Introduction to…

Assoc. Prof. Neil Hurley

Course Reference: COMP 30030

E-mail: neil.hurley@ucd.ie

The **European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases** will take place in the Croke Park Conference Centre, Dublin, Ireland during the 10 – 14 September 2018.

LATEST NEWS & DEADLINES

Pádraig Cunningham

Professor of Knowledge and Data Engineering
Head of School
padraig.cunningham@ucd.ie

Overview

- 2 lectures per week
  - Tuesday 3pm - 4pm [Science Lecture E-H1.26SCH]
  - Thursday 4pm - 5pm [Comp Sci Theatre B004]

- 1 lab session
  - Friday 9am - 11am [B1:06 Computer Science ALC]

- Allocation of Final Marks
  - Progress Check 15% Mid-Term
  - Written Exam 60% End of Term
  - Weekly CA 25%
    - Assignments
    - Implementation Tasks

Please note….

In order to take this module you need to have:

(1) prior knowledge of Data Structures & Algorithms, and
(2) reasonable Java programming skills.

CS Support Centre (CSSC)

- This is a FREE SERVICE, offered to UCD students taking computer science modules.
- The centre operates as a drop-in service, so if you have any computer science related difficulty, feel free to drop in.

  - CSSC Location: B1.03, 1st Floor CSI main building
  - CSSC Coordinator: Maryanne Doyle
  - Contact E-mail: cssc@ucd.ie
  - For more information: http://www.cs.ucd.ie/cssc/

Communication and Resources

- Lecture Notes and Announcements
  - Register online from http://csmoodle.ucd.ie/moodle.
  - Enter registration key: “AI2018”

  Students must demonstrate their abilities in both the written exam and practical components or otherwise risk failing the unit.

- Other Queries
  - Primary Contact: neil.hurley@ucd.ie
  - Module TA: gunjan.kumar@insight-centre.org
  - Guest lecturer on this course (2 lectures):
    - Prof. Pádraig Cunningham
  - Guest lecturer on this course (4 lectures):
    - Dr. Michael O’Mahony

Plagiarism and Computer Science

Plagiarism is a serious academic offence!

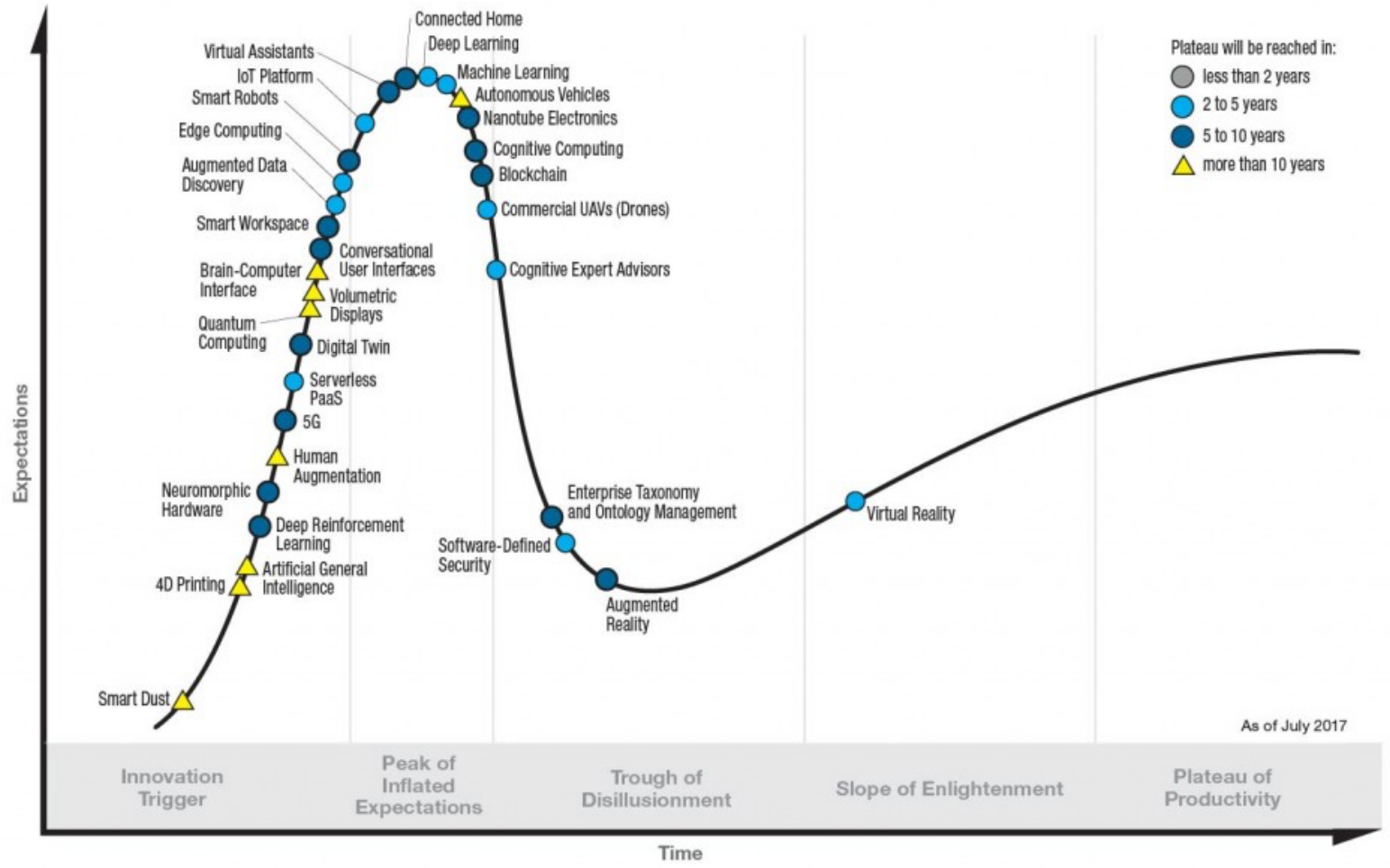
- [Student Code, section 6.2] or [UCD Registry Plagiarism Policy] or [CS Plagiarism policy and procedures]
- Our staff and demonstrators are **proactive** in looking for possible plagiarism in all submitted work
- Suspected plagiarism is reported to the CS Plagiarism subcommittee for investigation
- Usually includes an interview with student(s) involved
  - 1st offence: usually 0 or NG in the affected components
  - 2nd offence: referred to the University disciplinary committee
- Student who enables plagiarism is equally responsible

