CS3061 Artificial Intelligence I

Introduction

www.scss.tcd.ie/Tim.Fernando/AI

Key Phrases:

Can machines think?

- Turing test & ELIZA effect
- AI-complete

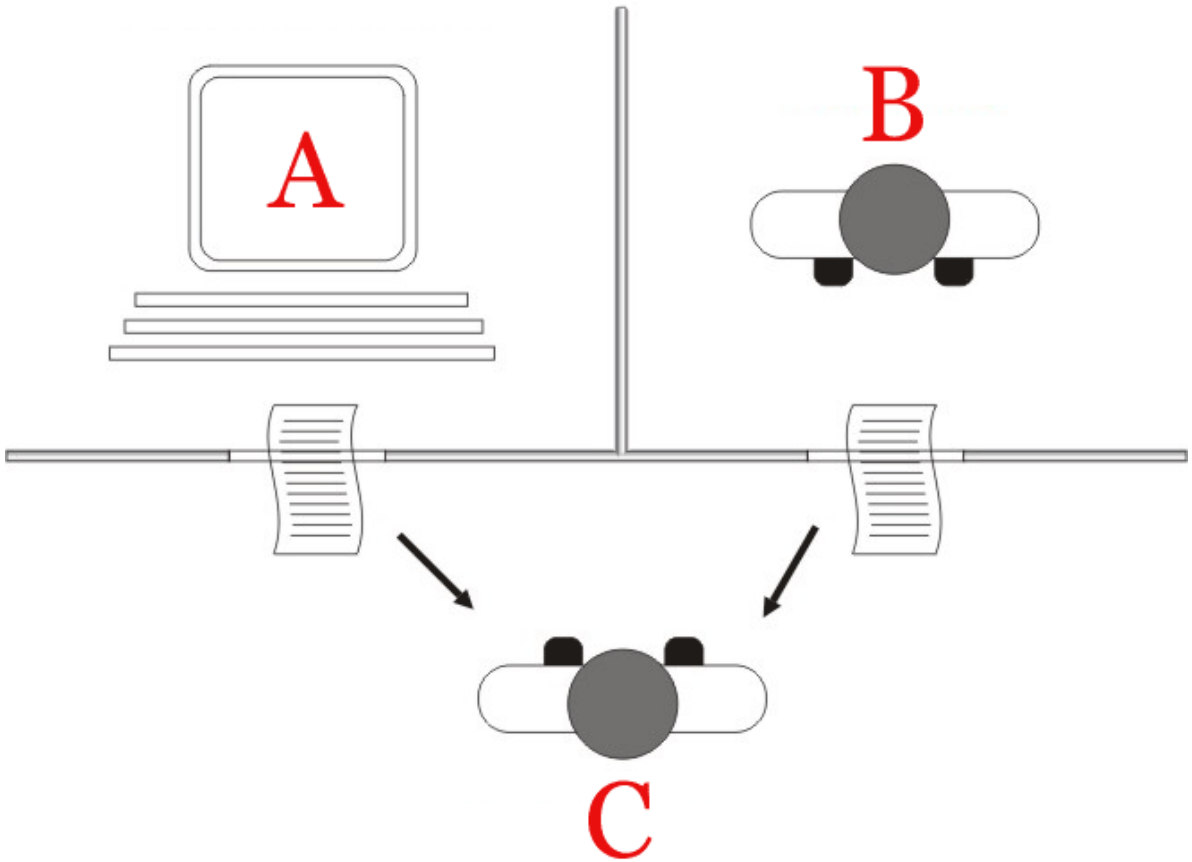
Agent & environment

- Cognitive Revolution & Big Data

Levels of intelligence

Can machines think? (Turing 1950)

Turing test: can C tell A from B?



