
人工智能
The ShanghAI Lectures
上海授课

The Shanghai Lectures 2022

Natural and Artificial Intelligence in Embodied Physical Agents

November 3rd, 2022

From Zagreb, Croatia

Today's program (CET)

08:30 sites begin connecting
08:55 all sites are ready
09:00 (Fabio) Welcome
09:05 Intelligence (think different!)
10:00 Break
10:10 Guest Lecture: Angelo Cangelosi, University of Manchester, UK
Cognitive Robotics
11:00 Wrap-up

Lecture 1

Intelligence: think different!

What it is and how it can be studied

Fabio Bonsignorio
Professor, ERA CHAIR in AI for Robotics

University of Zagreb
Faculty of Electrical Engineering and Computing
Laboratory for Autonomous Systems and Mobile Robotics

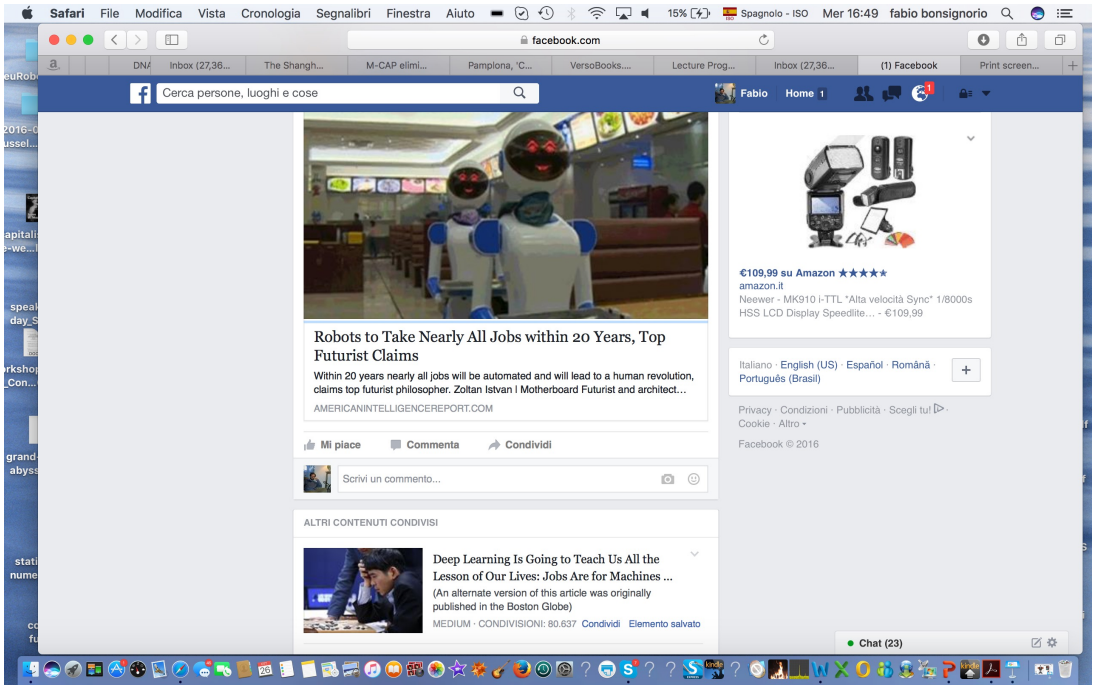
This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No. 952275

www.heronrobots.com

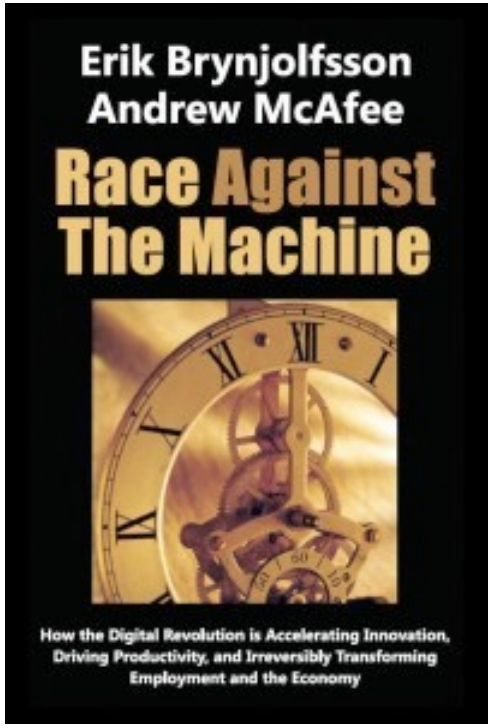
Goals

- What is intelligence? Natural and artificial?
- conceptual and technical know-how in the field
- informed opinion on media reports
- things can always be seen differently
- new ways of thinking about ourselves and the world around us

Info in the media....



Someone is worried....



But maybe we should not be....

Erik Brynjolfsson (first author of the book above):

“The key to growth?

Race _with_ the machines”

(check his nice TED talk here:

http://www.youtube.com/watch?v=sod-eJBf9Y0)