Relevant References:

http://www.ucd.ie/registry/academicsecretariat/docs/plagiarism_po.pdf
http://www.ucd.ie/registry/academicsecretariat/docs/student_code.pdf
http://libguides.ucd.ie/academicintegrity

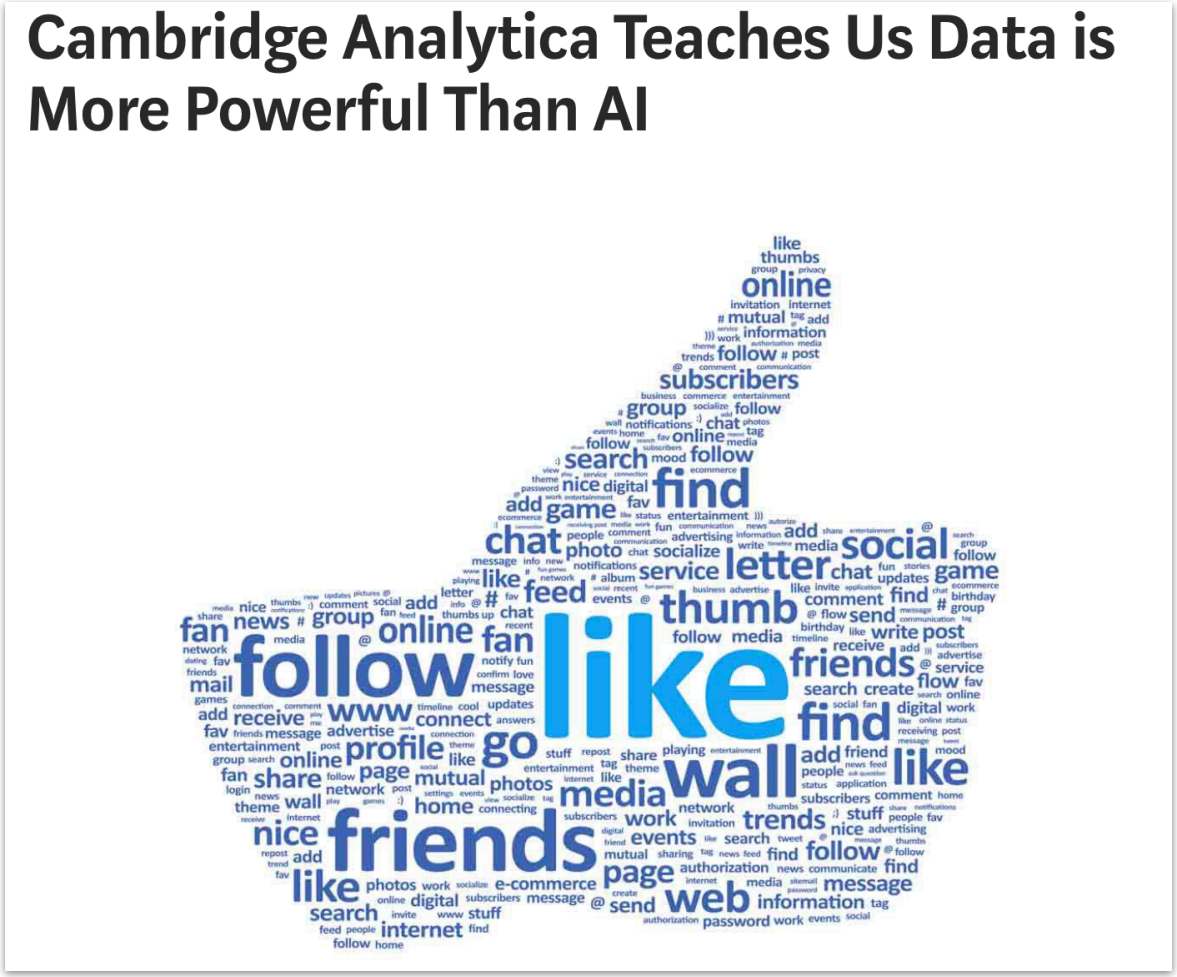
AI in the News

- Gartner Hype Cycle 2017




Google DeepMind
Challenge Match
8 - 15 March 2016
AlphaGo
ALPHAGO
02:00:00
LEE SEDOL
01:59:42
AlphaGo
Lee Sedol

"algorithm" has taken on a new lay meaning that is approximately "evil computer witchcraft"



2011

2018

Technology & Ideas

IBM's Watson Hasn't Beaten Cancer, But A.I. Still Has Promise