From Wikipedia, (Juan Alberto Sánchez Margallo)

Intelligence operationalized: subject to testing

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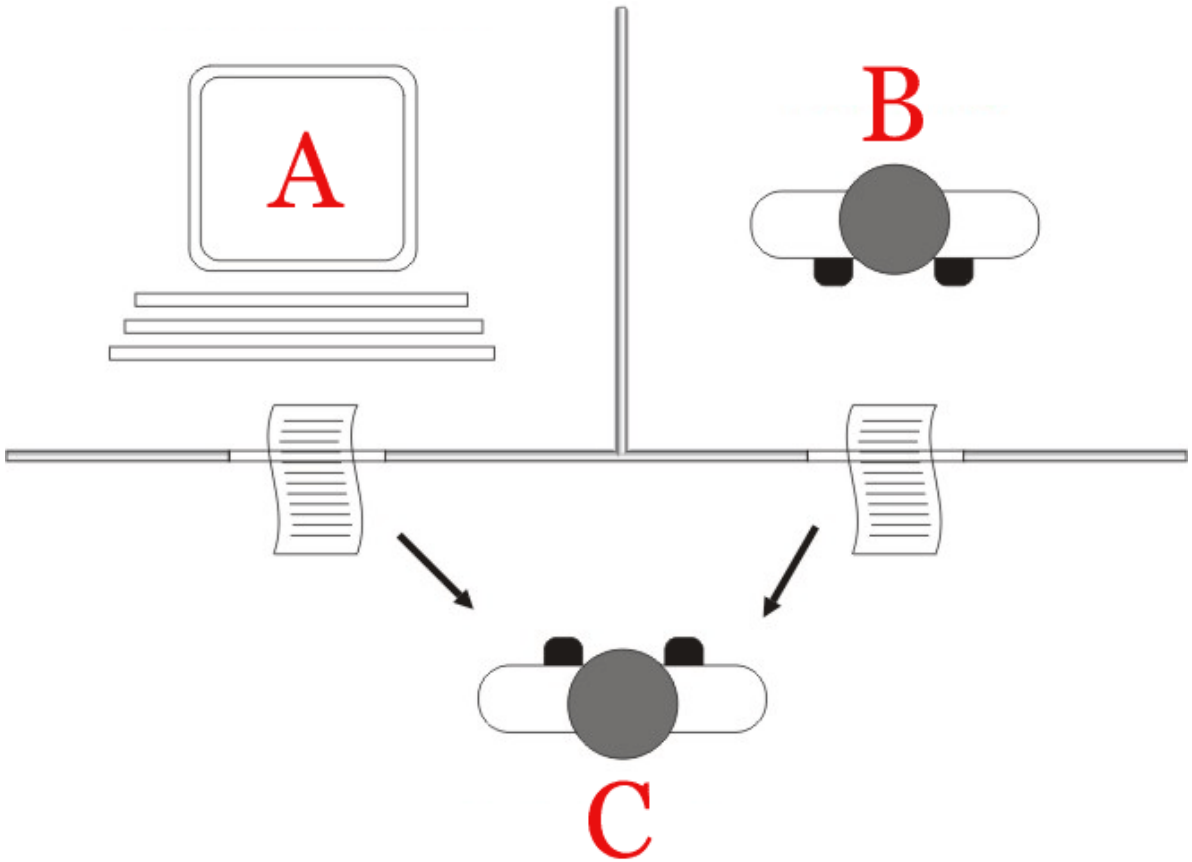

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Intelligence operationalized: subject to testing

. . . cheating?

ELIZA (Weizenbaum, 1964-66) & artful deception

- use pattern matching and substitution to fake understanding

ELIZA effect: humans are inclined to see computers as humans

e.g. when ATM says “thank you”

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An AI problem is **AI-complete** if any AI problem is mechanically reducible to it (i.e., it is at least as hard as any other).

E.g. Natural Language Understanding

The town councilors refused to give the demonstrators a permit because they feared violence.
Who feared violence?

T. Winograd

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The town councilors refused to give the demonstrators a permit because they advocated violence.
Who advocated violence?

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Who advocated violence?