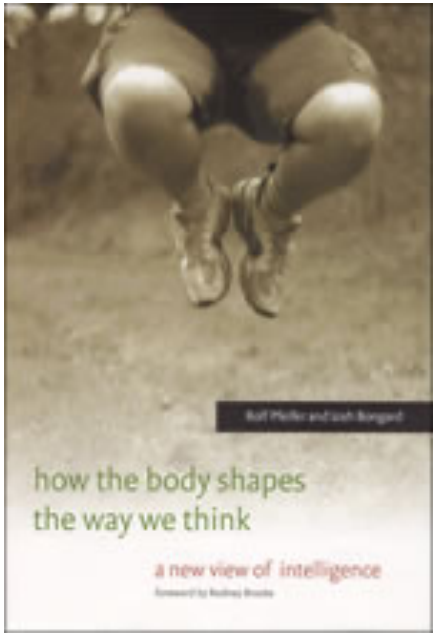
Book for class

Rolf Pfeifer and Josh Bongard

How the body shapes the way we think — a new view of intelligence

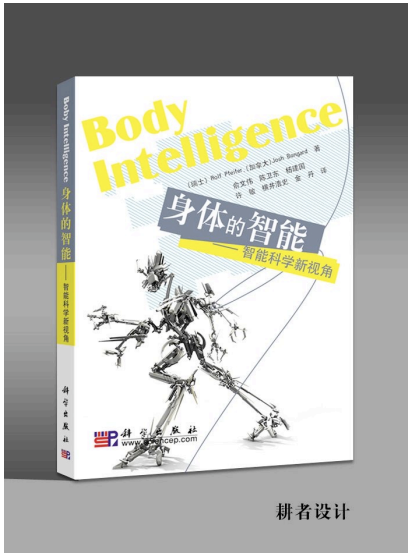
MIT Press, 2007

Illustrations by Shun Iwasawa



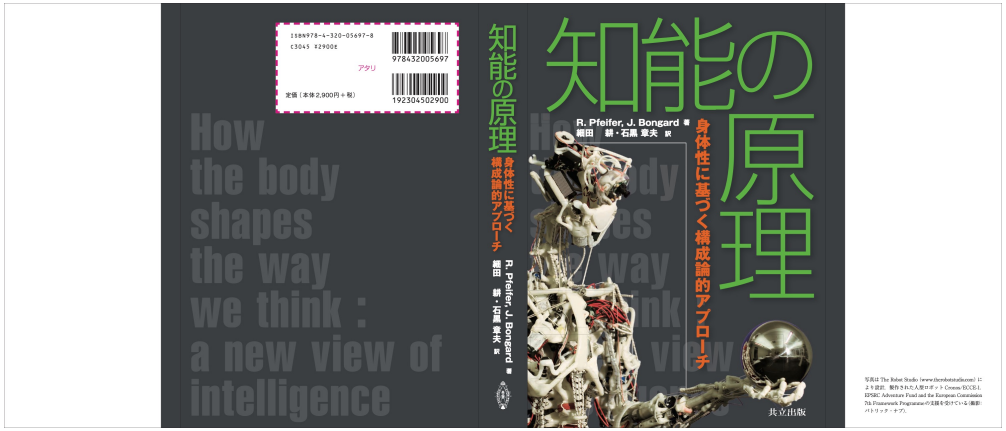
Chinese edition

Translated by
Weidong Chen
Shanghai Jiao Tong University
and
Wenwei Yu
Chiba University, Japan



Foreword by
Lin Chen
Chinese Academy of Science, Beijing

Japanese edition



translated by
Koh Hosoda, Osaka University
and
Akio Ishiguro, Tohoku University

Arabic edition

كيف يشكل الجسد .طريقة تفكيرنا.

Arab Scientific Publishers,

(100 pages)

French edition

La Révolution de l'intelligence du corps

Rolf Pfeifer
Alexandre Pitti

Short e-book version

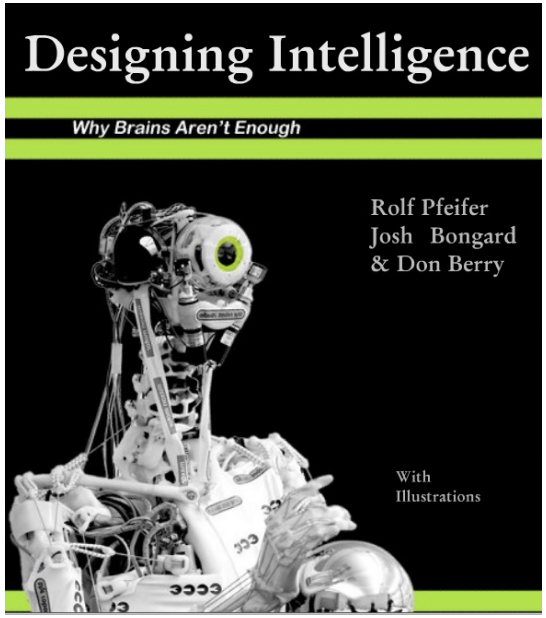
http://ailab.ifi.uzh.ch/

Designing Intelligence

Why Brains Aren't Enough

Rolf Pfeifer
Josh Bongard
Don Berry

(100 pages)

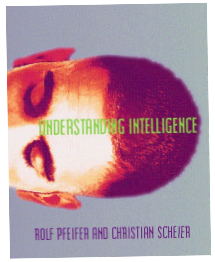


Can be complemented by

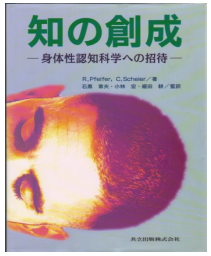
Rolf Pfeifer and Christian Scheier

Understanding Intelligence

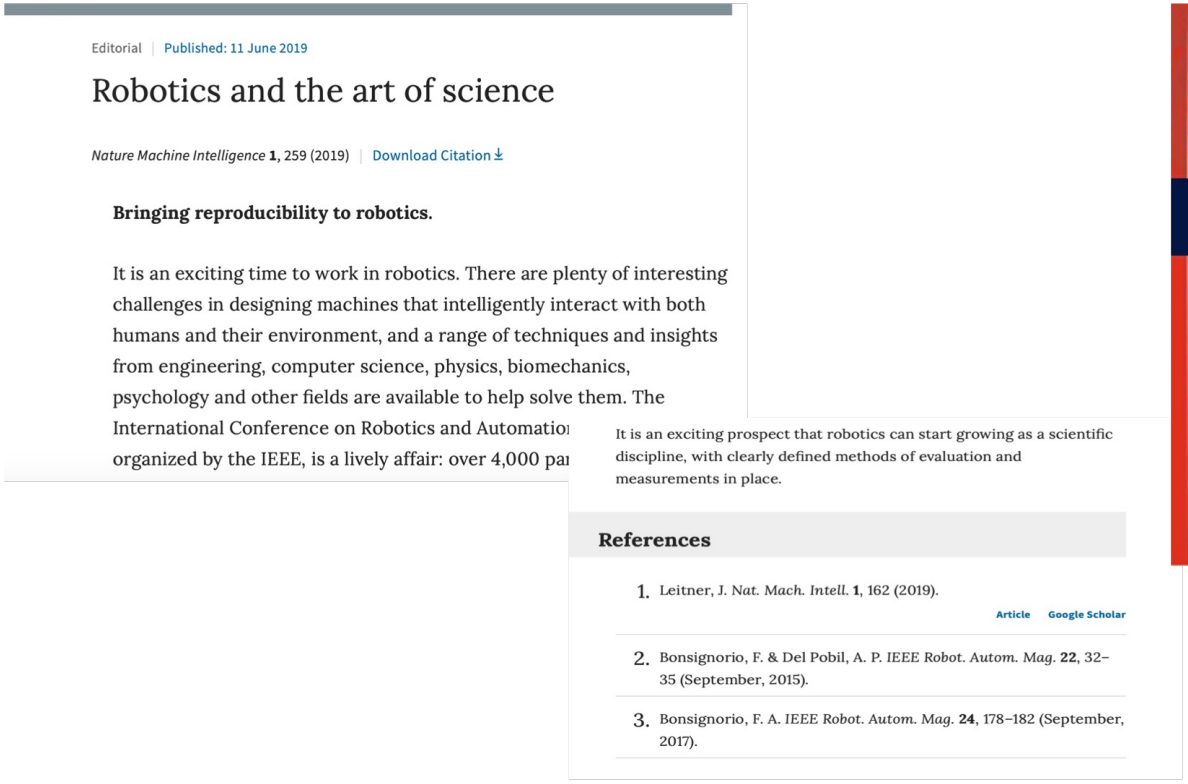
MIT Press, 1999 (paperback edition)



知の創成、共立出版、２００１



Can be complemented by



Editorial | Published: 11 June 2019

Robotics and the art of science

Nature Machine Intelligence **1**, 259 (2019) | Download Citation

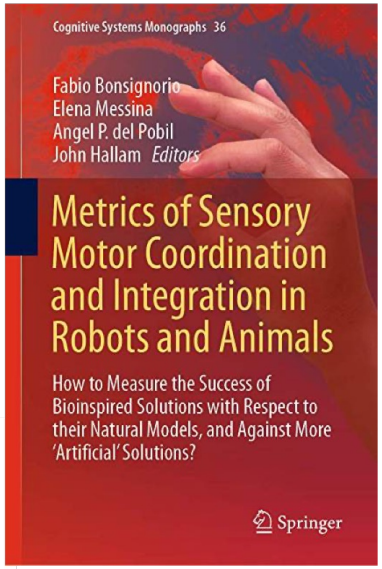
Bringing reproducibility to robotics.