The company made bold claims that haven't yet panned out. But someday artificial intelligence could crack the code of individualized diagnosis and treatment.

By Faye Flam

24 August 2018, 16:00 IST

What is Intelligence?

- Fast thinking?
- Knowledge?
- Ability to learn?
- Ability to perceive and act upon one's environment?
- Ability to predict a persons intentions, and actions?
- Ability to play chess at grand-master level?

VOL. LIX. No. 236.] [October, 1950

MIND

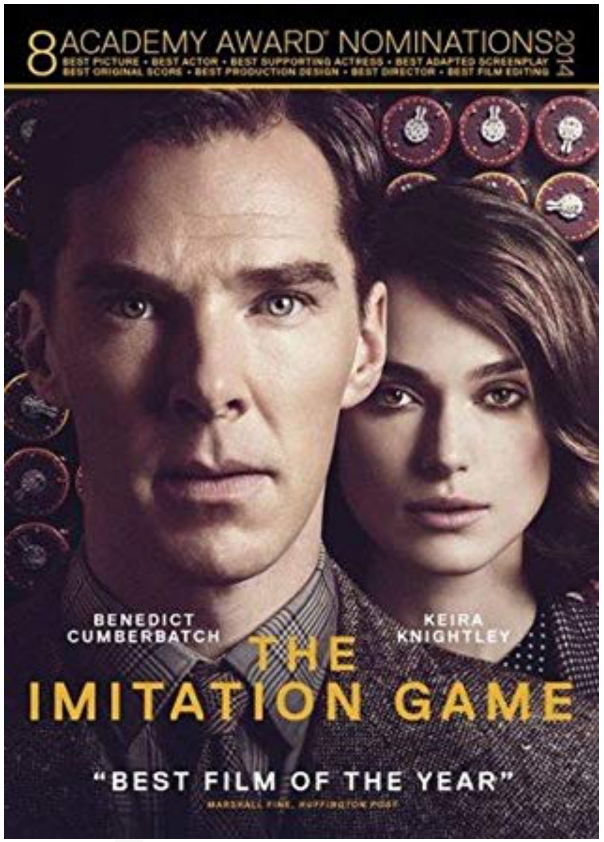
A QUARTERLY REVIEW OF PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND INTELLIGENCE

