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The  
Shanghai AI

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Lectures

授  
课



# The ShanghAI Lectures

## An experiment in global teaching

Fabio Bonsignorio  
The BioRobotics Institute, SSSA and Heron Robots

欢迎您参与  
“来自上海的人工智能系列讲座”

# Lecture 2

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**Intelligence — things can be seen  
differently**

**What it is and how it can be studied**

**01 November 2018**



# Goals

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- **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**





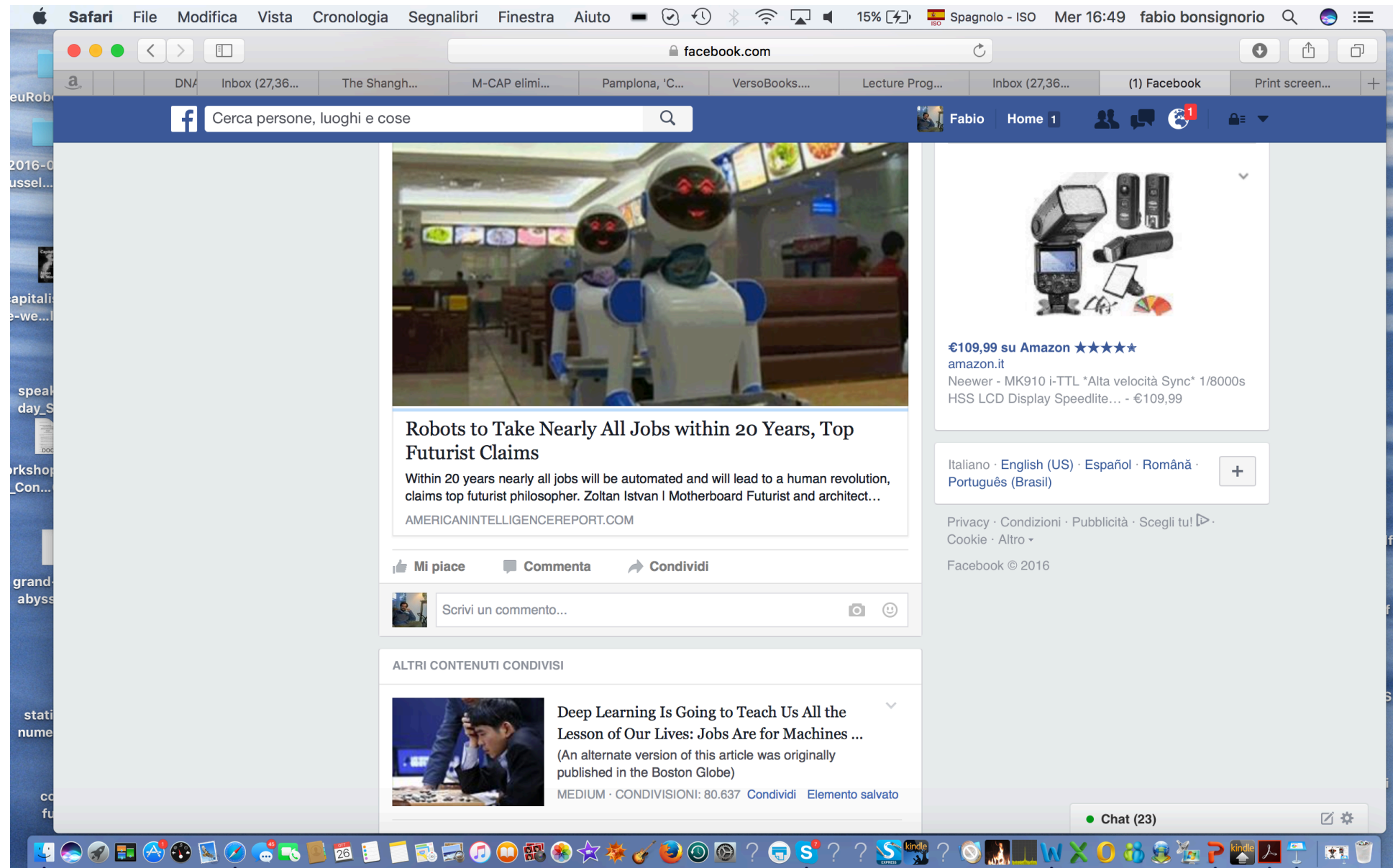
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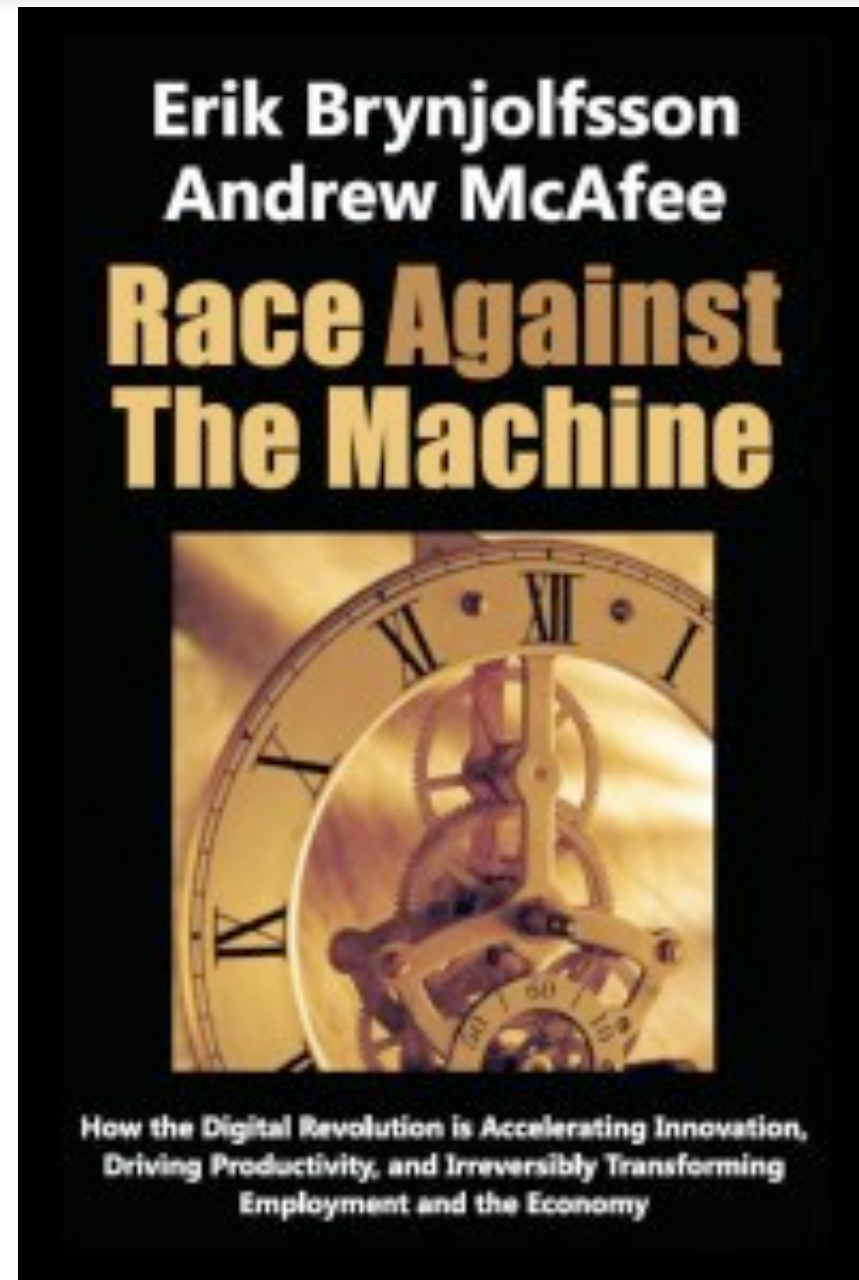


# Info in the media....



# Someone is worried....

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# But maybe we should not be....