It is an exciting time to work in robotics. There are plenty of interesting challenges in designing machines that intelligently interact with both humans and their environment, and a range of techniques and insights from engineering, computer science, physics, biomechanics, psychology and other fields are available to help solve them. The International Conference on Robotics and Automatio
organized by the IEEE, is a lively affair: over 4,000 pa

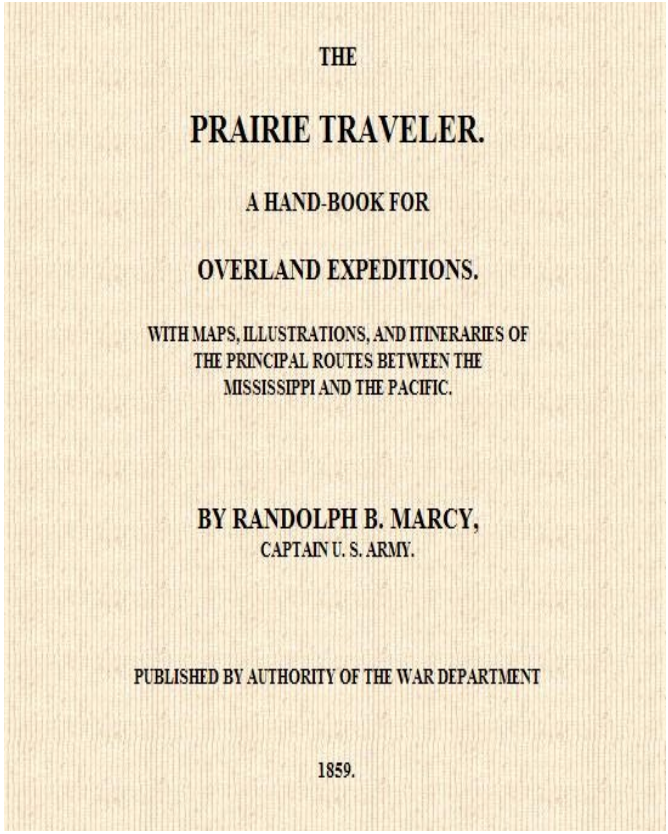
It is an exciting prospect that robotics can start growing as a scientific discipline, with clearly defined methods of evaluation and measurements in place.

References

1. Leitner, J. *Nat. Mach. Intell.* **1**, 162 (2019).
   Article Google Scholar
2. Bonsignorio, F. & Del Pobil, A. P. *IEEE Robot. Autom. Mag.* **22**, 32–35 (September, 2015).
3. Bonsignorio, F. A. *IEEE Robot. Autom. Mag.* **24**, 178–182 (September, 2017).



‘Caveat’



THE

PRAIRIE TRAVELER.

A HAND-BOOK FOR

OVERLAND EXPEDITIONS.

WITH MAPS, ILLUSTRATIONS, AND ITINERARIES OF
THE PRINCIPAL ROUTES BETWEEN THE
MISSISSIPPI AND THE PACIFIC.

BY RANDOLPH B. MARCY,
CAPTAIN U. S. ARMY.

PUBLISHED BY AUTHORITY OF THE WAR DEPARTMENT

1859.

Today's topics

- characterizing intelligence, thinking, and cognition
- "Turing Test" and "Chinese Room Experiment"
- intelligence testing — IQ
- artificial intelligence and its goals
- how to study intelligence: the "synthetic methodology"

Today's topics

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Intelligence?

From the Penguin Dictionary of Psychology

“Few concepts in psychology have received more devoted attention and few have resisted clarification so throughly.”

(Reber, 1995, p. 379)

Some definitions
(1927 psychology journal)

"The ability to carry on abstract thinking" (L. M. Terman)

"Having learned or ability to learn to adjust oneself to the environment" (S. S. Colvin)

"The ability to adapt oneself adequately to relatively new situations in life" (R. Pintner)

"A biological mechanism by which the effects of a complexity of stimuli are brought together and given a somewhat unified effect in behavior" (J. Peterson)

"The capacity to acquire capacity" (W. Woodrow)

"The capacity to learn or to profit by experience"
(W. F. Dearborn)

Definitions of intelligence

http://www.vetta.org/definitions-of-intelligence/ — now defunct ;-(with _70_ definitions

“… there seem to be almost as many definitions of intelligence as there were experts asked to define it.” R.J. Sternberg

(Robert J. Sternberg, distinguished psychologist; famous book “Beyond IQ: A triarchic theory of human intelligence”, 1985)

read instead: “A collection of definitions of intelligence”, Shane Legg, and Markus Hutter, IDSIA, Switzerland

Definitions of intelligence

http://www.vetta.org/definitions-of-intelligence/

Legg and Hutter (webpage): three commonalities

A property that an individual agent has as it interacts with its environment or environments.

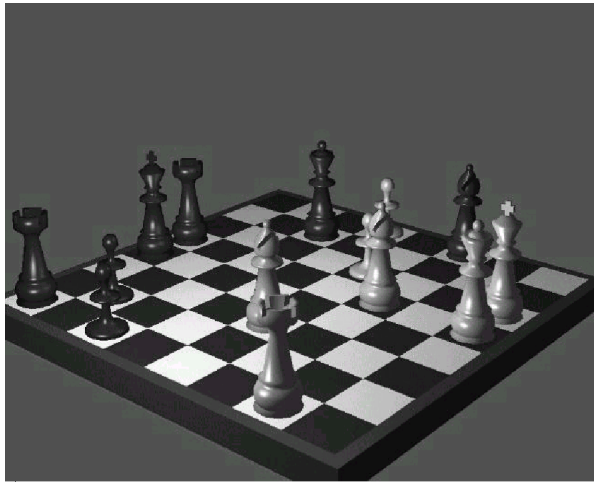
Is related to the agent's ability to succeed or profit with respect to some goal or objective.

Depends on how able the agent is to adapt to different objectives and environments.