BY A. M. TURING

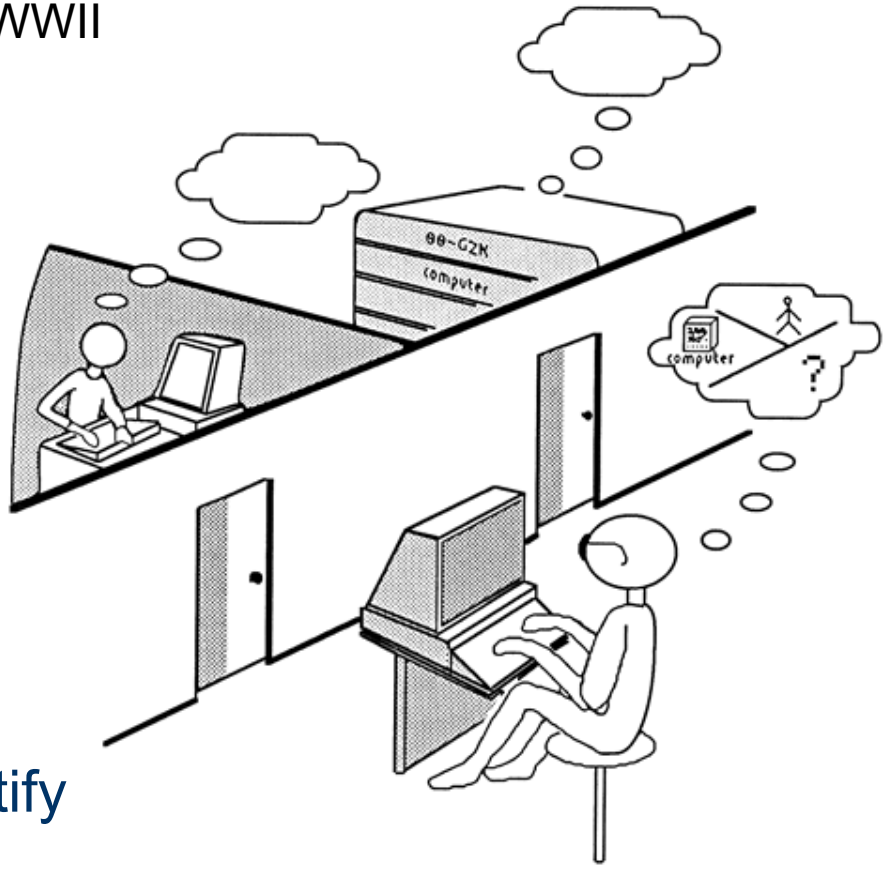
1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly



Alan Turing

- Famous for three things:
  - Contribution to code breaking WWII
  - The Turing Machine
  - The **Turning Test** - aka "The Imitation Game"



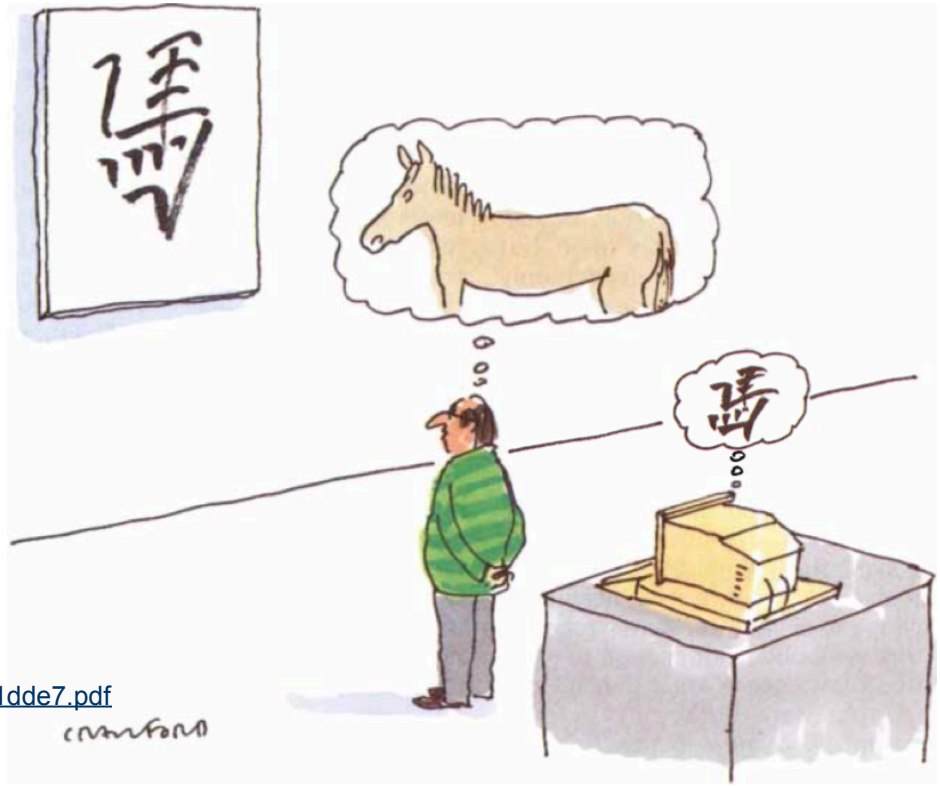
Human tester in conversation with a computer and a human through a 'teletype' system.
If the tester cannot reliably identify the computer the computer passes the **Turing Tes**t.