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**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>)**



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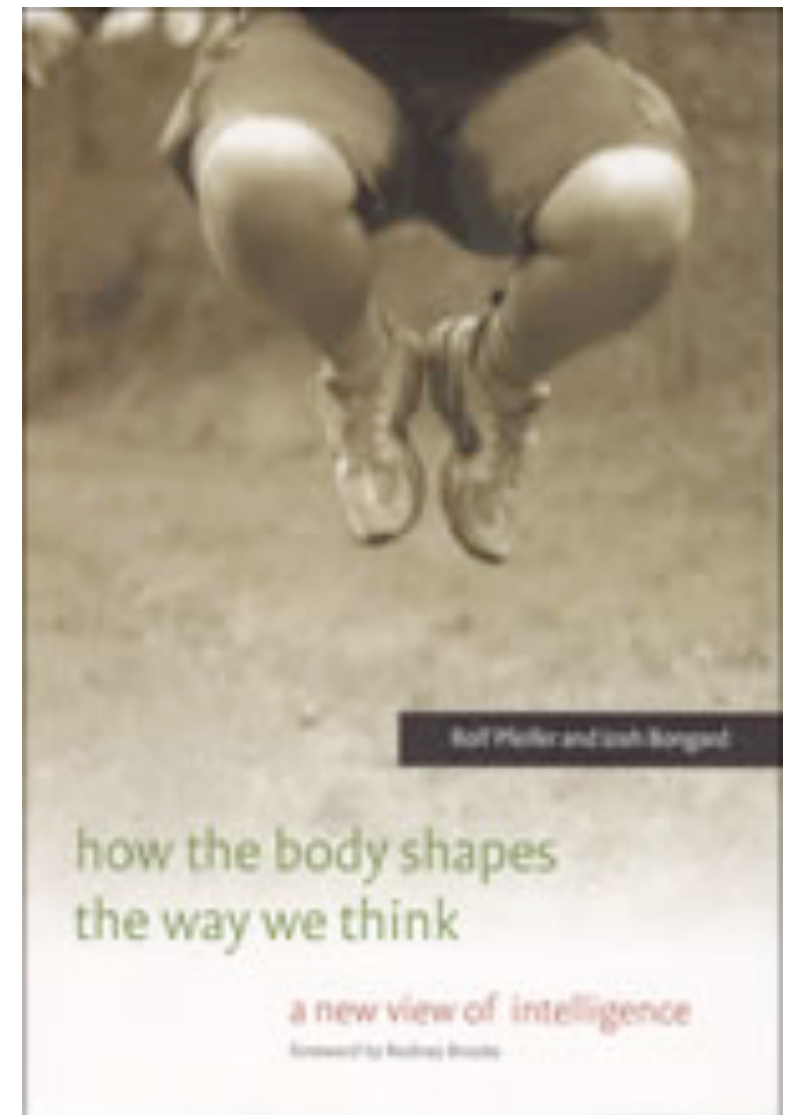
# Book for class

**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**

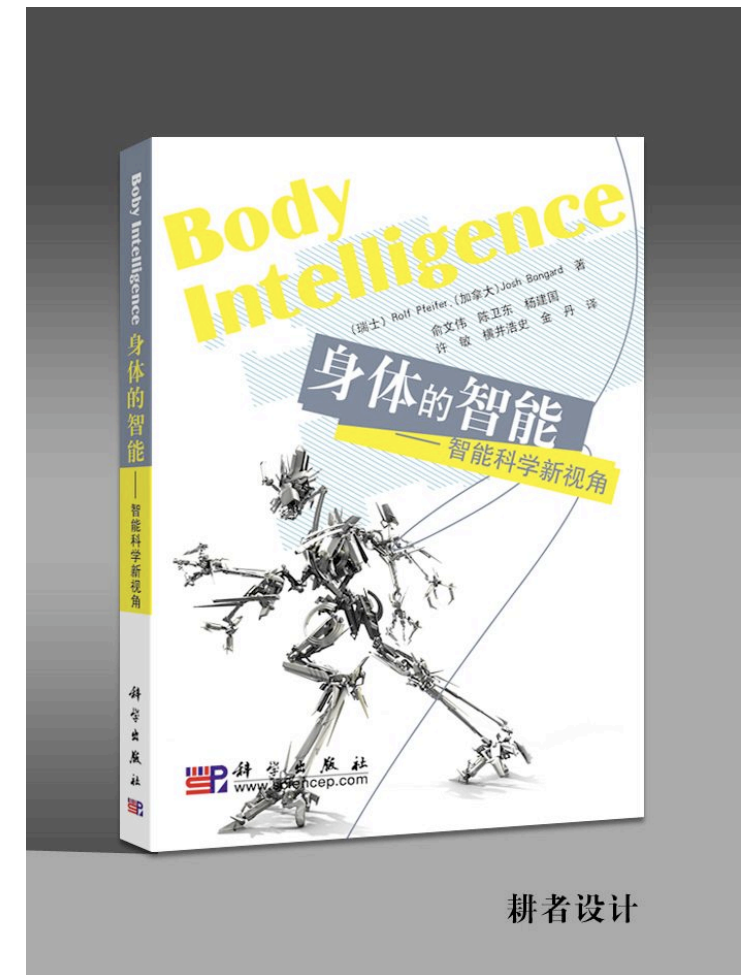


# Chinese edition

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

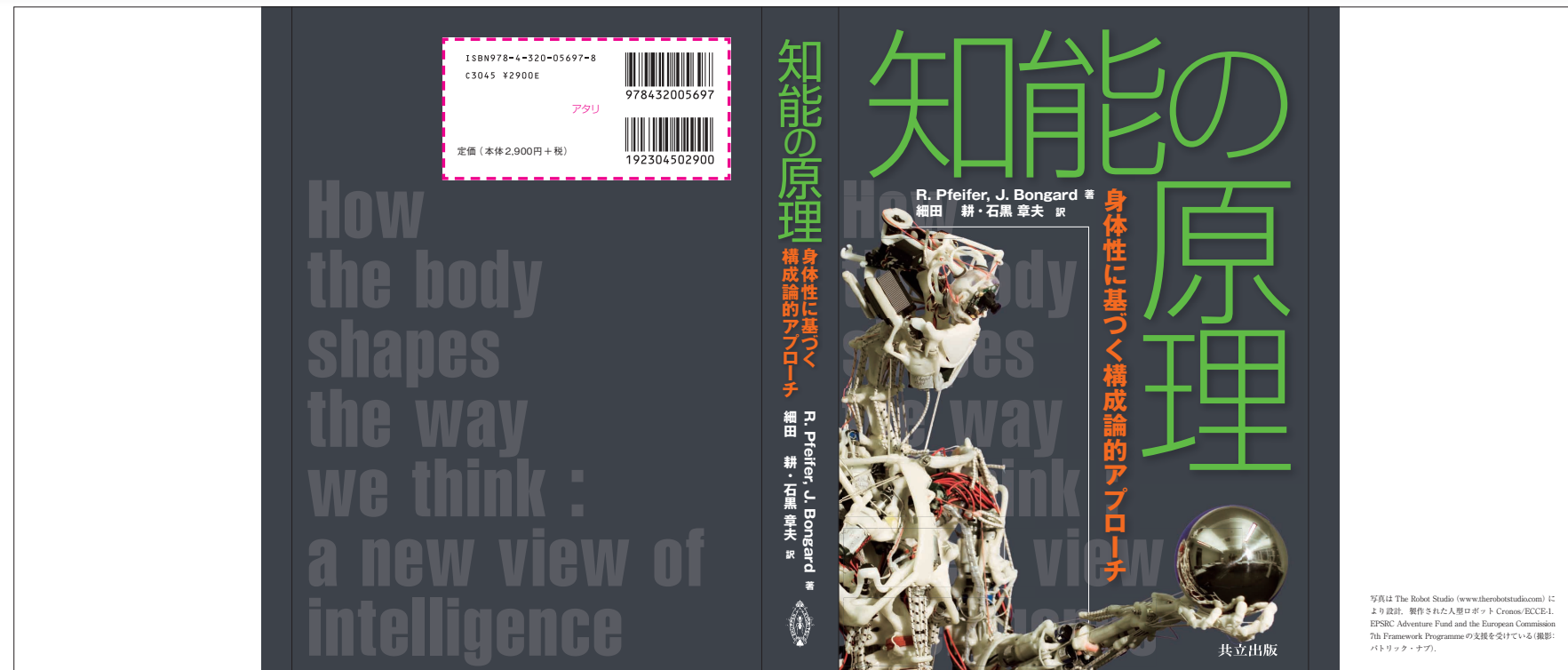
Foreword by  
**Lin Chen**  
**Chinese Academy of Science, Beijing**



耕者设计



# 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

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## La Révolution de l'intelligence du corps