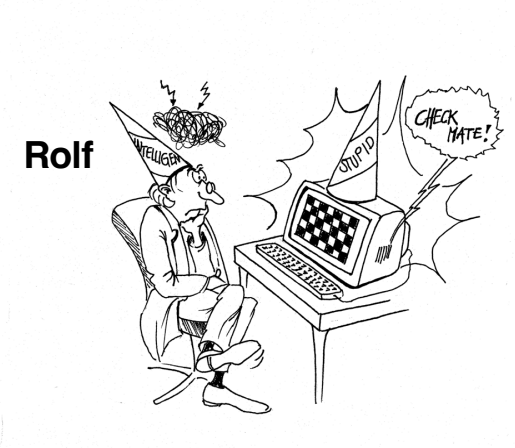
Their definition:
"Intelligence measures an agent's ability to achieve goals in a wide range of environments."

Subjectivity, expectations

Playing chess



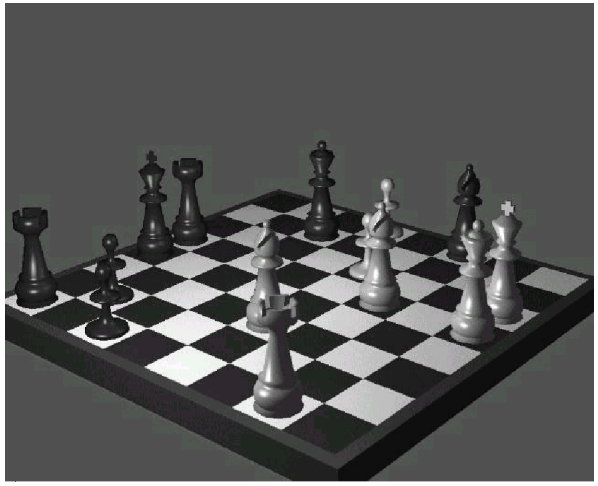
Rolf playing chess



Note: Fabio is obviously much better :-)

Subjectivity, expectations

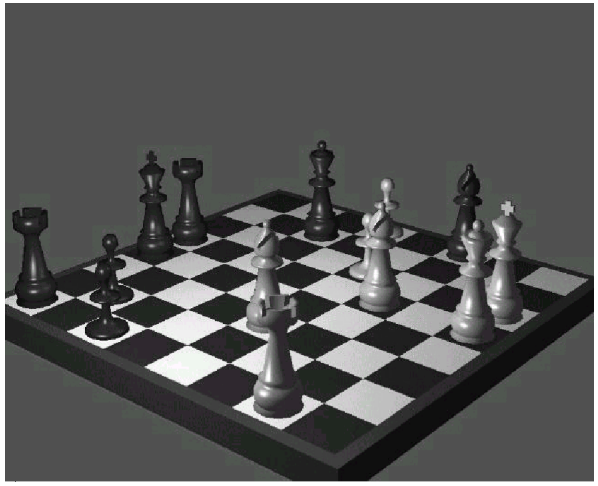
Playing chess



baby girl playing chess

Subjectivity, expectations

Playing chess



dog playing chess

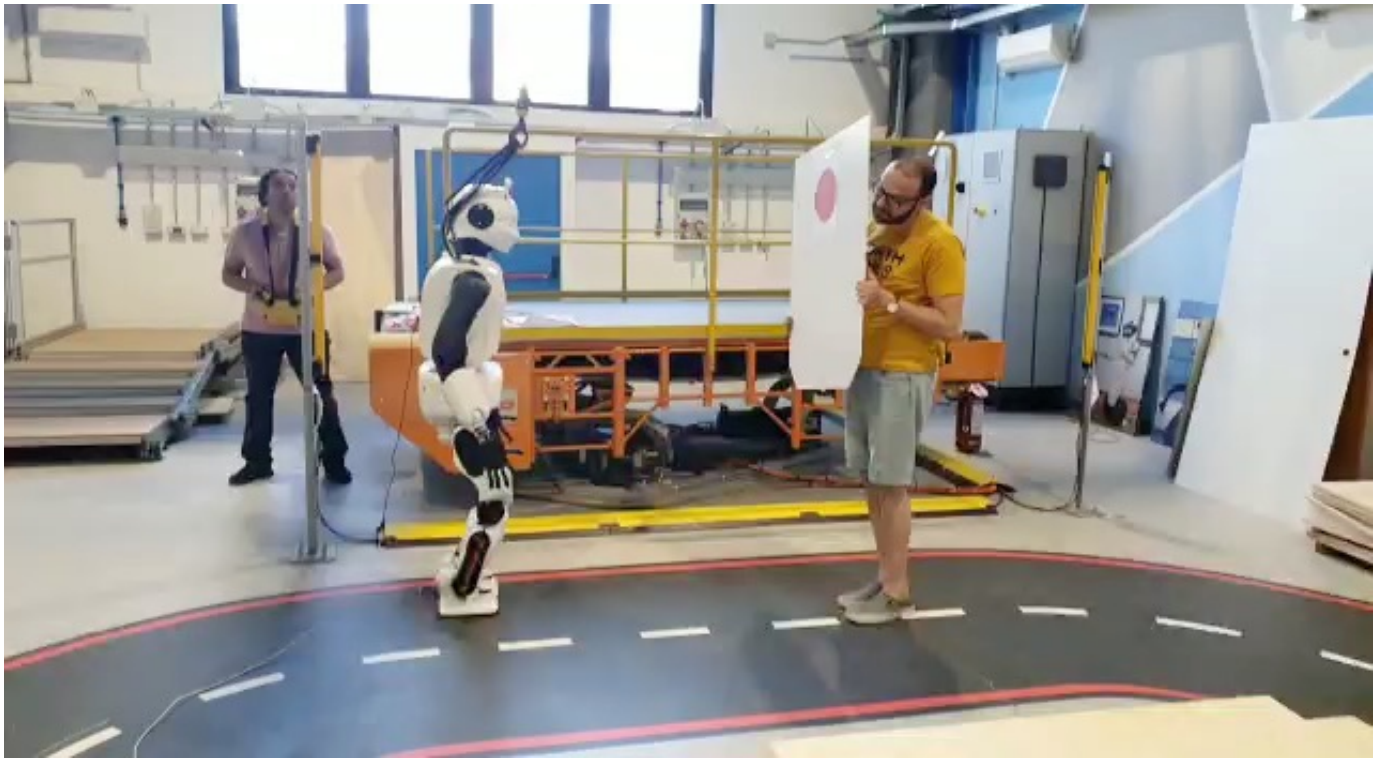
Definitions, arguments

- hard to agree on
- necessary and sufficient conditions?
- are robots, ants, humans intelligent?
- more productive question:

“Given a behavior of interest, how does it come about?”