Turing Test - criticism

- John Searle's "Chinese Room" thought experiment
  - A person knowing nothing about Chinese is locked in a room with a rule book about Chinese symbols.
  - The person produces written answers to written questions in Chinese according to the instructions in the book.
- Criticism of what Searle calls "Strong AI"
  - "The appropriately programmed computer with the right inputs and outputs would thereby have a mind in exactly the same sense human beings have minds."

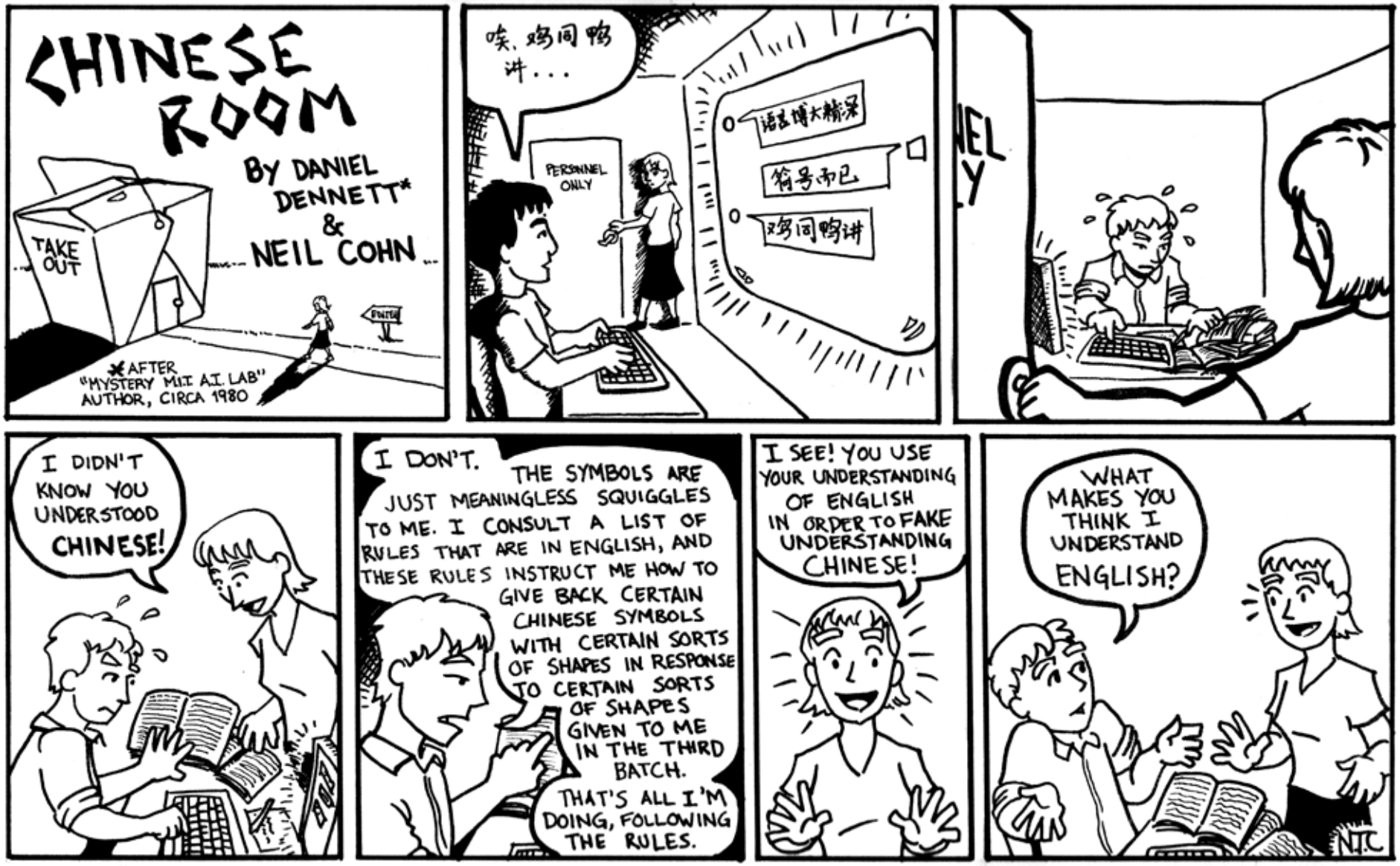
Chinese Room Criticism

- "Programs are formal (syntactic)."
  - A program uses syntax to manipulate symbols and pays no attention to the semantics of the symbols. It knows where to put the symbols and how to move them around, but it doesn't know what they stand for or what they mean. For the program, the symbols are just physical objects like any others.
- "Minds have mental contents (semantics)."
  - Unlike the symbols used by a program, our thoughts have meaning: they represent things and we know what it is they represent.