Rolf Pfeifer

Alexandre Pitti





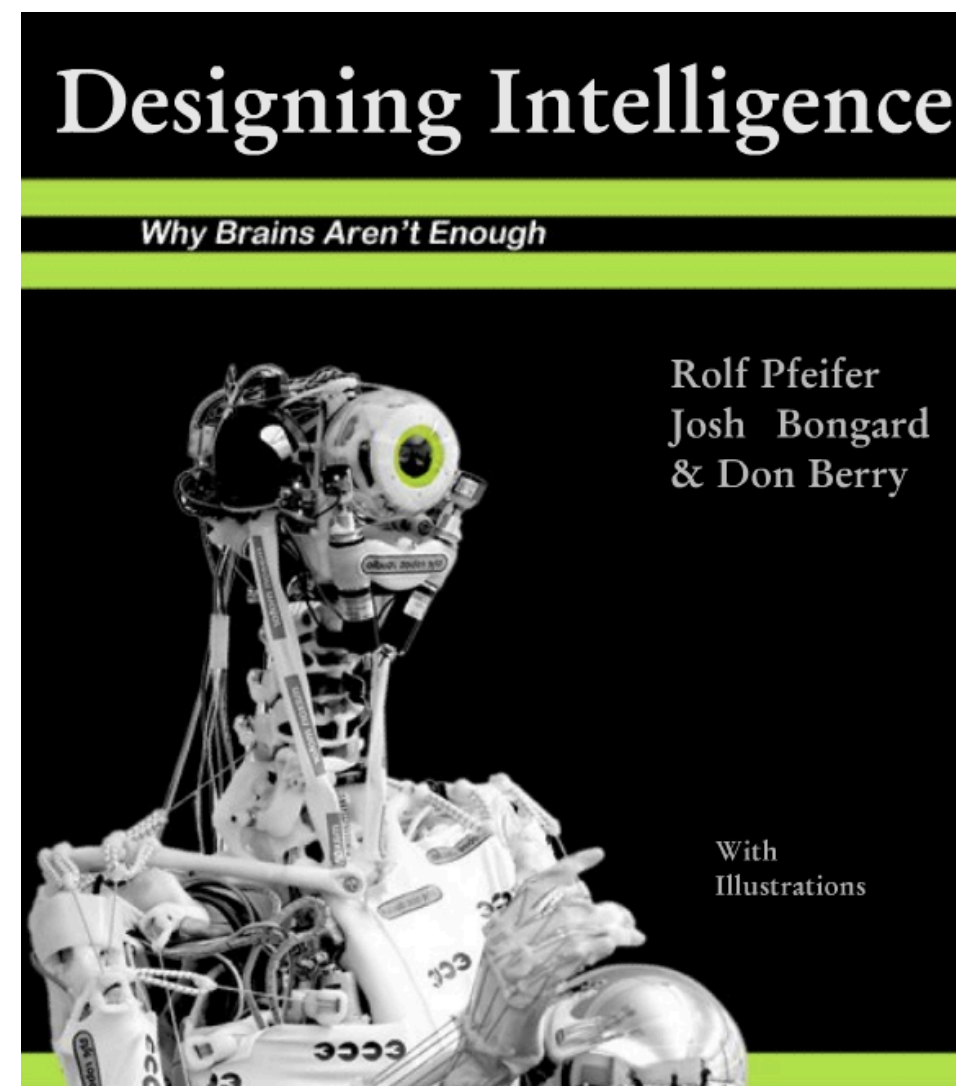
# Short e-book version

<http://ailab.ifl.uzh.ch/>

## Designing Intelligence

## Why Brains Aren't Enough

Rolf Pfeifer  
Josh Bongard  
Don Berry



Can be downloaded from here:

<http://www.grin.com/e-book/165548/designing-intelligence#inside>

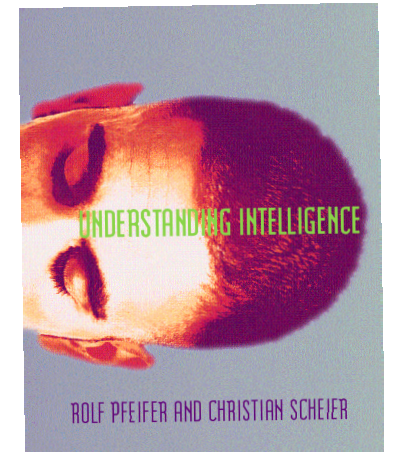
# Can be complemented by

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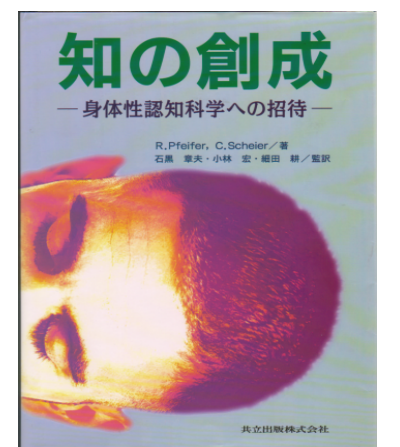
**Rolf Pfeifer and Christian Scheier**

**Understanding Intelligence**

**MIT Press, 1999 (paperback edition)**

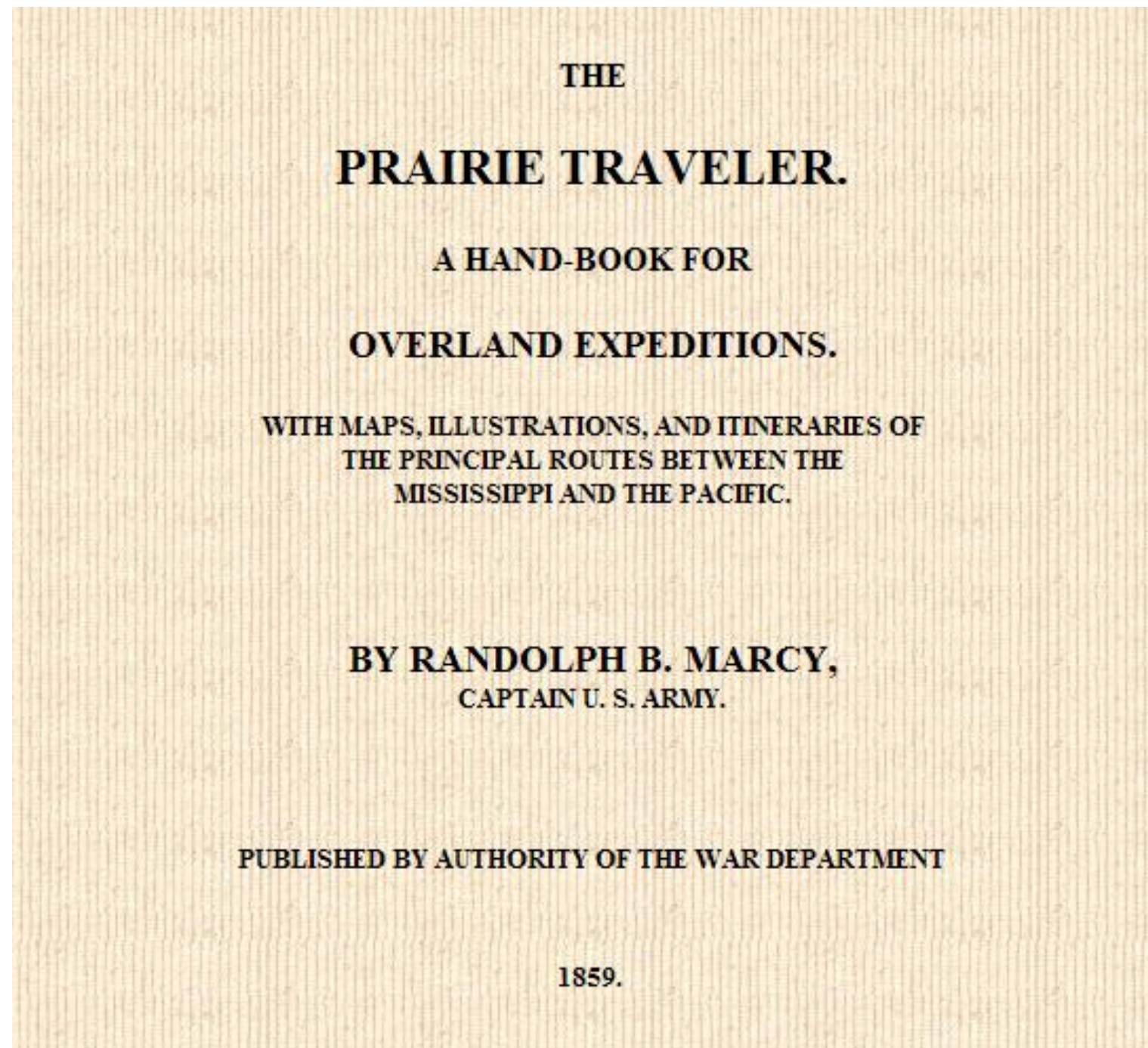


知の創成、共立出版、2001



# ‘Caveat’

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# Today's topics

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- **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”**



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# Intelligence?

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# From the Penguin Dictionary of Psychology

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

**(Reber, 1995, p. 379)**



# Some definitions (1927 psychology journal)

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“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 definitions

Robert Sternberg is an eminent psychologist who has been “fighting” against a simplistic notion of IQ. One of his famous books is “Beyond IQ: A triarchic theory of intelligence”, first published 1984

“at as many definitions of experts asked to define it.”

psychologist; famous book “Beyond IQ: A (1985)

collection of definitions of and Markus Hutter, IDSIA,



# Definitions of intelligence

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

**Le** Robert Sternberg is an eminent psychologist who has been “fighting” against a simplistic notion of IQ. One of his famous books is “Beyond IQ: A triarchic theory of intelligence”, first published 1984 published 1984