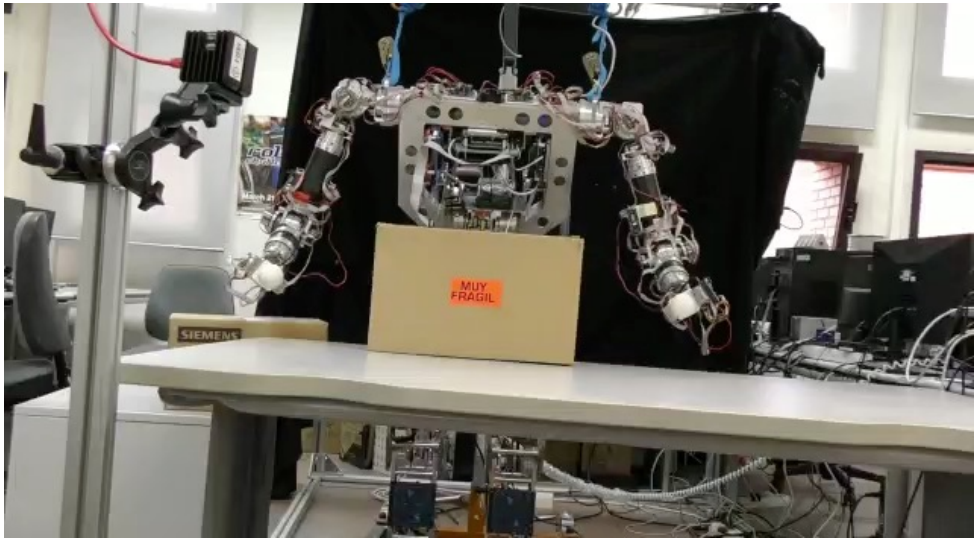
Interaction and observation

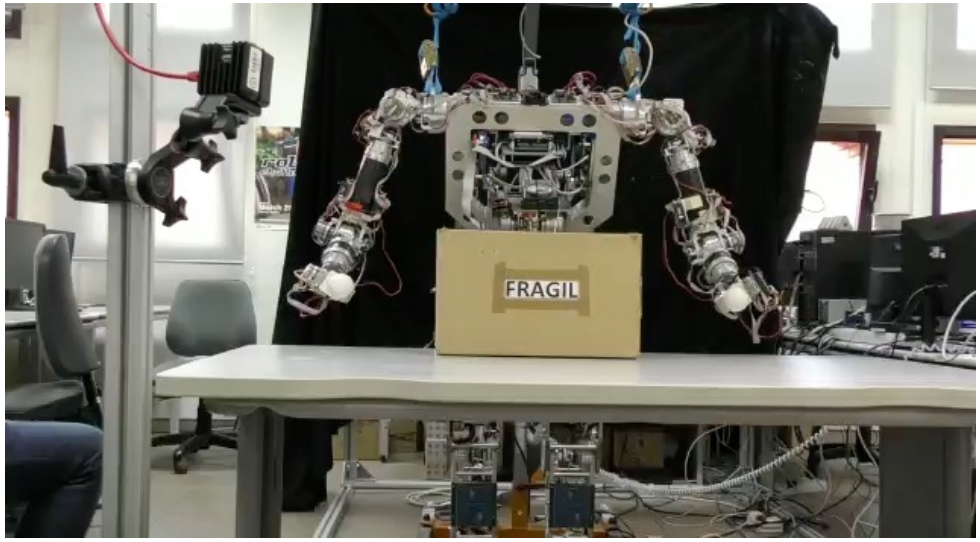
HumaBeliefs



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 779963

HumaBiMan





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Interaction and observation

videos:

intelligent?

—> highly subjective

—> Turing suggests empirical test

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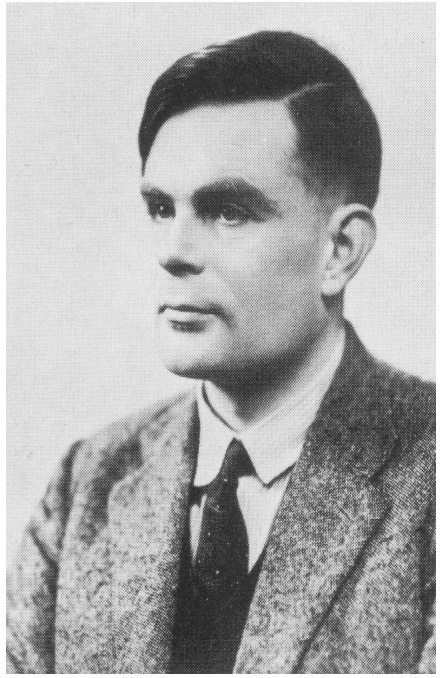
- how to study intelligence: the "synthetic" methodology

An empirical test?

Alan Turing (1912 - 1954)