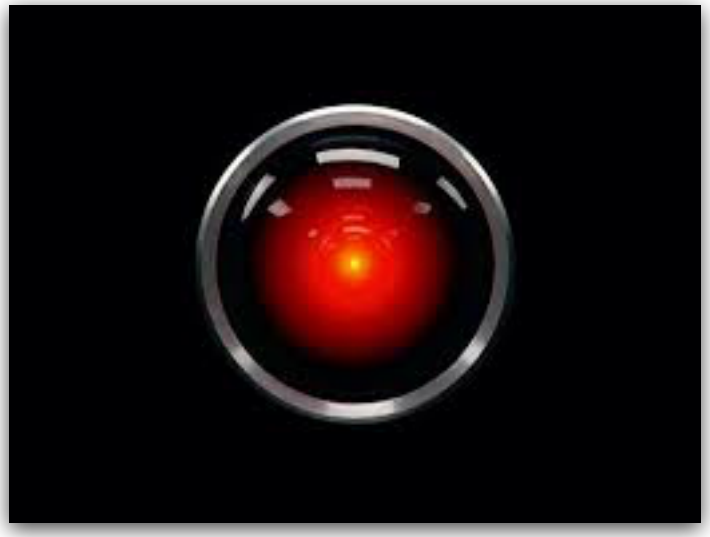
Searle's paper

https://pdfs.semanticscholar.org/77ba/8c7fcffb676758bece2bb3107f1706c1dde7.pdf



www.visuallanguagelab.com

AI in Movies



What is Artificial Intelligence?

‘The scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines.’

The American Association for Artificial Intelligence.

‘AI is the science of making machines do things that would require intelligence if done by humans.’ Marvin Minsky.

What is Artificial Intelligence?

- AI is the part of computer science concerned with designing *intelligent* computer systems –
  - That is, computer systems that exhibit the characteristics we associate with intelligence in human behaviour.
    - For example, problem understanding, learning, reasoning, reacting and planning in order to solve problems.
- AI is helping people in every field make better use of information to work smarter, not harder.


Poster by
AAAI
Association for the Advancement of Artificial Intelligence
AI magazine
Poster development supported in part by
Microsoft Research
YAHOO! RESEARCH
Optimizing Paths & Flows
AI & Creative Expression
Planning
Plan Recognition
AI in Art
AI in Music
Autonomous Vehicles & Safety
Robot Guides & Assistants
Augmenting Cognition
Humanoid Robots
PV=nRT
Intelligent Tutoring
Ubiquitous Computing
Social Computing
Autonomous Space Exploration
AI and Preferences, Media & Entertainment
Home Robotics
AI HISTORY TOUR STARTS HERE
Descartes
Aristotle
Leibniz
Whitehead
Lovelace
Russell
Turing
Gesture Recognition
Multimodal Interfaces
Mixed-Initiative Collaboration
Robots For Education
Robotic Surgery
Diagnosis
Drug Design
Scientific Discovery
Assistive Technology
AI LAB
MEDICAL CENTER
Security & Privacy
Search & Retrieval
User Modeling
Vehicle Navigation
Handwriting & Sketch Recognition
Recommender Systems & Question Answering
Communications Triage
Machine Translation
Ecocomputing
See the AI timeline and more at
www.aaai.org/AILandscape
The AI Landscape
David Leake, Indiana University, Poster Development Committee Chair
Poster Design: Giacomo Marchesi, www.GiacomoMarchesi.com

A Broad Coverage…

- Search
- GamePlaying
- Constraint Satisfaction
- Logic
- Knowledge Representation
- Planning
- Reasoning Under Uncertainty
- Automated Reasoning
- Natural Language Processing
- Perception and Robotics
- Machine Learning
- Data Mining
- Neural Networks…

This Course Overview

- Problem Representation & Reasoning
- Search
  - Blind, Heuristic, Optimal, Stochastic
- Game Playing & Adversarial Search
- Planning
  - Standard, Partial-Order, Hierarchical
- Learning & Classification
  - Machine Learning, Inductive Learning, etc.
  - Neural Networks
  - Genetic Algorithms
- Recommender Systems
  - Collaborative, content-based, hybrid, etc.
- Case Base Reasoning
  - AI application case study