**three commonalities**

**A**gent has as it interacts with its

**en**

**Is** to succeed or profit with

**re**ve.

**D**nt is to adapt to different

**ok**

**T**

**“I**gent’s ability to achieve goals

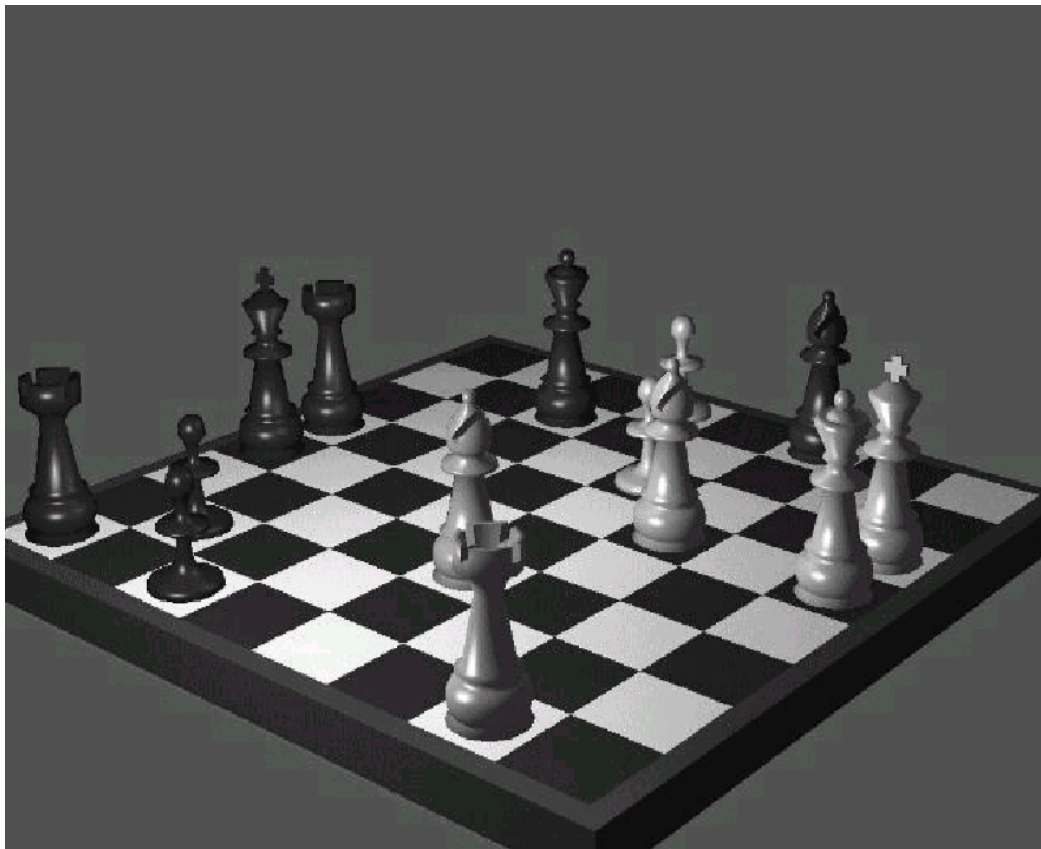
**in a wide range of environments.”**



# Subjectivity, expectations

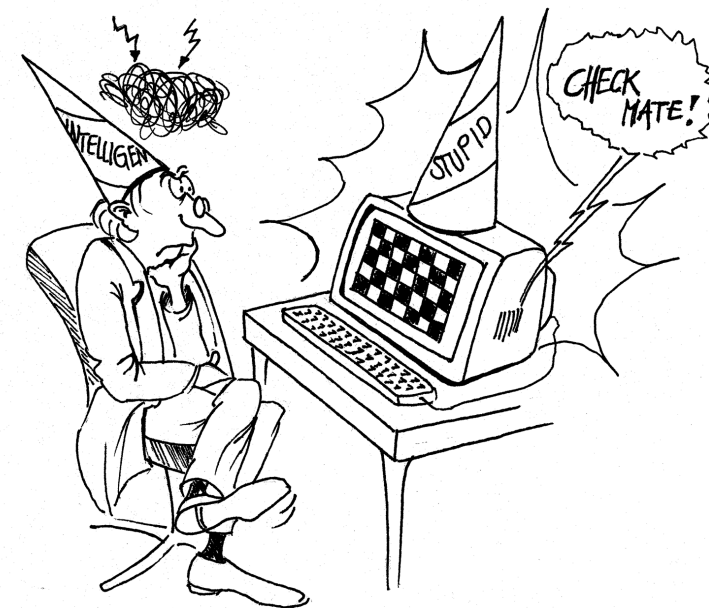
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## Playing chess



## Rolf playing chess

Rolf



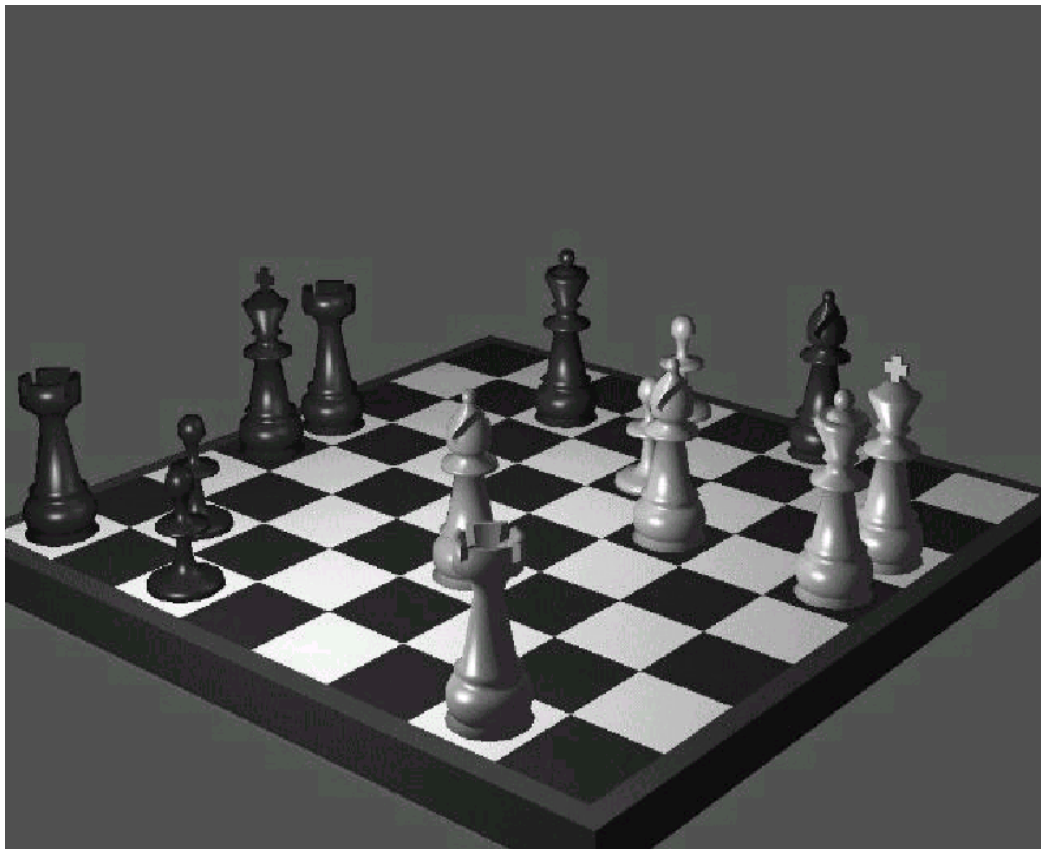
**Note: Fabio is obviously much better :-)**



# Subjectivity, expectations

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**Playing chess**



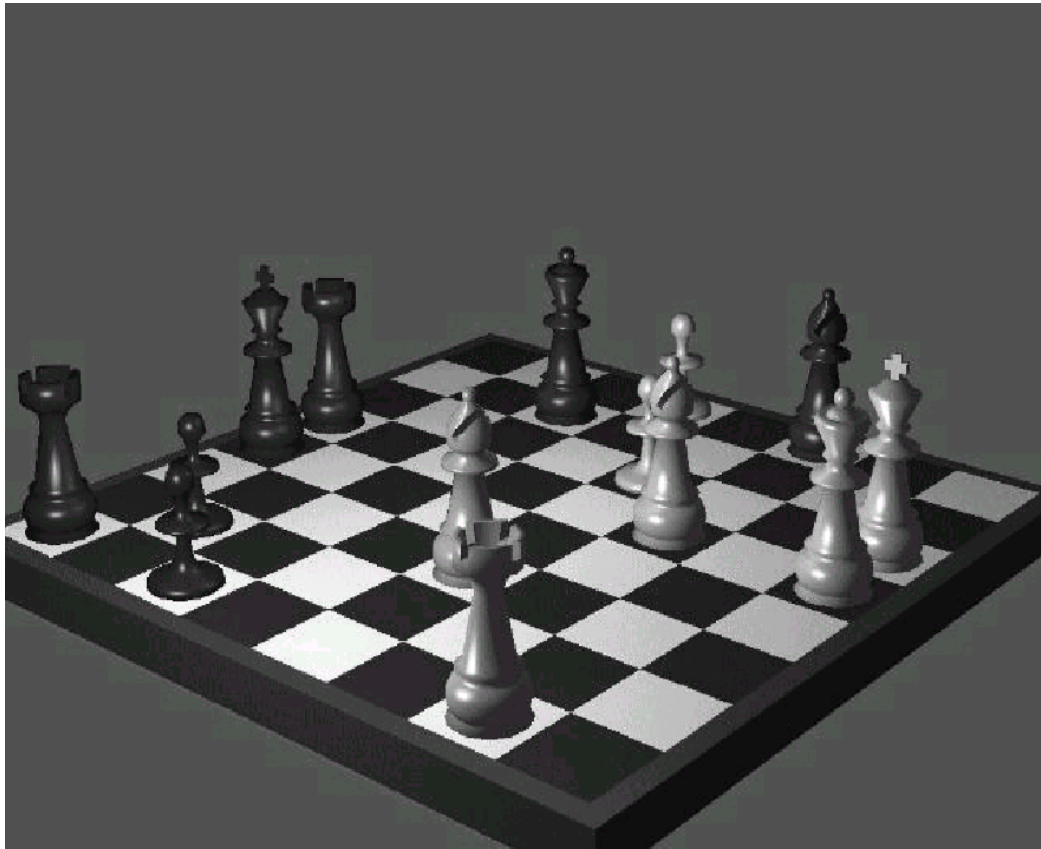
**baby girl playing chess**



# Subjectivity, expectations

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## Playing chess



## dog playing chess



# Definitions, arguments

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- **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