- **computer**
- **“computation”**
- **intelligence**

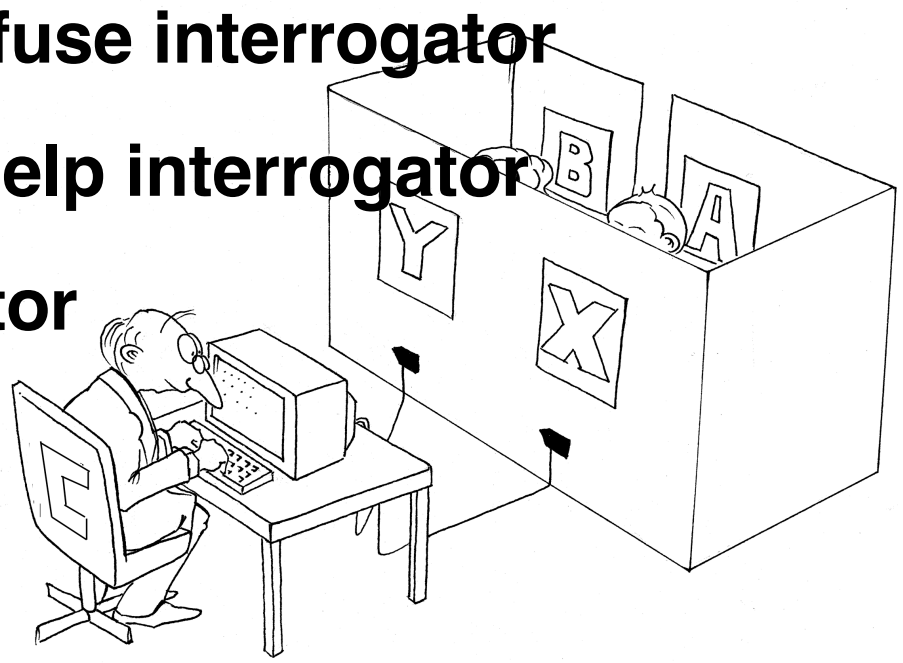


The Turing Test

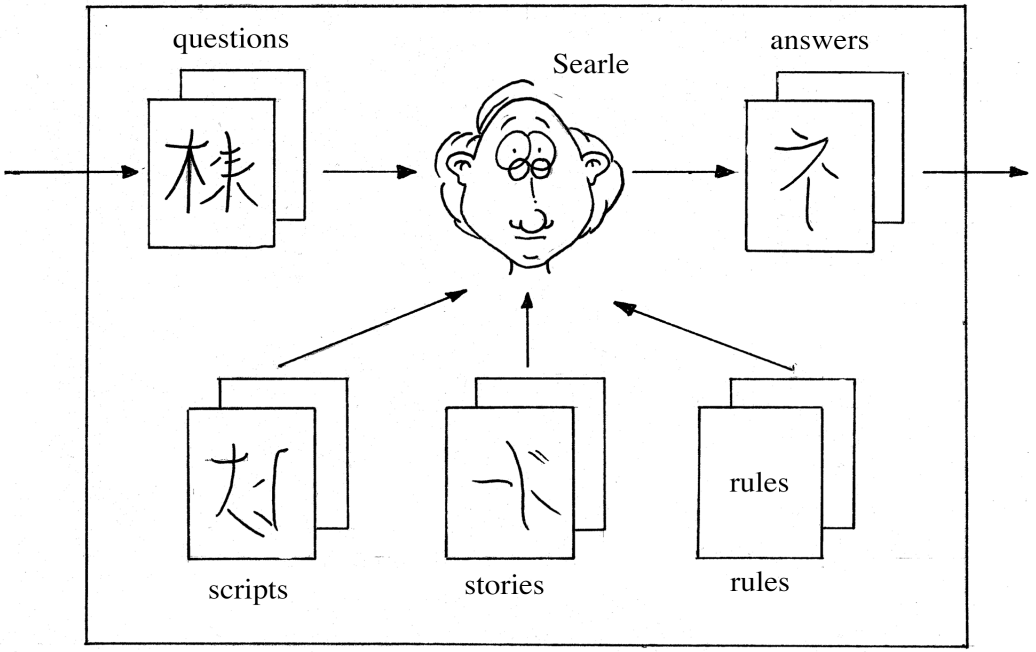
A: man, confuse interrogator

B: woman, help interrogator

C: interrogator



Searle's "Chinese Room" thought experiment



Searle's "Chinese Room" thought experiment

homework:
think about pros and cons
student presentation
next week

Variations on the Turing Test

- Historical: ELIZA (Doctor), Josef Weizenbaum, 1966
- Movie “Blade Runner”, 1982, based on novel by Philip K. Dick (“replicants” look like humans, programmed to die after 4 years —> video clip)
- The Loebner Prize Competition (every year)
- Chatterbots (text-based conversational agents)
- Simplified versions: Computer or Human?

Turing tests

Turing tests

The Voight-Kampff test

The Voight-Kampff test was a test used by the LAPD's Blade Runners to assist in determining whether or not an individual was a replicant. The test measured bodily functions such as respiration, heart rate, blushing and pupillary dilation in response to emotionally provocative questions.

Voight-Kampff test | Off-world - The Blade Runner Wiki - Fandom
https://bladerunner.fandom.com

Turing tests

Turing tests

Measuring intelligence

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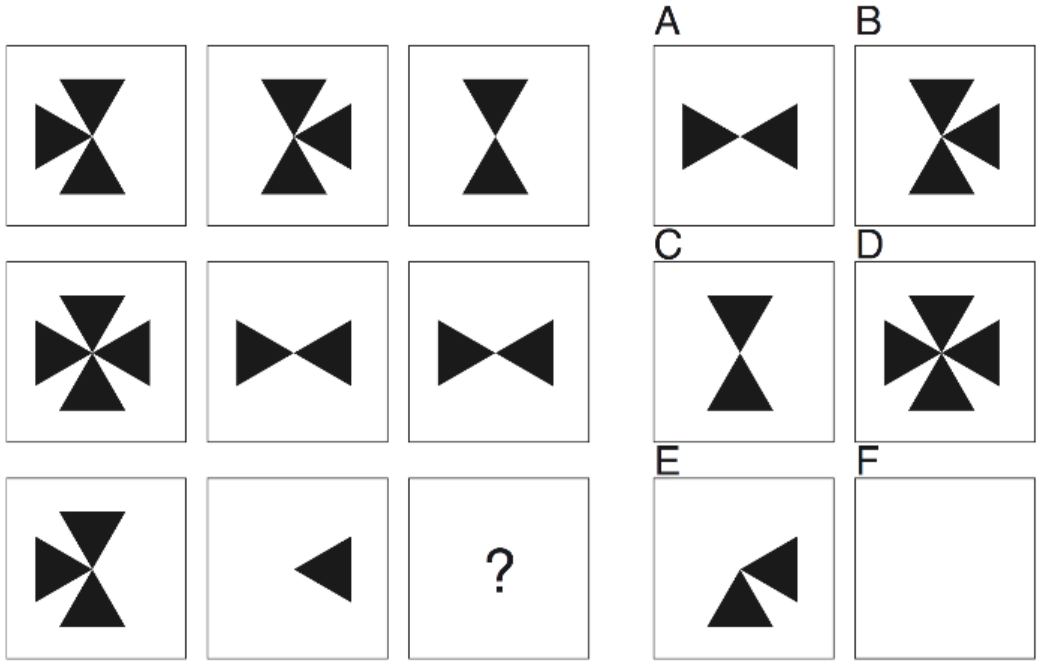
Measuring intelligence



IQ testing — issues

IQ testing — issues (1)

- IQ in genes (nature) or acquired (nurture)? — the “nature-nurture debate”
- IQ trainable — increased through practice?
- cultural differences?
- professional success? why are some with high IQ successful, others not?
- emotional intelligence?
- relation to brain processes?

IQ testing — issues (2)

- many different abilities, not just one number? (tests for different abilities; see Howard Gardner, Robert Sternberg, Steven J. Gould, and many others)
- the “Flynn Effect” (IQ increasing over the years)

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Artificial Intelligence — goals

1. **Understanding biological systems**


animals

humans

2. **Making abstractions, developing theory**

beer-serving robot

Engkey

3. **Applications**

vacuum-cleaner

Today's topics

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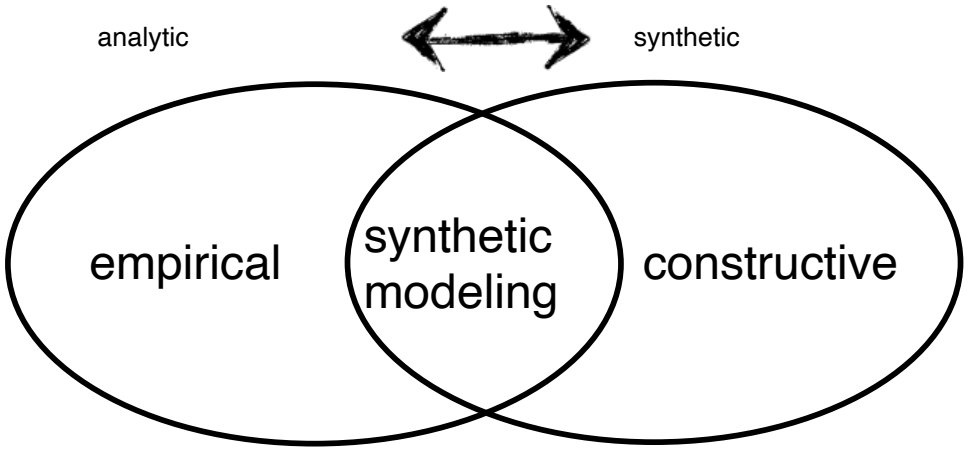
How to study intelligence?



