

# ARTIFICIAL INTELLIGENCE

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Russell & Norvig

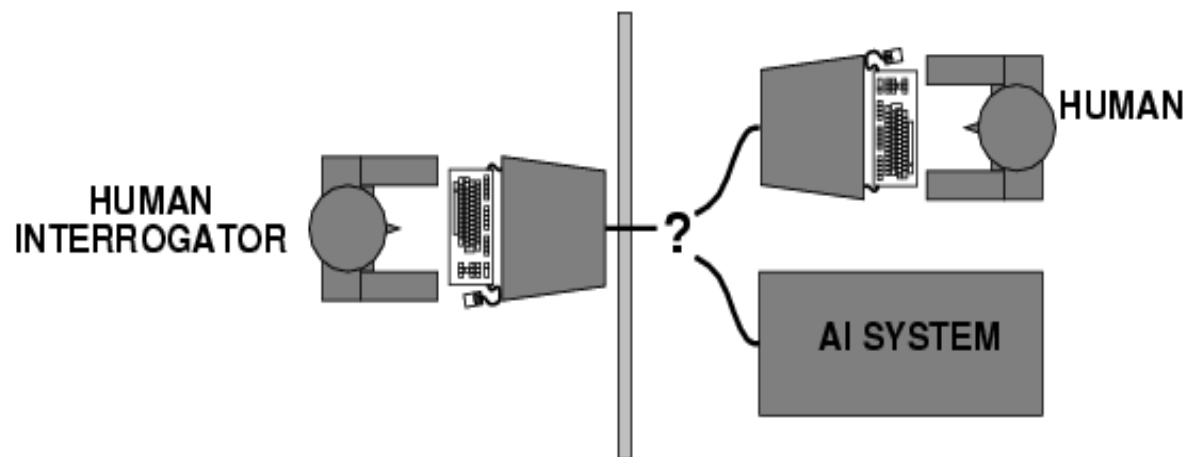
Chapter 1

# What is AI?

	Human	Rational
Think	Cognitive Modeling	Laws of Thought/Logic
Act	Turing Test Approach	Rational Agent Approach

# Acting Humanly

- Turing Test Approach (Alan Turing, 1950)
- “Can machines think” → “Can machines behave intelligently”
- Human interacting with two entities
- How long to tell which is which? How reliable?
- Avoids physical contact



# Acting Humanly, continued

- Turing predicted by 2000 a machine would have 30% chance of fooling a lay person for 5 minutes
- He anticipated all major arguments against AI in following 50 years
- Suggested major components of AI:
  - Natural Language Processing
  - Knowledge Representation
  - Automated Reasoning
  - Machine Learning
- Total Turing Test includes **Vision** and **Robotics**
- Loebner prize, chatterbot, annual since 1990
- [http://en.wikipedia.org/wiki/Loebner\\_Prize](http://en.wikipedia.org/wiki/Loebner_Prize)

# Thinking Humanly

- Cognitive modeling
- First problem – how do humans think?
  - Introspection: catch our own thoughts
  - Psychological experiments: observing people
  - Brain imaging
- Newell & Simon's General Problem Solver, 1961
  - Less interested in “correct” solutions
  - Wanted to compare trace to reasoning steps of human on same problems

# Thinking Rationally

- “Laws of Thought” approach, Logic
- Direct line through math and philosophy to modern AI
- Aristotle’s Syllogisms
- For example:
  - Socrates is a man                      man (Socrates)
  - All men are mortal                       $\forall x \text{ man}(x) \rightarrow \text{mortal}(x)$
  - Then, Socrates is mortal               $\rightarrow \text{mortal}(\text{Socrates})$
- Encode (hard), create database, let inference system determine valid statements

# Acting Rationally

- Rational agent approach
- *Agent* is something that (perceives and) acts
- *Rational agent* is one that acts so as to achieve the best outcome (or best expected outcome, if uncertainty)
- Should make correct inferences (as in Think Rationally) but also reason logically
- Includes:
  - Inference (logic)
  - Reflex (hot stove, don't deliberate)
  - Knowledge representation and reasoning
- **This is approach used in textbook**

# Foundations of AI

Philosophy	Logic, methods of reasoning, mind as physical system, foundations of learning, language, rationality
Mathematics	Formal representation and proof, algorithms, computation, decidability, tractability, probability
Psychology	Adaptation, perception and motor control, experimental techniques
Economics	Formal theory of rational decisions
Linguistics	Knowledge representation, grammar
Neuroscience	Mapping brain activity, models of nervous system
Control Theory	Stochastic optimal control



# History of AI

- Gestation of AI (1943-1955)
- Birth of AI (1956)
- Early enthusiasm, great expectations (1952-1969)
- A dose of reality (1966-1973)
- Knowledge-based systems: key to power (1969-1979)
- AI becomes an industry (1980-present)
- The return of neural networks (1986-present)
- AI adopts the scientific method (1987-present)
- Emergence of intelligent agents (1995-present)
- Availability of very large data sets (2001-present)

# AI: State of the Art examples

- Robotic vehicles - driverless
- Speech recognition
- Autonomous planning and scheduling – NASA is leader
- Game playing – IBM's Deep Blue (beat Kasparov, 1997)
- Spam fighting
- Logistics planning – DARPA is leader
- Robotics – Roomba, hazardous materials
- Machine translation – various languages