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Video “Robovie”

Video “iCub attention”





# Interaction and observation

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**videos:**

**intelligent?**

**—> highly subjective**

**—> Turing suggests empirical test**



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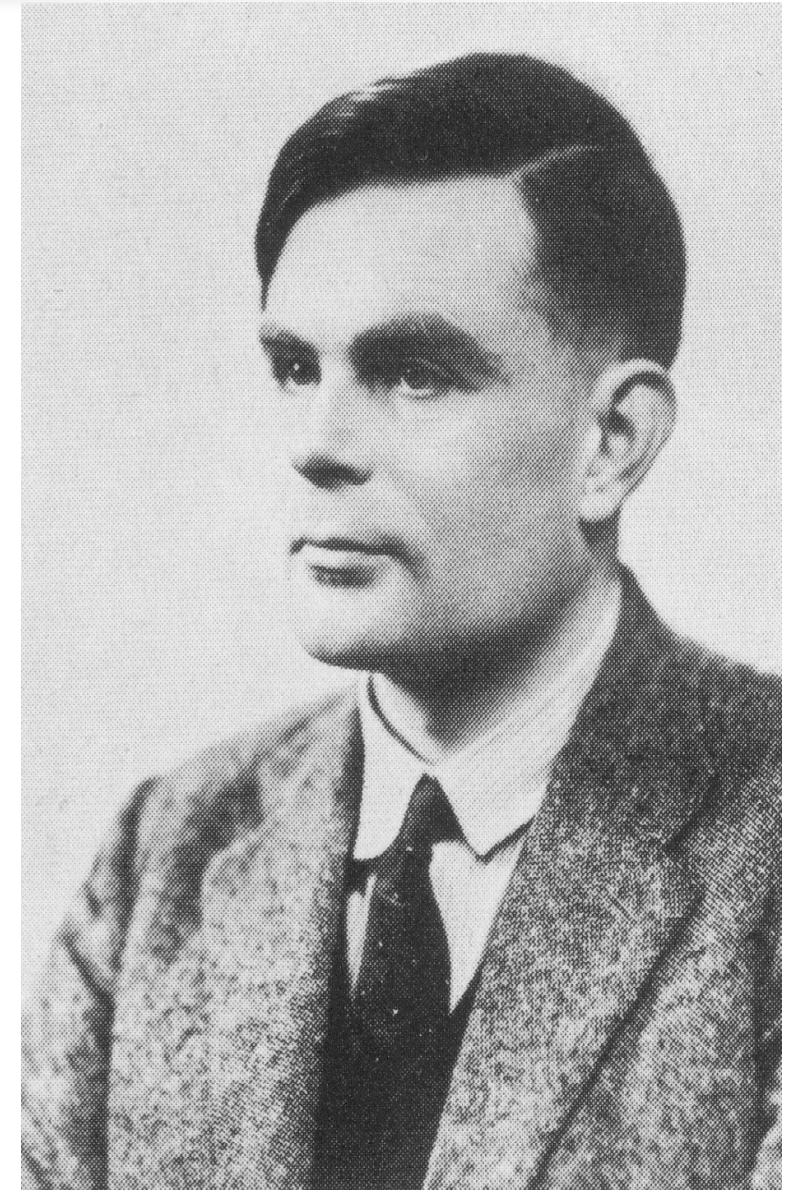


# An empirical test?

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**Alan Turing (1912 - 1954)**