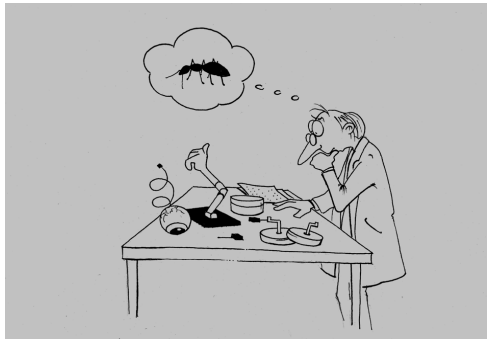
psychology
biology
neuroscience

artificial intelligence
engineering
cognitive science

The synthetic methodology

Slogan:

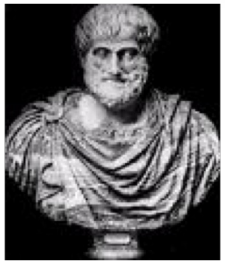
“Understanding by building”



modeling behavior of interest

abstraction of principles

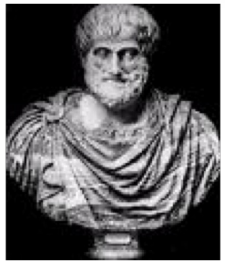
An old dream



“If every tool, when ordered, or even of its own accord, could do the work that befits it, just as the creations of Daedalus moved of themselves . . . If the weavers' shuttles were to weave of themselves, then there would be no need either of apprentices for the master workers or of slaves for the lords.”

Aristotle (from Politics, Book 1, 1253b, 322 BC)

Aristoteles dixit

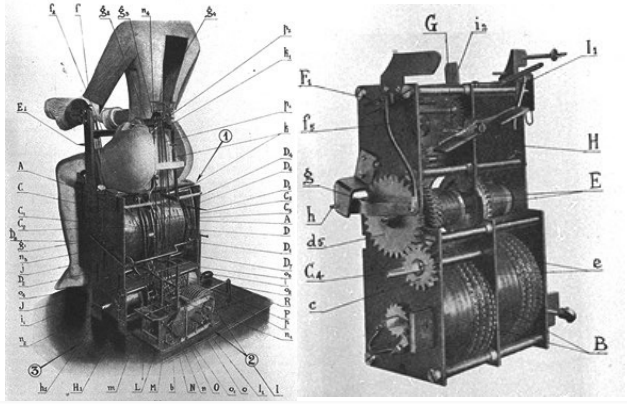


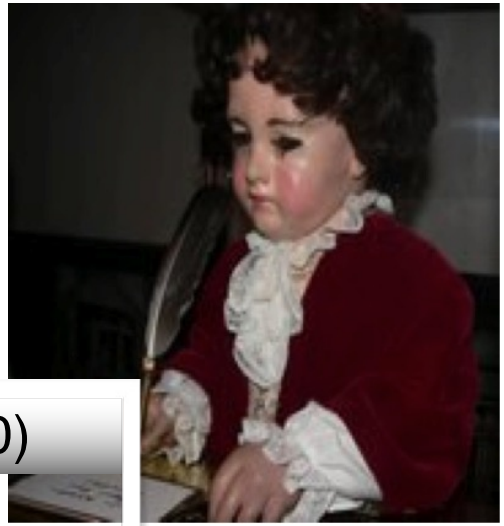
“The part of the quote "or even of its own accord” is elsewhere translated as "or by seeing what to do in advance" etc. (you may find many translations). I think this is an important part of the quote, so it's good to go back to the original text: Aristotle uses the word "προαισθανόμενον" –

proaisthanomenon this means literaly: pro = before, aisthanomenon = perceiving, apprehending, understanding, learning (any of these meanings in this order of frequency) in my view it is clearly a word that is attributed to intelligent, living agents....i.e. ones with cognitive abilities (!)”

personal communication, Dr. Katerina Pastra
Research Fellow
Language Technology Group
Athens, Greece

Old attempts





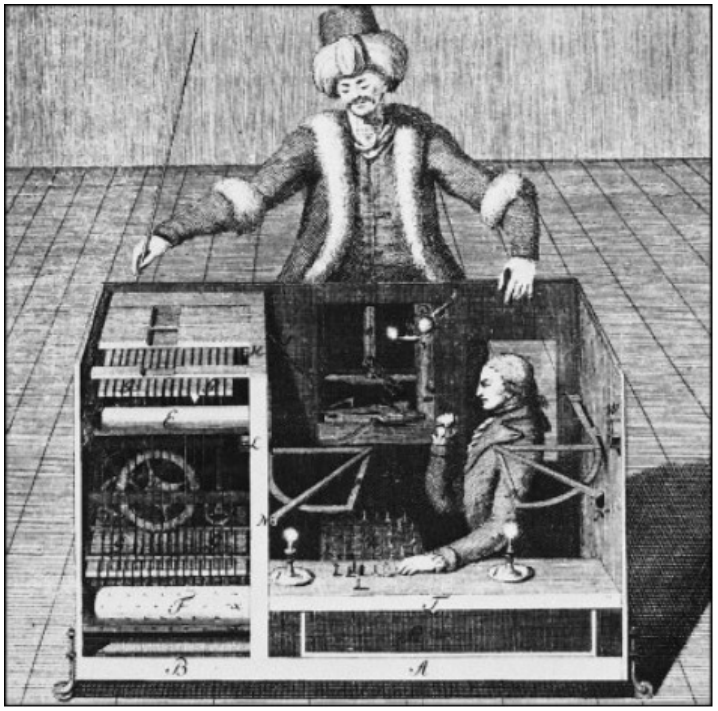
Jaquet-Droz Brothers (1720-1780)

Old attempts

Karakuri Dolls

Chahakobi Ningyo (Tea Serving Doll) by SHOBEI Tamaya IX, and plan from 'Karakuri Zuii' ('Karakuri - An Illustrated Anthology') published in 1796.