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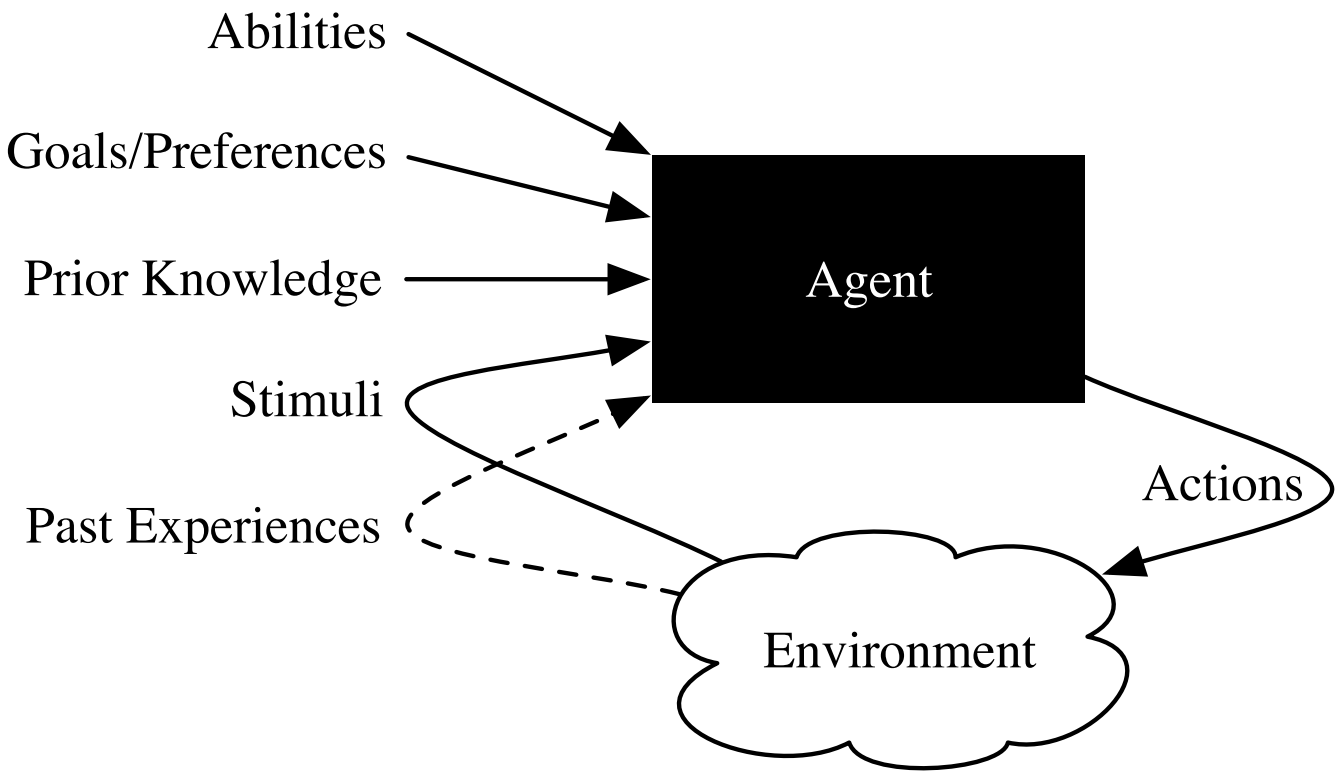
CAUTION: Programs may appear to work better than they do

Siri rage (Urban dictionary):

When you get enraged because Siri just doesn't get it.

Locating intelligence (black box)