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

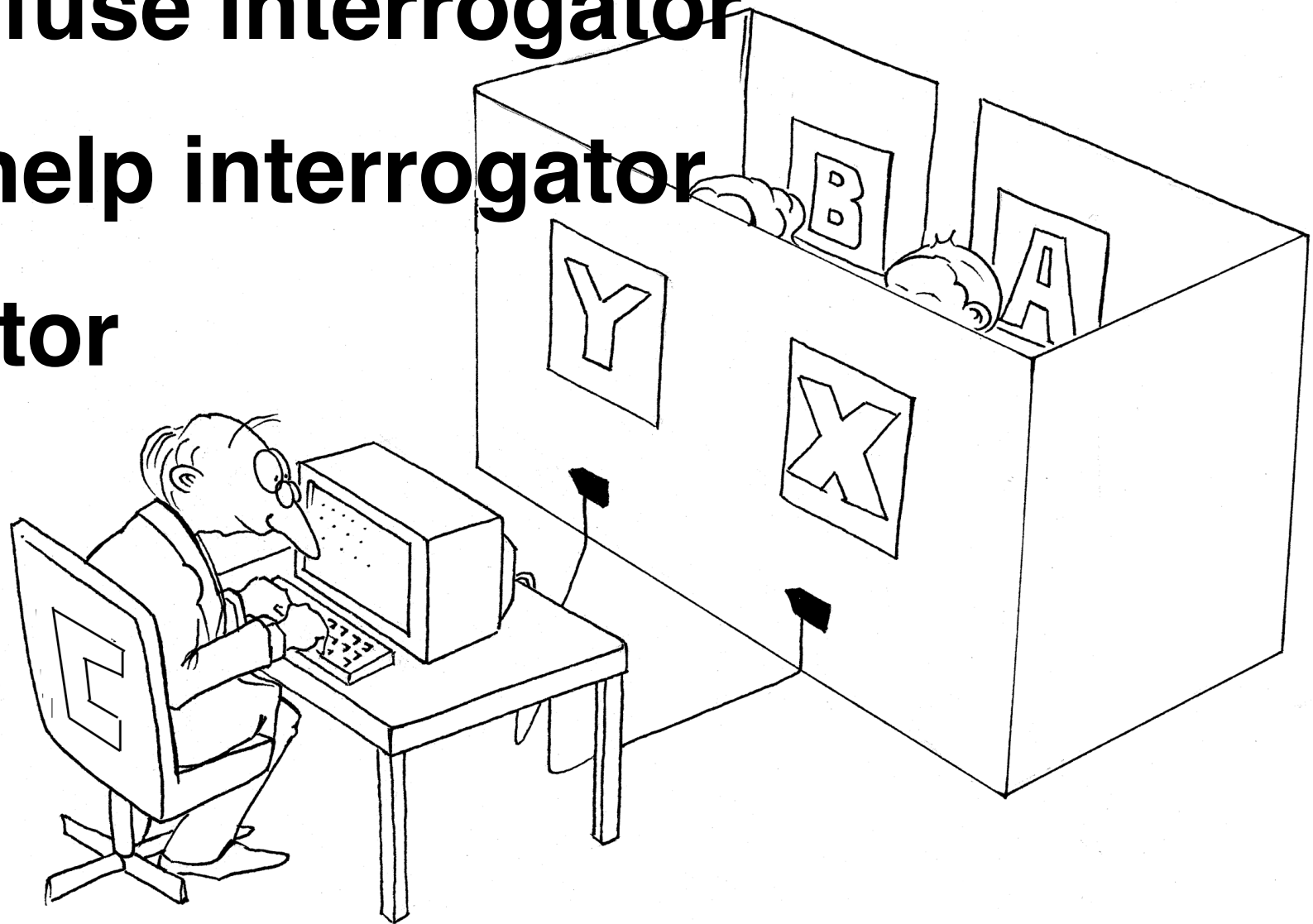


# The Turing Test

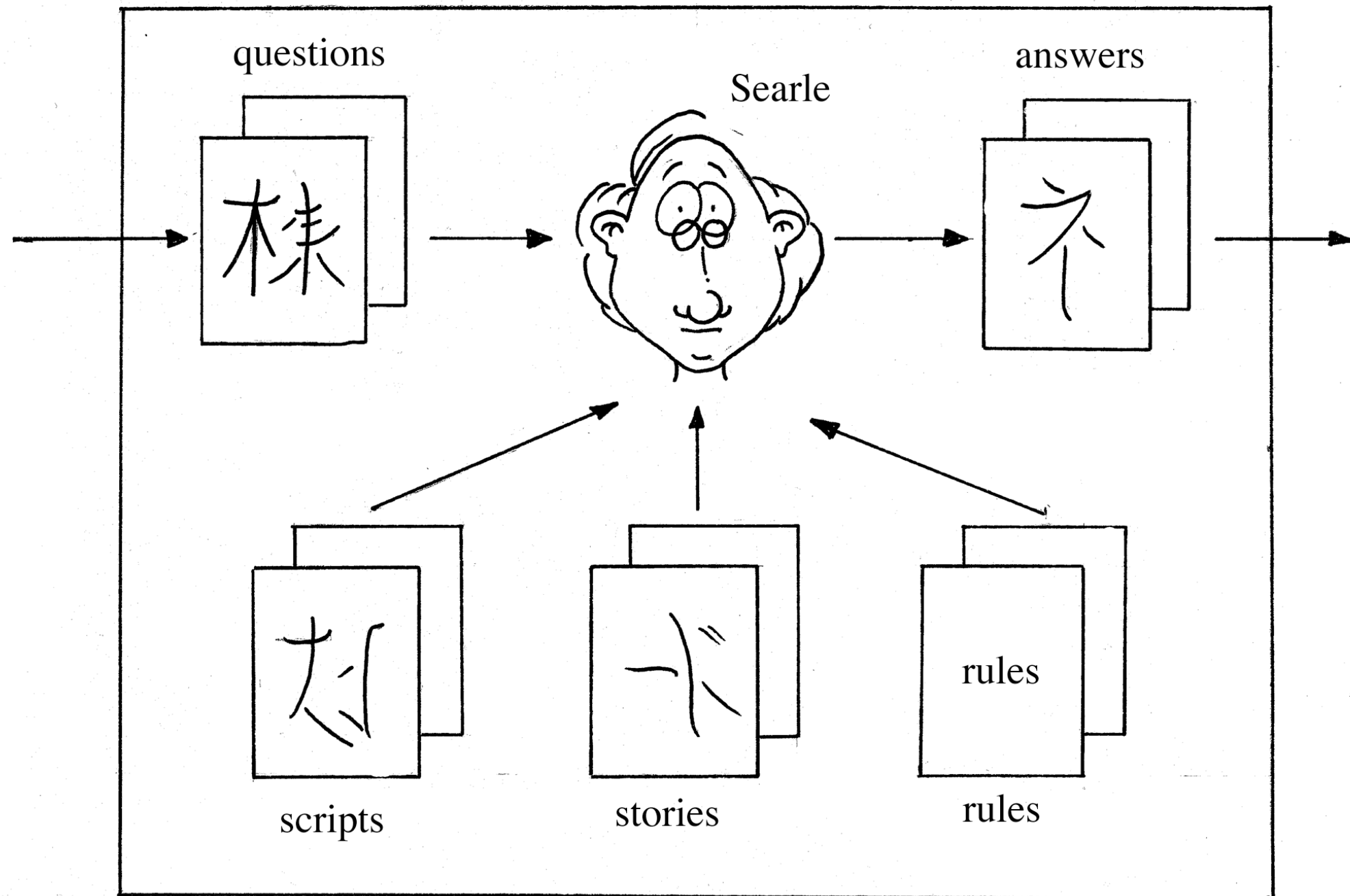
**A: man, confuse interrogator**

**B: woman, help interrogator**

**C: interrogator**



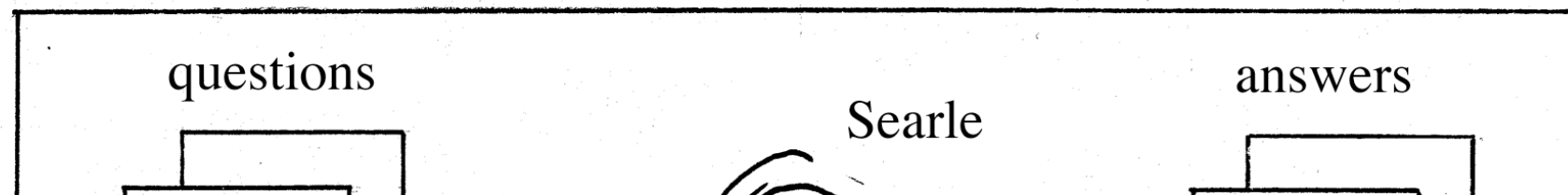
# Searle's “Chinese Room” thought experiment





# Searle's “Chinese Room” thought experiment

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homework:  
think about pros and  
cons  
student presentation  
next week

# Variations on the Turing Test

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- **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**



# Turing tests

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Video: “Blade runner”

Video “real dog vs.  
Aibo”



# Measuring intelligence

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# Today's topics

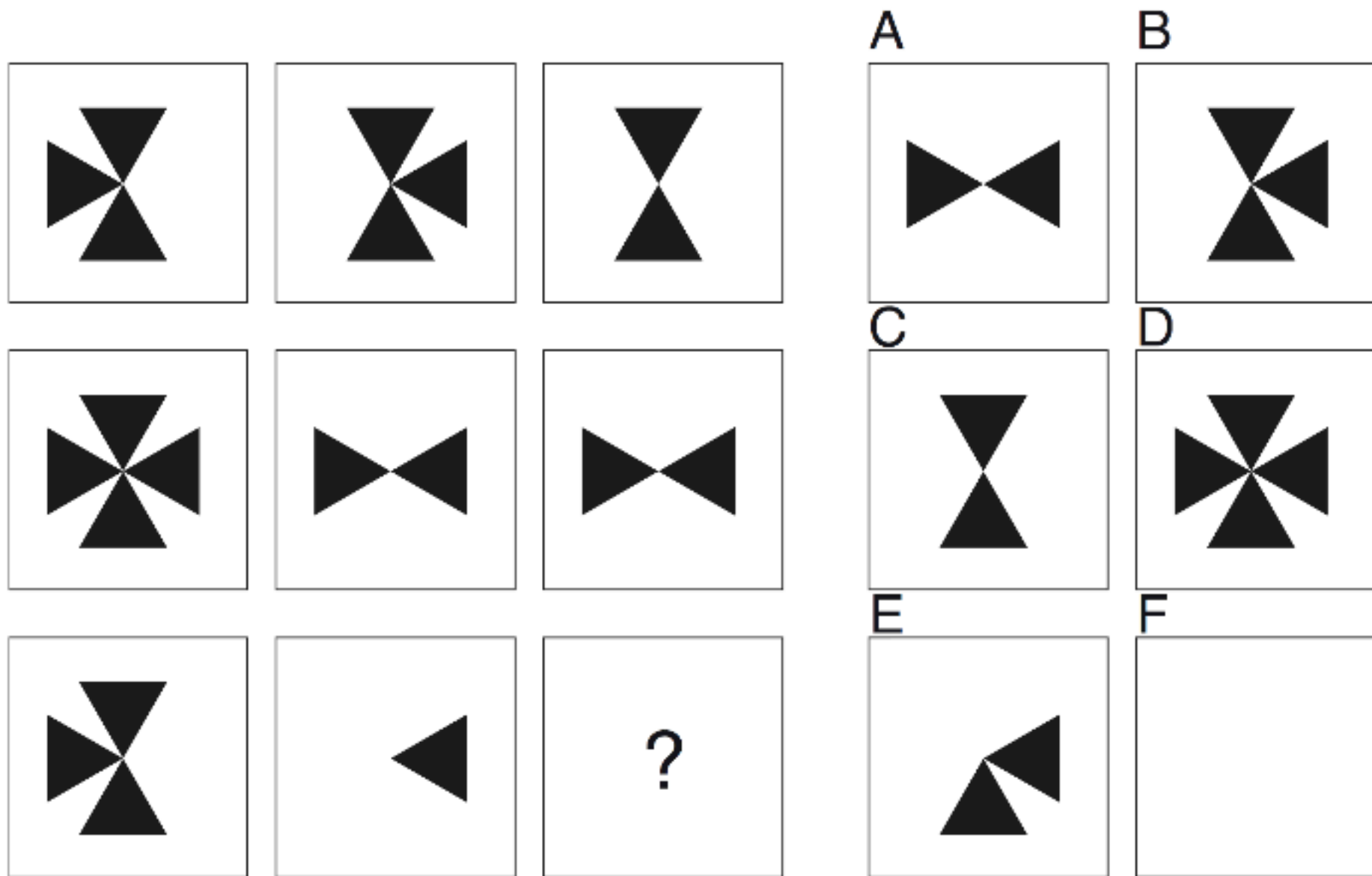
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# Measuring intelligence



# IQ testing — issues

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# **IQ testing — issues (1)**

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- **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)

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- **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

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## 1. Understanding biological systems