This Course Overview

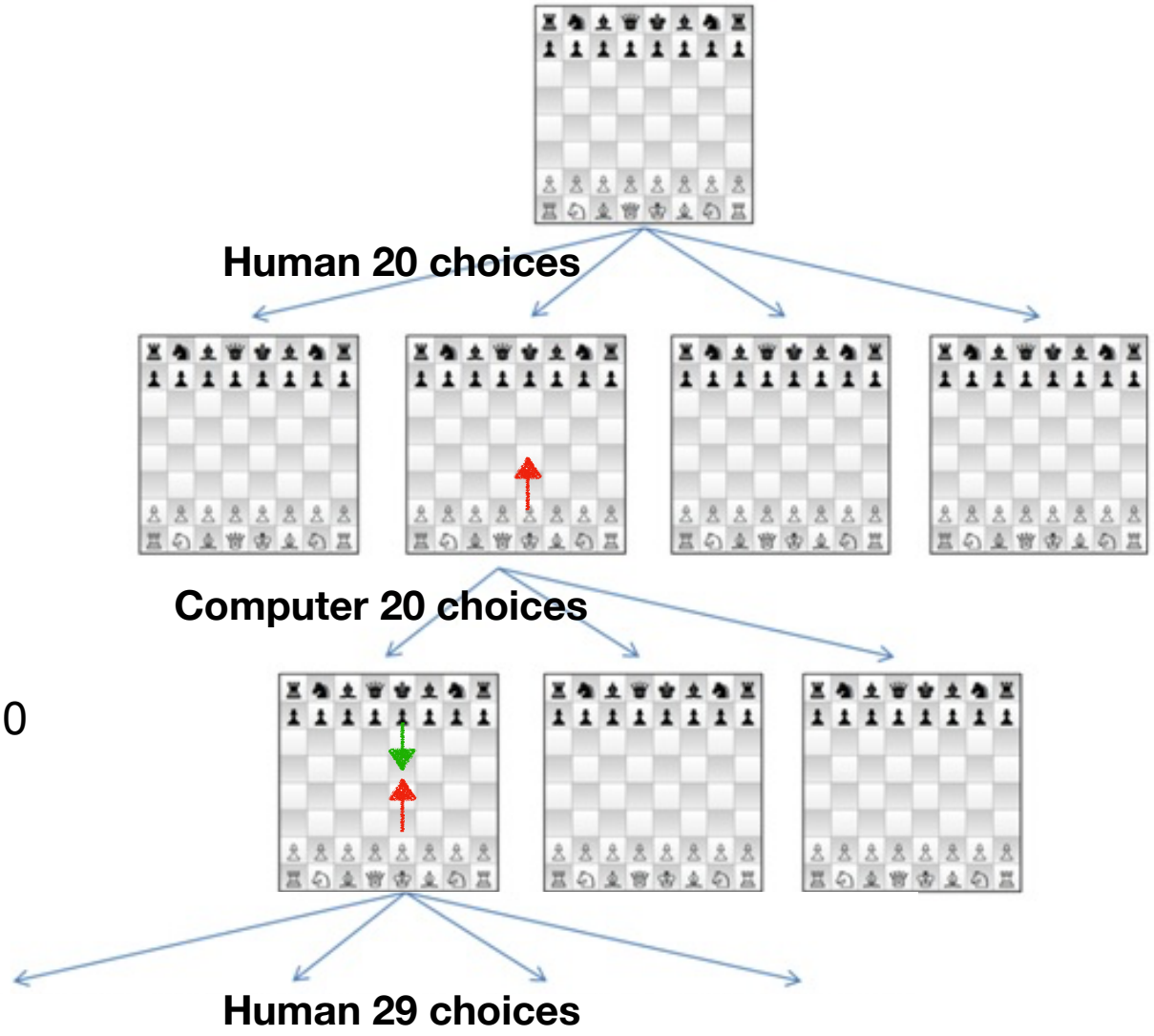
- Problem Representation & Reasoning
- Search
  - Blind, Heuristic, Optimal, Stochastic
- Game Playing & Adversarial Search
- Planning
  - Standard, Partial-Order, Hierarchical
- Learning & Classification
  - Machine Learning, Inductive Learning, etc.
  - Neural Networks
  - Genetic Algorithms
- Recommender Systems
  - Collaborative, content-based, hybrid, etc.
- Case Base Reasoning
  - AI application case study

AI as State-Space Search

- New York 1997
- Deep Blue—Garry Kasparov (3 ½—2 ½)

Chess

- Move - 2 plies
  - White opens
  - Black plays
- Typical game
  - 40 moves
  - 80 ply (half moves)
- Each move
  - > 20 choices
- Game tree
  - Branching factor > 20
  - Depth ~ 80

