



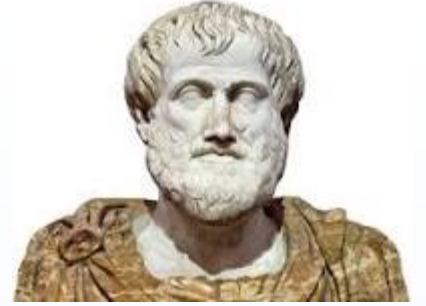
Introduction to Artificial Intelligence

Week 2



What is Intelligence?

Philosophy



- Epistemology – fr. Greek - from Greek ἐπιστήμη, epistēmē, meaning "knowledge", and λόγος, logos, meaning "logical discourse"
- Study of how we know what we know
- Many epistemologists see a separation of Truth/Belief/Justification that gives Knowledge
 - Truth is the objective reality
 - Belief is the subjective idea of what reality is
 - Justification is an explanation
 - Knowledge is True Belief with Justification (comes from Socrates)
 - Example: I had a coffee this morning to keep myself awake for class



Gettier Cases

- Smith and Jones apply for a job
- Smith asks Jones for some change and knows he has 10 Rouble coins in his pocket
- Smith is informed that it is Jones who will be given the job
 - Jones has ten coins in his pocket, Jones will get the job
 - Smith now believes that the man with 10 coins in his pocket will get the job
- Assume there is a change of plan and Smith is selected; also unknown to Smith to him was that in his pocket are 10 coins
- So, the above propositions were True, were beliefs, were justified
- But Smith didn't KNOW!
 - Includes a justified false beliefs
 - A Justification must also be necessarily the cause

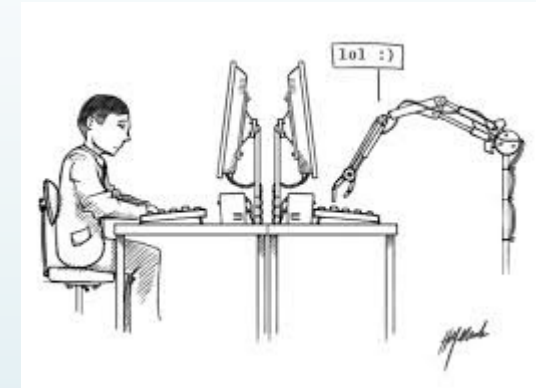
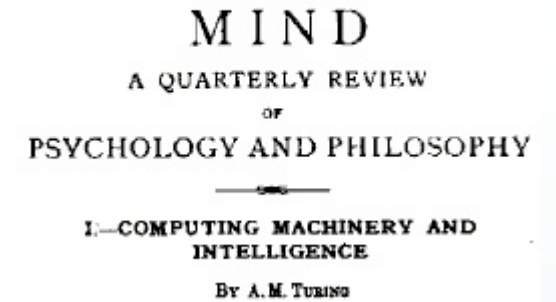
Alan Mathison Turing OBE FRS



- Born 23 June 1912 to an English civil servant for India
- Studied mathematics at King's College, Cambridge, and was elected a fellow
- Developed the Universal Turing Machine as part of the Church-Turing Thesis
- PhD from Princeton; offered a postdoctoral position by John von Neumann but instead returns to England to Cambridge
- Multiple Philosophical fights with Ludwig Wittgenstein
- Went on to work at Bletchley Park
 - Developed the Bombe decoder
 - *The Applications of Probability to Cryptography and Paper on Statistics of Repetitions* not released by UK Govt. for 70 years
- Developed and popularized the Turing Test
- Went on to studies of new computers, biology, and mathematics
- Turing was prosecuted in 1952, Public government apology 2009, full pardon in 2013
- Died 1954 of cyanide poisoning (Apple) – most likely at his own hand

Turing Test

- Published in 1952
- Interrogator
- Human v. Computer
- Can the Interrogator detect the computer
- Inverse of this test used as a human detector



CAPTCHA aka completely automated public Turing test to tell computers and humans apart

- Utilized in a number of systems
 - Email
 - Online ordering
 - Account creation
- Cost effective
- Has been utilized in order to decode OCR issues



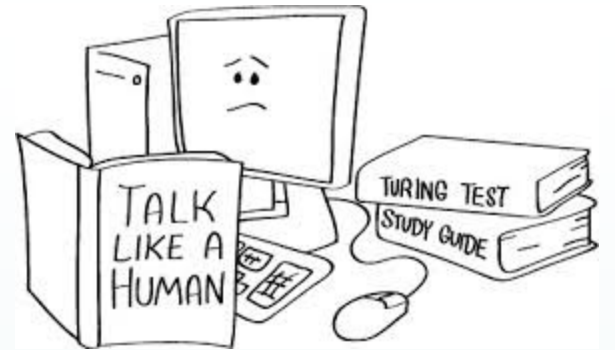
Prove you're not a robot

Mills, SP8Z

Type the two pieces of text:

Verify Cancel

Computers do not think like us?



- Image Recognition
 - Segmentation
 - Detection
 - Conceptualization
 - Verbalization



Syntax v. Semantics

- Chair has a meaning conceptually and as an object



Chinese Room Argument



- Thought experiment
- Imagine yourself as someone who has no knowledge of the language of Chinese
 - Rather easy for some of us – but feel free to substitute any language you don't know
- You are locked in the room with a large book of instructions, a pile of paper, and two slots labeled in and out
- From the in slot comes a page of Chinese characters, the instructions tell you what to do and to write before putting it on the out slot



Does this mean you KNOW Chinese?

- ▶ You don't know what the characters mean – semantics
- ▶ You know actions to be produced on symbols – syntax
- ▶ You will be slow to begin with, but as you learn the rule system you become better and better at your actions
- ▶ This is how a computer makes actions but is it all it does?



Arguments against the Room

- You are not processing meaningless symbols
 - They have a meaning internally and a different external meaning
- This might be only part of the bigger system
 - Many Chinese rooms
 - Who writes the rule book?
 - Can the rules be changed?
 - Development of rules is now part of many AI



First Order and Propositional Logic



Why do we care?

- Utilized in a number of AI systems
- Allows us to have a basic idea of 'knowledge'
- Categories
- Binary predicates
 - Part of the set/Not part of the set

Operations

- For Every \forall
 - For Every X its value is 3; $\forall x=3$
- There exists \exists
 - There is an X which is 3; $\exists x=3$
- Conjunction \wedge
 - X and Y; $x \wedge y$
- Disjunction \vee
 - X or Y; $x \vee y$
- Implication \rightarrow
 - If x then y; $x \rightarrow y$
- Biconditional \leftrightarrow
 - X if and only Y; $x \leftrightarrow y$
- Such that (s.t.) or :



Example Prepositions

- $\text{REDHAIR}(X)$ – X has red hair
- $\text{EVIL}(X)$ – X is evil
- $\text{GLASSES}(X)$ – X wears glasses
- $\text{FEMALE}(X)$ – X is female

Example

- All female redheads are evil
- $\forall X, \text{REDHAIR}(X) \wedge \text{FEMALE}(X) \rightarrow \text{EVIL}(X)$
- $\forall X \text{ FEMALE}(X) \rightarrow \exists X \text{ REDHAIR}(X) \vee \text{EVIL}(X)$
- For all females there exists one who has red hair or who is evil