLEDGE AND REASONING
- PROBABILISTIC REASONING
- LEARNING
- PERCEPTION - ACTION