Poole & Mackworth

Intelligence: (abilities, goals, . . ., experience) $\mapsto$ action

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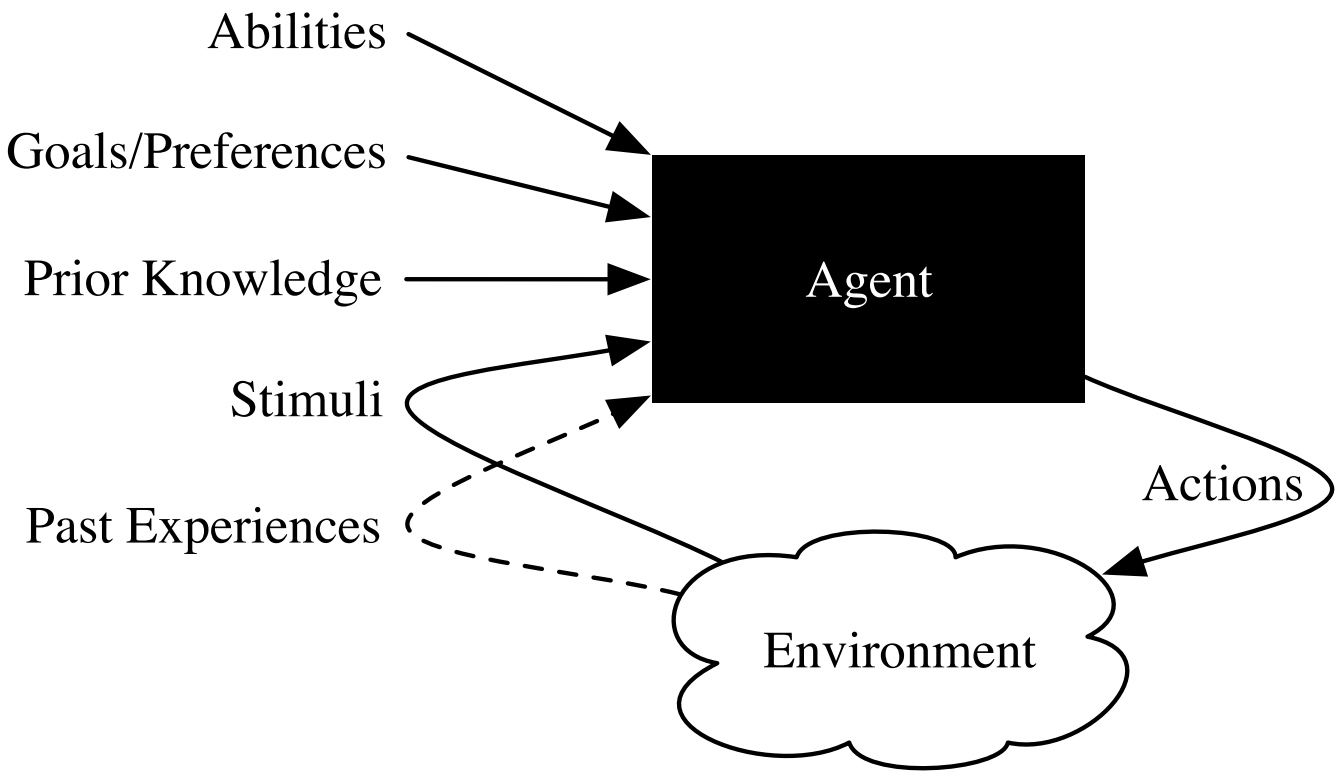

Poole & Mackworth

Intelligence: (abilities, goals, ..., experience) $\mapsto$ action

Turing test: what to say $\rightsquigarrow$ what to do

Between agent and environment

agent	environment
program	data
Cognitive Revolution	Big Data
hard-wired	experienced
rationalist	empiricist
nativist	behaviorist
innate	tabula rasa
nature	nurture

Turing machine &
specialized automaton

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Learning (from environment)
trial & error: "data as oil"

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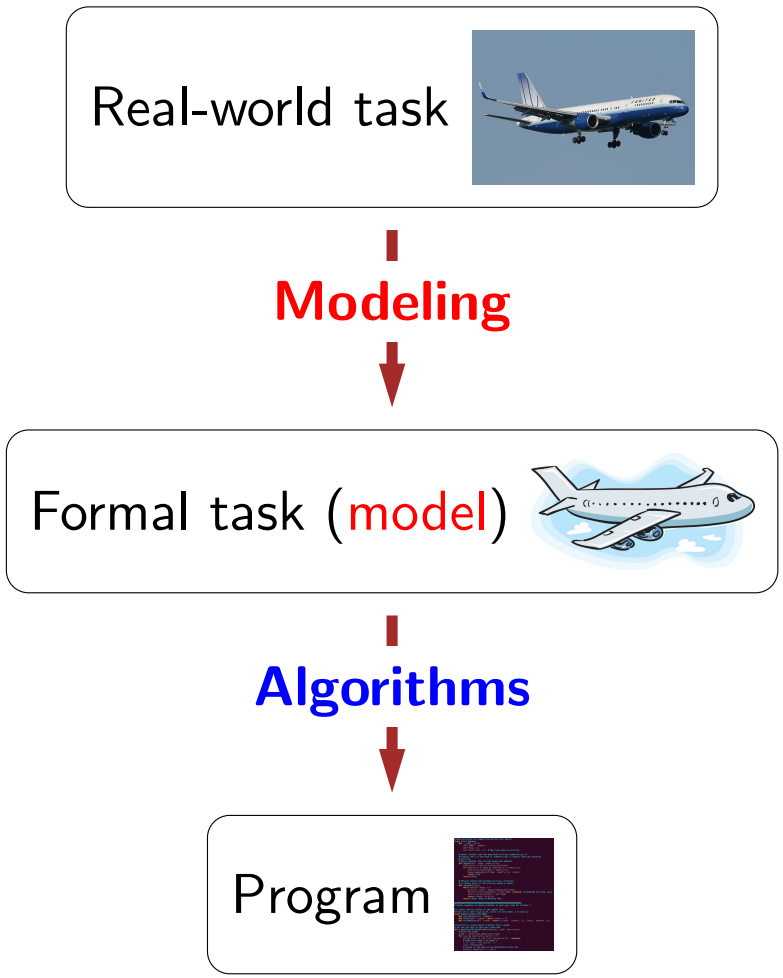
trial & error: "data as oil"