*animals*



*humans*

## 2. Making abstractions, developing theory

## 3. Applications



*vacuum-cleaner*

*beer-serving robot*



*Engkey*



# Today's topics

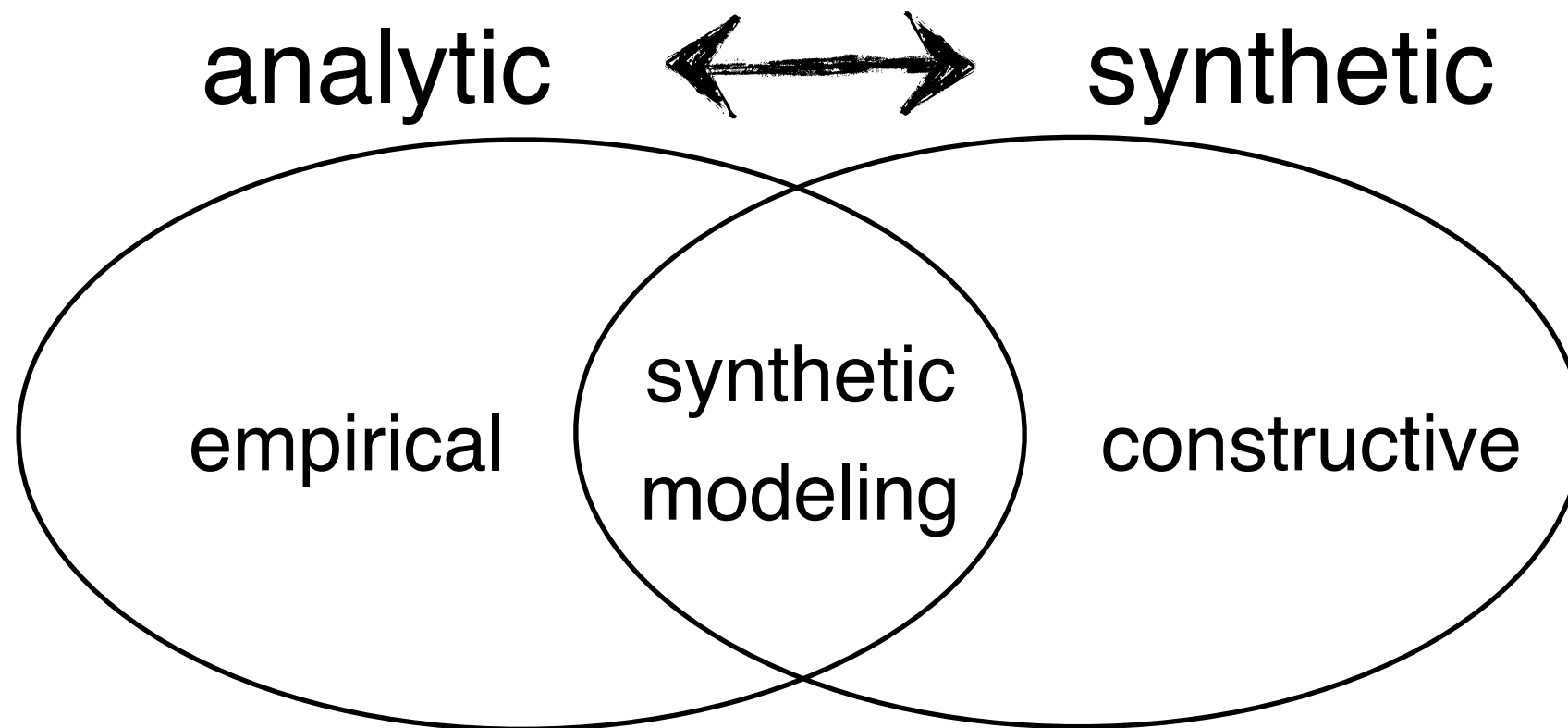
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# How to study intelligence?

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psychology  
biology  
neuroscience

artificial intelligence  
engineering  
cognitive science



# The synthetic methodology

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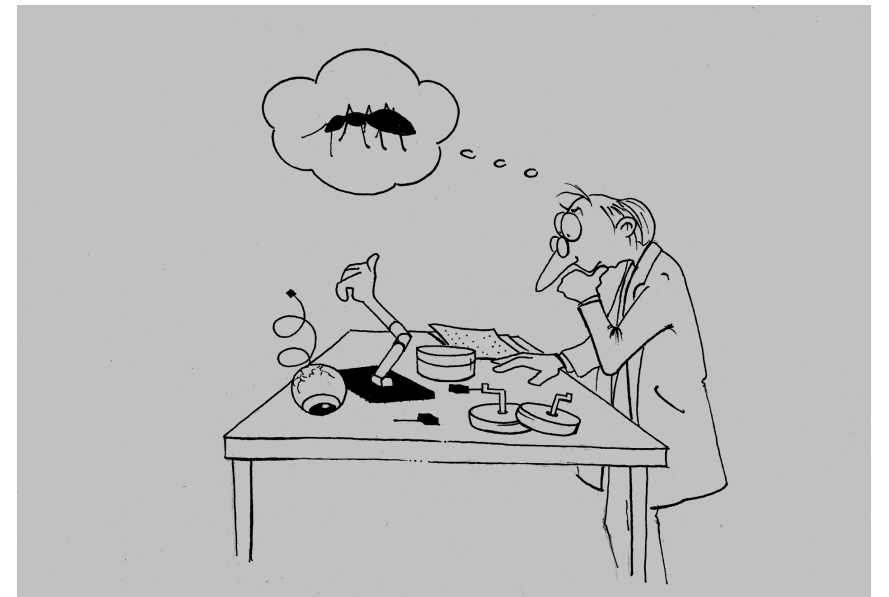
Slogan:

**“Understanding by building”**

**modeling behavior of interest  
abstraction of principles**



**robots as tools for scientific  
investigation**



# An old dream

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**“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



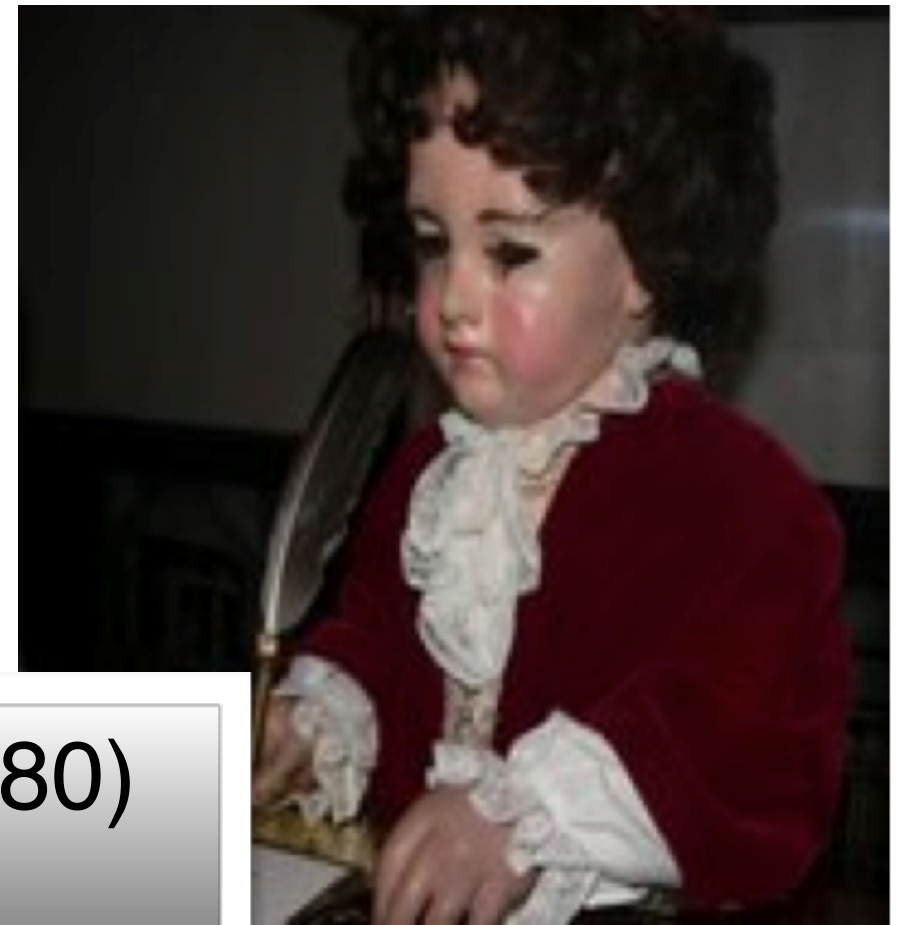
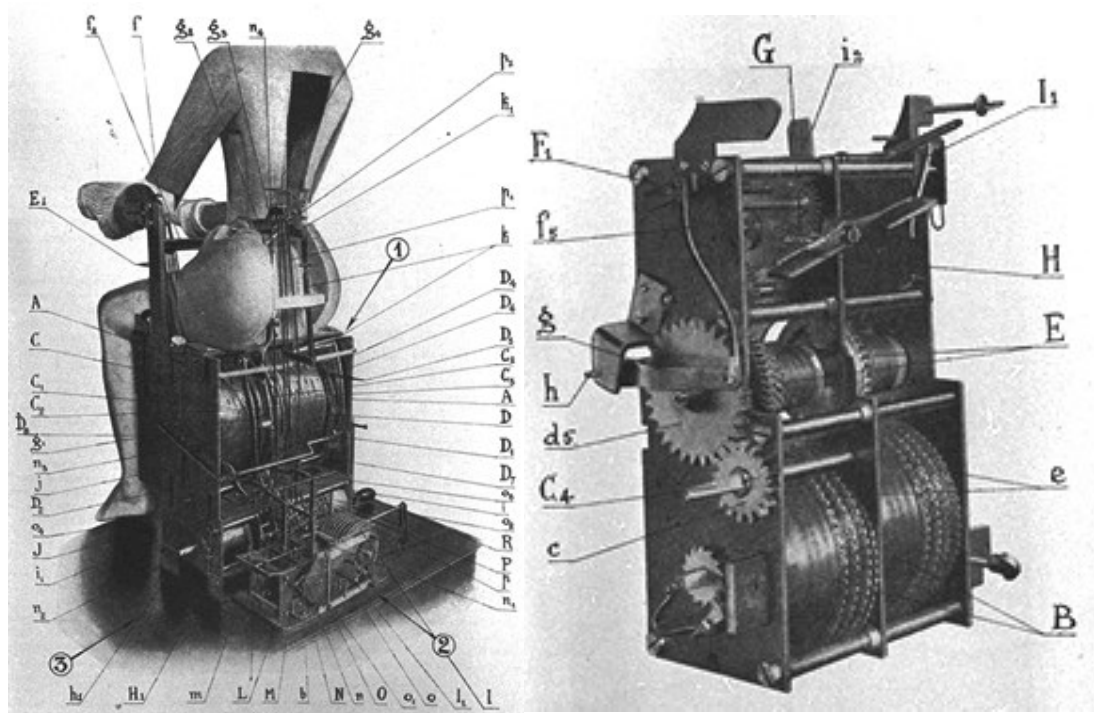
**“The part of the quote "or even of its own accord” is elsewhere translated as "or by seeing what to do in advance" etc. (you may find many translations). I think this is an important part of the quote, so it's good to go back to the original text: Aristotle uses the word "προαισθανόμενον" – proaisthanomenon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



