

## CMSC 372 Artificial Intelligence Spring 2015

### Instructor



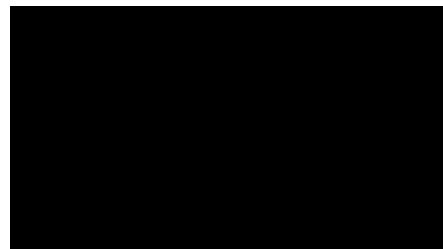
2

### Administrivia

- Lectures: Tues & Thurs 9:55a to 11:15a
- Labs: Tuesdays 1:00p to 3:00p
- Pre-requisites: CMSC B206 or H106 and CMSC B231 or permission of instructor
- Course web page:  
<http://cs.brynmawr.edu/Courses/cs372/spring2015/>

3

### Watson: Jeopardy!

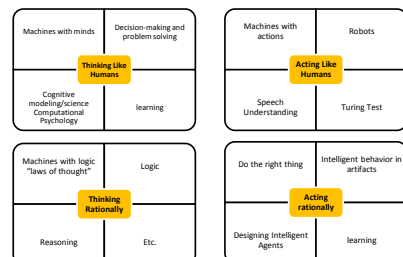


February 2011

### What is AI?

5

### What is AI?



6

## What is AI?

Machines with actions	Robots
Acting Like Humans	
Speech Understanding	Turing Test

Alan Turing (1950)

The Imitation Game



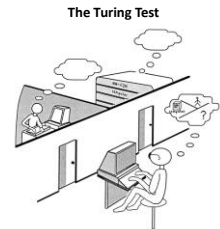
7

## What is AI?

Machines with actions	Robots
Acting Like Humans	
Speech Understanding	Turing Test

Alan Turing (1950)

The Imitation Game



8

## What is AI?

Machines with actions	Robots
Acting Like Humans	
Speech Understanding	Turing Test

Alan Turing (1950)

The Imitation Game

### The Turing Test

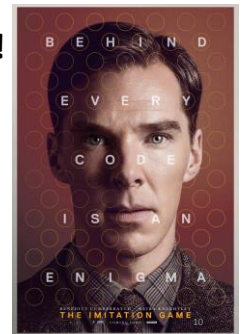
- Operational test for intelligent behavior
- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes.
- Anticipated all major arguments against AI in following 50 years
- Suggested major components of AI: knowledge, reasoning, language understanding, learning

**Problem:** Turing Test is not reproducible, constructive, or amenable to mathematical analysis

9

## Imitation Game Movie!

Free tickets available to go see Imitation Game this Thursday at BMFI, 8pm show.



## CAPTCHA?

- Completely Automated Public Turing test to tell Computers and Humans Apart
- A “reverse Turing Test”?



11

## What is AI?

Machines with minds	Decision-making and problem solving
Thinking Like Humans	
Cognitive modeling/science Computational Psychology	How does the brain work?

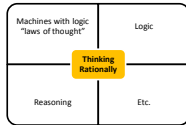
### Cognitive Science

- Brain as an information processing system
- Requires theories of internal activities of the brain (level of abstraction? Knowledge or circuits?)
- How to validate?
  - Predicting and testing behavior of human subjects (top-down)
  - Theories from neurological data (bottom-up)
- Two fields: Cognitive Science & Cognitive neuroscience

**Problem:** Current theories do not explain anything resembling human-level general intelligence.

12

## What is AI?



### Reasoning with Logic

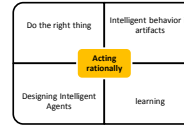
- Aristotle: What are correct arguments/thought processes?
- Formal Logics:

*Socrates is human.  
All humans are mortal.  
Therefore Socrates is mortal.*

- Laws of thought govern the operation of the mind.

**Problem:** Not all intelligent behavior is mediated by logical deliberation. Not easy to formalize informal knowledge. E.g. Most students might be sleepy.

## What is AI?



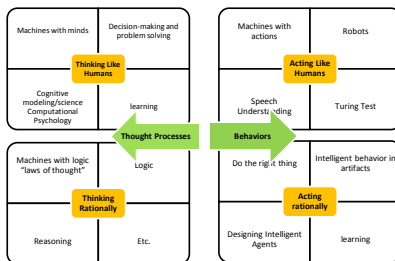
### Rational Behavior

- Do the right thing.
- That which is expected to maximize goal achievement, given available information.
- Doesn't necessarily involve 'thinking'. E.g. blinking reflex.
- Any thinking there is, should be in service of rational action.
- Design Rational Agents.

$$f: P^* \rightarrow A$$

**Problem:** Computational limitations make perfect rationality unachievable. So, design best program for given computational resources.

## What is AI?



15

## What is AI?

### Is intelligence computable?

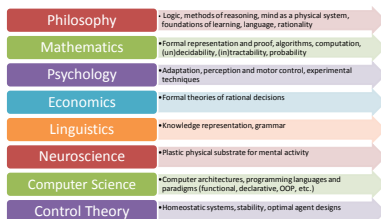
#### Physical Symbol System Hypothesis

"a physical symbol system [such as a digital computer, for example] has the necessary and sufficient means for intelligent action."

-: Newell & Simon, 1976

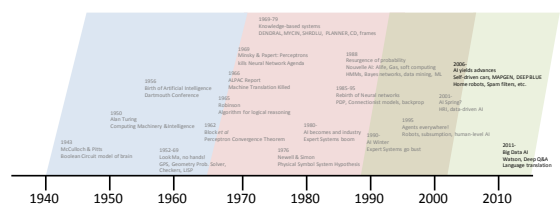
16

## Prehistory of AI



17

## Landmarks in AI History



18

## Agenda

- What is AI? History, Foundations, Examples: Overview
- Intelligent Agents
- Problem Solving Using Classical Search Techniques
- Beyond Classical Search
- Adversarial Search & Game Playing
- Constraint Satisfaction Problems
- Knowledge Representation & Reasoning (KRR)
- First Order Logic & Inference
- Classical Planning
- Planning & Acting in the Real World
- Other topics depending upon time...

19

## Acknowledgements

- Much of the content in this presentation is based on Chapter 1, *Artificial Intelligence: A Modern Approach*, by Russell & Norvig, Third Edition, Prentice Hall, 2010.
- Tickets to the movie Imitation Game sponsored by Bryn Mawr College Department of Computer Science, Center for Science of Information, Bryn Mawr Film Institute, Mellon Foundation Association for Advancement of Liberal Arts Colleges (AALAC). We thank them for their support.
- This presentation is being made available by Deepak Kumar for any and all educational purposes. Please feel free to use, modify, or distribute. Powerpoint file(s) are available upon request by writing to [dkumar@cs.brynmawr.edu](mailto:dkumar@cs.brynmawr.edu)
- Prepared in January 2015.

20