Moving target: changing agent & environment
e.g. change in state

What & how



unstructured information $\rightsquigarrow$ actionable knowledge

Demis Hassabis

www.theguardian.com/technology/2016/feb/16/demis-hassabis-artificial-intelligence-deepmind-alphago

From web.stanford.edu/class/cs221 (Autumn 2016, 2017)

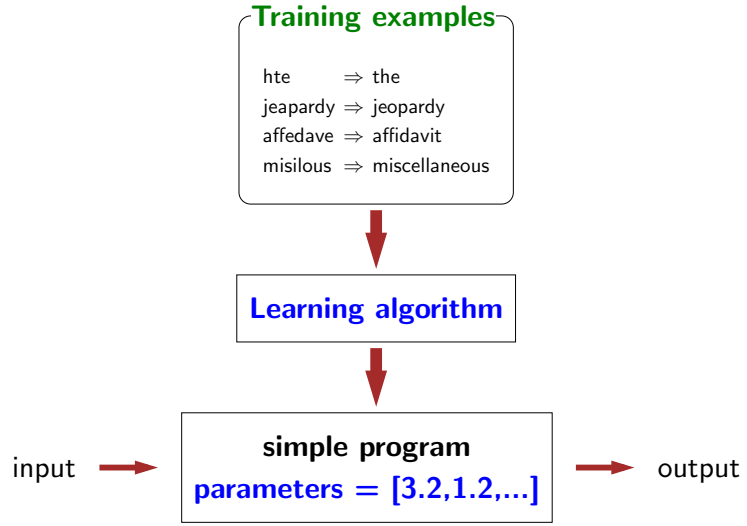
Traditional approach

A spell checker:

input *"hte"* → **complex program** → output *"the"*

Problem: complexity becomes unwieldy

Machine learning approach



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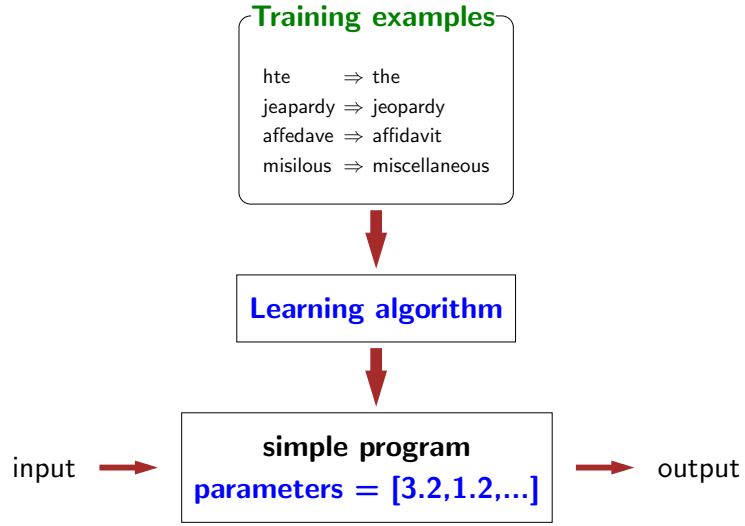

Search problems

Markov decision processes

Adversarial games

Constraint satisfaction problems

Bayesian networks

Reflex **States** **Variables** **Logic**

"Low-level intelligence" "High-level intelligence"

Machine learning

Back in Trinity

Undergraduate ML modules

- CS4404 Machine Learning
  Michaelmas Term (5 ECTS)

- CS4LL5 Advanced Computational Linguistics
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  unsupervised ML for natural language processing

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CS3061: a taste building on CS3011 (Prolog)

- logic & agents as Turing machines
- search
+ Q-learning & Markov decision processes
- Constraint satisfaction
+ Bayesian networks