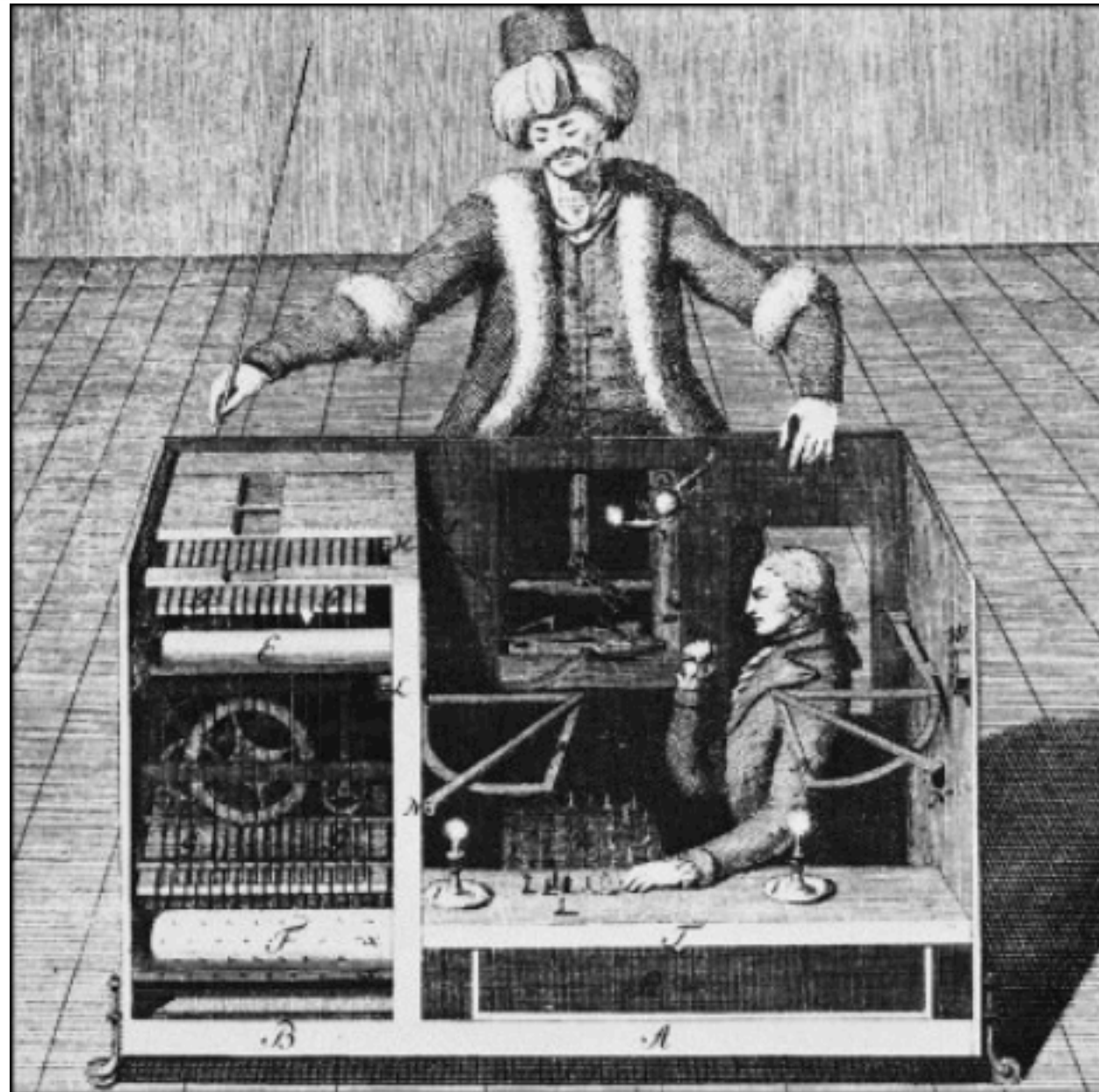
**Karakuri Dolls**  
Chahakobi Ningyo (Tea Serving Doll) by SHOBEI Tamaya IX, and plan from 'Karakuri Zuii' ('Karakuri - An Illustrated Anthology') published in 1796.





# W. Van Kempelen's Chess Player (1769)

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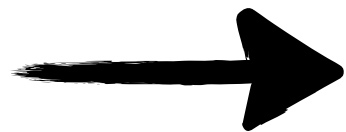
# The synthetic methodology

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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

---

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 above.

While IQ has sometimes been taken as a predictor for professional success, it is interesting that some of the “Mensa” members are professionally successful whereas others aren’t.

Why could that be?



# Issues to think about: IQ and professional

---

The “Mensa International” <http://www.mensa.org/> is an organization whose roughly 100.000 members worldwide score in the top 2 % on

homework:  
think about this issue  
student presentation  
next week

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# Issues to think about: an unfair comparison

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Video: an excellent  
robot's "bad day"

Video: "the inner life of  
a cell"



# Issues to think about: an unfair comparison

---

Video: an excellent

homework:  
think about this issue  
student presentation  
next week



# Assignments for next week

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- **Next lecture on 8 November 2018: “Embodied Intelligence”.**
- **Read chapters 1 and 2 of “How the body ...”**



# End of lecture 1

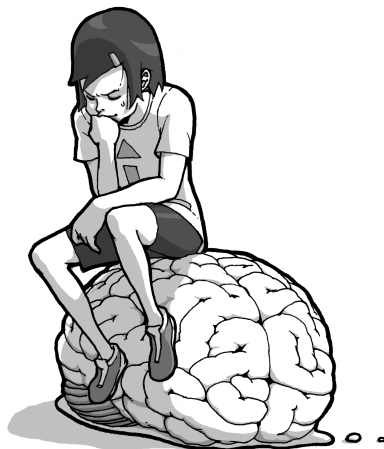
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**Thank you for your attention!**



**stay tuned for lecture 2**

**“A Theory of Embodied Intelligence”**



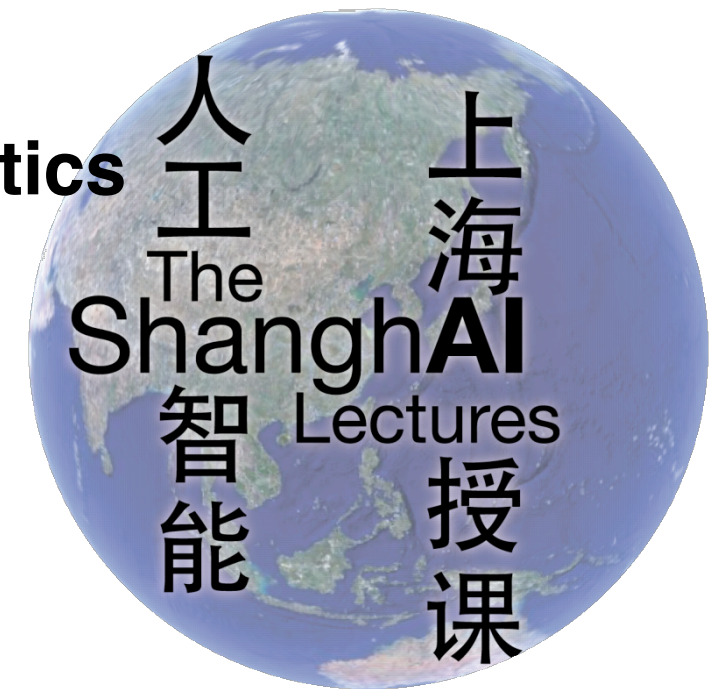
# Fabio Bonsignorio

Vis.Prof, the BioRobotics Institute, SSSA  
CEO and Founder Heron Robots  
Santander - UC3M Chair of Excellence 2010



## Research interests

- **embodied intelligence, cognition/AI and robotics**
- **experimental methods in Robotics and AI**
- **Advanced approaches to Industry 4.0**
- **synthetic modeling of life and cognition**
- **novel technologically enabled approaches to higher education and lifelong learning**



The ShanghAI Lectures  
2013-2018