W. Van Kempelen's Chess Player (1769)

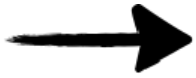


The synthetic methodology

Slogan:

“Understanding by building”

modeling behavior of interest
abstraction of principles



robots as tools for scientific investigation

Many examples during ShanghAI lectures

Issues to think about:
IQ and professional success

The "Mensa International" http://www.mensa.org/ is an organization whose roughly 100.000 members worldwide score in the top 2 % on intelligence tests. On standard IQ tests, this is around 140 or

Issues to think about:
IQ and professional success

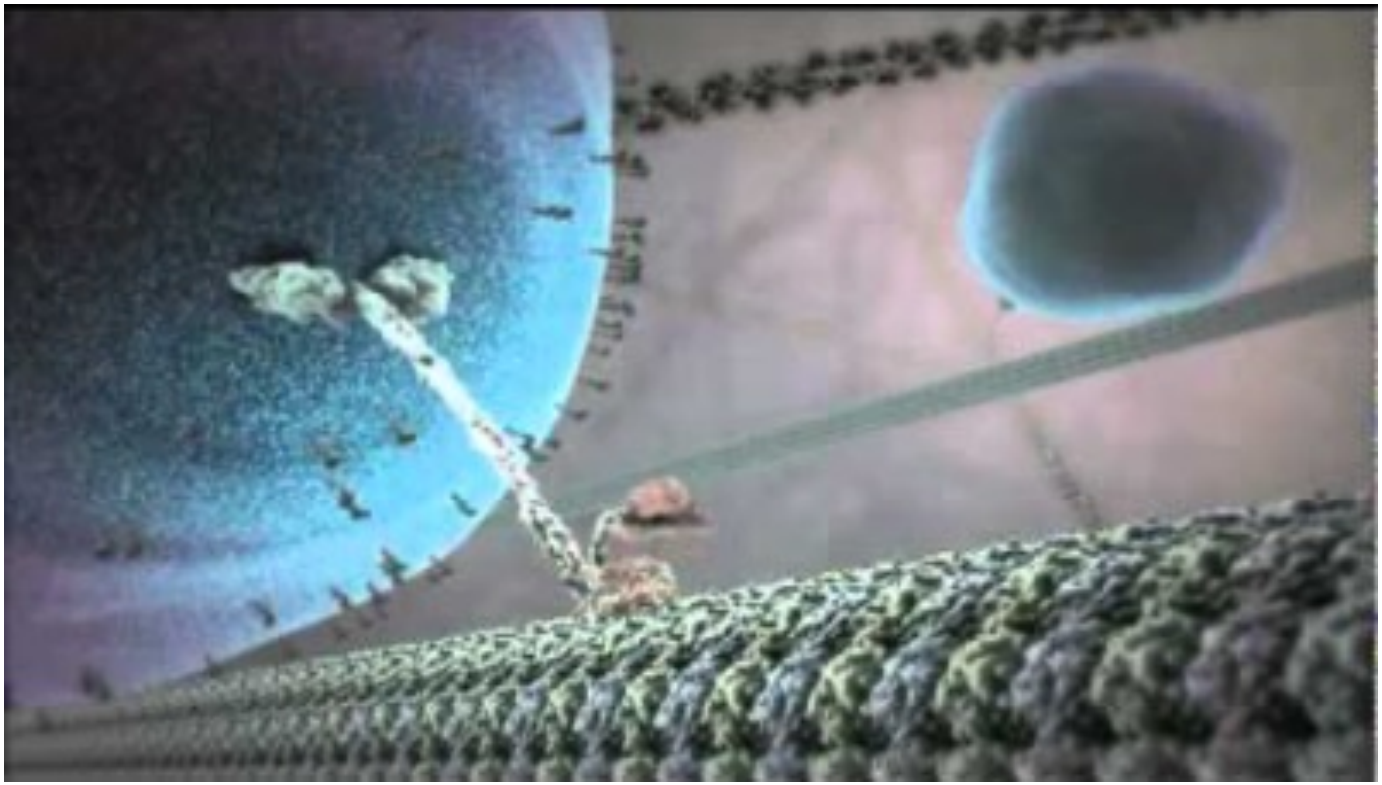
The "Mensa International" http://www.mensa.org/ is an organization whose roughly 100.000 members worldwide score in the [illegible] On standard IQ tests, this is [illegible] has sometimes been taken [illegible] success, it is interesting [illegible] members are professiona[illegible]n't.

Why could t[illegible]

homework:
think about this issue
student presentation
next week

Issues to think about: an unfair comparison

Issues to think about: an unfair comparison



Issues to think about: an unfair comparison

Video: an excellent

homework:
think about this issue
student presentation
next week

Today's Guest Lecture

10:10 CET Angelo Cangelosi,
University of Manchester, UK

«Cognitive Robotics»

Stay tuned!

End of lecture 1

Thank you for your attention!

stay tuned for lecture 2

“The Role of Embodiment in Intelligent Systems”

End of lecture 1

Thank you for your attention!

stay tuned for lecture 2

“The Role of Embodiment in Intelligent Systems”

Short Bio

The ShanghAI Lectures 2013-

Prof. Fabio Bonsignorio is **ERA Chair in AI for Robotics** at FER, University of Zagreb, Croatia. He is **Founder and CEO of Heron Robots (advanced robotics solutions), see www.heronrobots.com**. He has been visiting professor at the **Biorobotic Institute of the Scuola Superiore Sant'Anna in Pisa from 2014 to 2019**. He has been a professor in the Department of System Enginering and Automation at the **University Carlos III of Madrid until 2014**. In 2009 he got the **Santander Chair of Excellence in Robotics** at the same university. alla stessa università. He has been working for some 20 years in the high tech industry before joining the research community.

He is a **pioneer and has introduced the topic of Reproducibility of results in Robotics and AI**. He is a **pioneer in the application of the blockchain to robotics and IA (smart cities, smart land, smart logistics, circular economy. He coordinates Topic Group of euRobotics about Experiment Replication, Benchmarking, Challenges and Competitions. He is co-chair IEEE Robotics & Automation Society (RAS) Technical Commitee, TC-PEBRAS (PErformance and Benchmarking of Robotics and Autonomous Systems)**.

He is **Distinguished Lecturer per la IEEE Robotics and Automation Society.**' Senior Member of IEEE e member of the Order of the Engineers of Genoa, Italy.

He coordinates the task force robotics, in the G2net,an EU network studying the application of **Machine Learning and Deep Learning (Apprendimento Profondo) to Gravitational wave research, la Geophysics and Robotics**.

Has given invited seminars and talks in many places: MIT Media Lab, Max Planck Institute, Imperial College, Politecnico di Milano in Shenzhen, London, Madrid, Warsaw, San Petersbourg, Seoul, Rio Grande do Sul.…

Thank you!

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University of Zagreb
Faculty of Electrical Engineering and Computing
Laboratory for Autonomous Systems and Mobile Robotics

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www.heronrobots.com