

What is AI?

LECTURE 1 - part I
Introduction & History of AI



UNSW
SYDNEY

Foundations of AI



- Philosophy (428 B.C – present)
- Mathematics (c. 800 – present)
- Psychology (1879 – present)
- Linguistics (1957 – present)
- Computer engineering (1940 – present)
- Biocybernetics (1940's – present)

What is AI?

Thinking Humanly	Thinking Rationally
Acting Humanly	Acting Rationally

What is AI?

Thinking Humanly

Thinking Rationally

Acting Humanly

“The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)

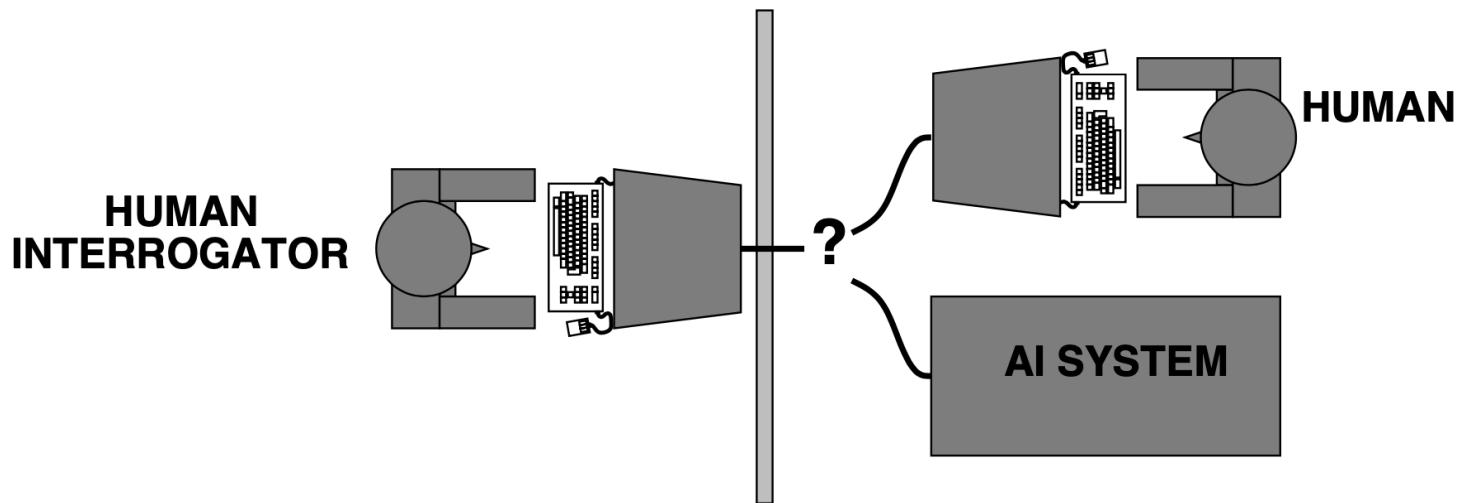
“The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)

Acting Rationally

Acting humanly - The Turing Test approach

The Turing test was proposed by Alan Turing (1950):

During the test, a human questioner writes a series of questions. A machine passes the test if, after the specified time, the questioner cannot tell whether the written responses come from a person or a machine.



Turing's expectations

Expectations

(extract from Turing's paper)

Interrogator: In the first line of your sonnet which reads "Shall I compare thee to a summer's day," would not a spring day do as well or better?

A: It wouldn't scan.

Interrogator: How about "winters day." That would scan all right.

A: Yes, but nobody wants to be compared to a winter's day.

Interrogator: Would you say that Mr. Pickwick reminded you of Christmas?

A: In a way.

Interrogator: Yet Christmas is a winter's day, and I do not think Mr. Pickwick would mind the comparison.

A: I don't think you're serious. By a winter's day one means a typical winter's day, rather than a special one like Christmas

Reality

(Eliza session)

Visitor: The trouble is, my mother's ill.

Doctor: How long has she been ill?

...

Visitor: The trouble is, my mother's Irish.

Doctor: How long has she been Irish?

...

Visitor: The trouble is, my mother's poodle.

Doctor: How long has she been poodle?

What is AI?

Thinking Humanly

“The exciting new effort to make computers think . . . machines with minds, in the full and literal sense.” (Haugeland, 1985)

“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (Bellman, 1978)

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Thinking Rationally

Acting Rationally

Thinking humanly - The cognitive modelling approach

- Reflect on our own thoughts
- Run psychological experiments and observe behaviour
- Observe brain activity

Cognitive science brings together computer models from AI and experimental techniques from psychology.



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Thinking Rationally

“The study of mental faculties through the use of computational models.” (Charniak and McDermott, 1985)

“The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)

Acting Rationally

Thinking rationally - The “laws of thoughts” approach

Originally, the laws of “right thinking” were proposed by philosophers.