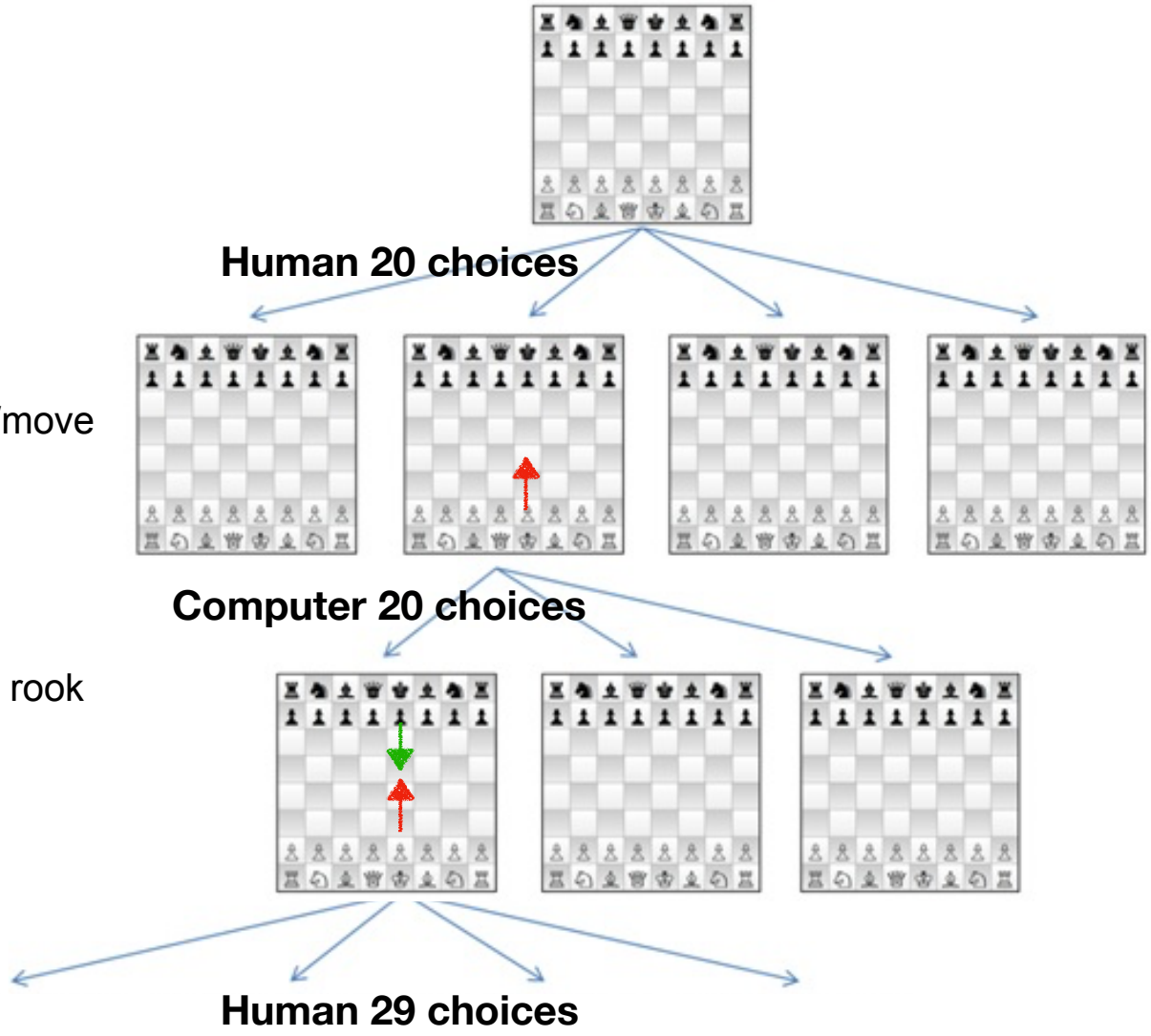


Computer Chess

Brute Force

- Search
  - 6 - 8 moves ahead
    - ***16 ply***
  - Evaluate 200 million positions per second
    - ***30 billion positions***/move

- Evaluation Function
  - Material:
    - pawn = 1, knight = 3, rook = 5, etc
  - Position:
    - piece dependent



The Water Measuring Problem…

- 2 containers with no measuring markers
  - 4 litre
  - 3 litre
- 1 tap
- How do you get exactly 2 litres of water into the 4 litre container?
- **State Space Search**
  - States:
    - Both empty
    - 2L in 4-litre container
  - Transitions
    - Fill 3-litre container
    - Empty 3-litre container into 4-litre container
    - …

- What is a solution?
- How to represent states?
- How many transition types?

Take-Home Messages

- The Turning Test
  - If it looks like a duck…
- The Chinese Room
  - Programs are syntactic
  - Minds have mental states - semantics
- AI as State-Space Search