Example:

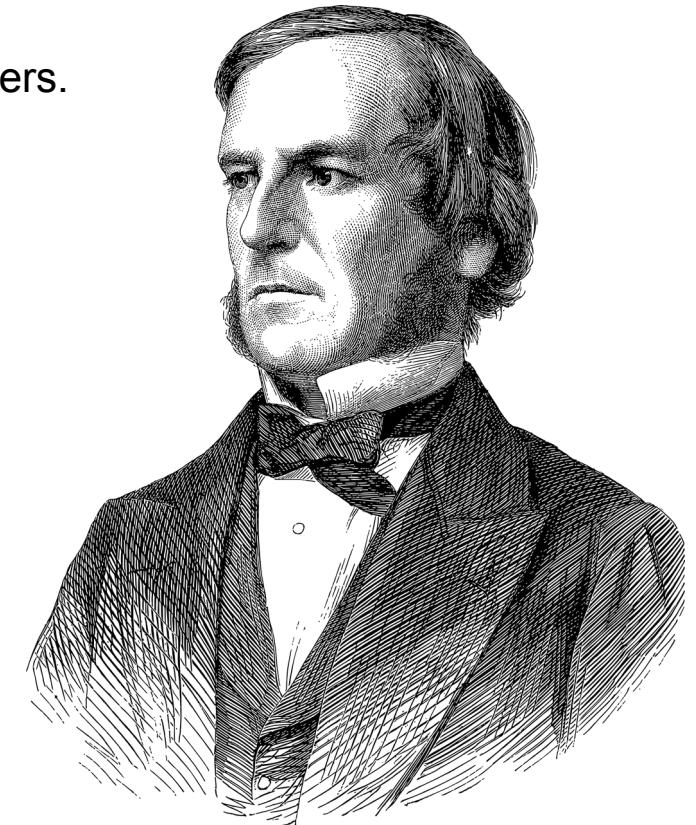
Socrates is a man; all men are mortal.

Therefore, Socrates is mortal.

The Mathematical Analysis of Logic by George Bool (1847) pushed the idea that logic indeed was a mathematical discipline, rather than philosophy.

The logic-based programs in theory can solve any solvable problem described in logical notation, **but**:

- Some knowledge is hard to state in the formal terms;
- In practice, solving a problem can require too much computational resources



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“Computational Intelligence is the study of the design of intelligent agents.” (Poole et al., 1998)

“AI . . . is concerned with intelligent behavior in artefacts.” (Nilsson, 1998)

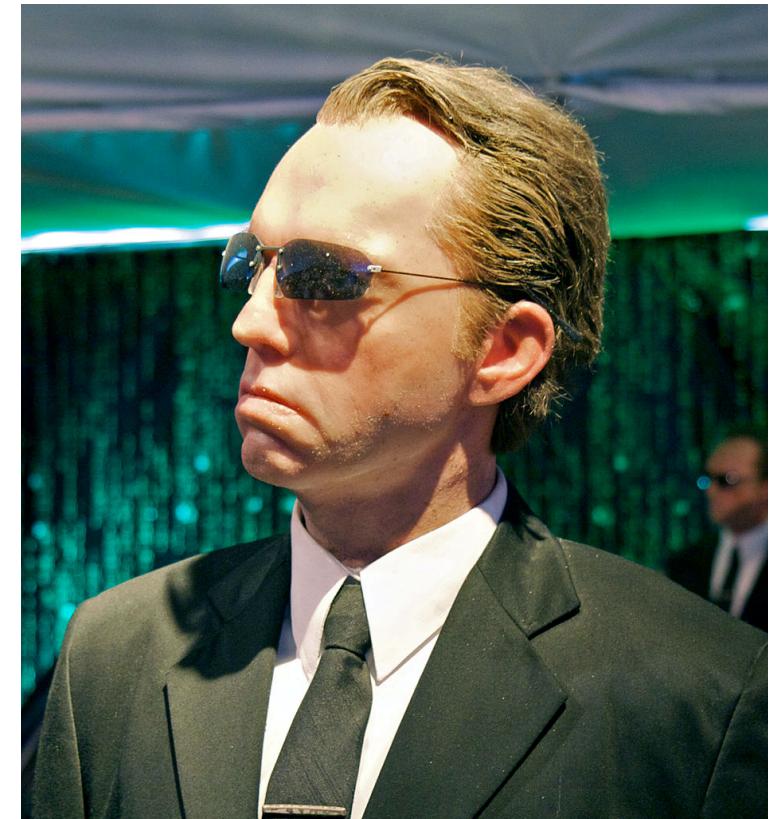
Acting rationally - The rational agent approach

Artificial Intelligence is the synthesis and analysis of **computational agents** that act intelligently.

An **agent** is something that acts in an environment.

An agent acts intelligently if:

- its actions are appropriate for its goals and circumstances
- it is flexible to changing environments and goals
- it learns from experience



Examples of Agents

People

Examples: teacher, stock trader, doctor



Computers/Devices

Examples: smart cars, games, advising systems



Animals & Bacterias

Examples: birds, worms, wolves, bacillus



Organisations

Examples: Government, UNSW, ant colonies



Goals of Artificial Intelligence

- **Scientific goal:** to understand the principles that make intelligent behaviour possible in natural or artificial systems.
 - analyse natural and artificial agents
 - formulate and test hypotheses about what it takes to construct intelligent agents
 - design, build, and experiment with computational systems that perform tasks that require intelligence
- **Engineering goal:** design useful, intelligent artefacts.
- Analogy between studying flying machines and thinking machines.

Summary - part I

- Artificial Intelligence has a long history in diverse areas of science as well as philosophy and literature
- Debates continue over the definition of Intelligence
- Significant progress has been made, but many challenges remain.

References:

- Poole & Mackworth, Artificial Intelligence: Foundations of Computational Agents, Chapter 1
- Russell & Norvig, Artificial Intelligence: a Modern Approach, Chapter 1.