
人工
上海
The
ShanghAI
智能
Lectures
授课

The ShanghAI Lectures

An experiment in global teaching

Rolf Pfeifer and Nathan Labhart
National Competence Center Research in Robotics (NCCR Robotics)
Artificial Intelligence Laboratory
University of Zurich

Fabio Bonsignorio
University Carlos III of Madrid and Heron Robots

Today from the University Carlos III of Madrid
Spain

欢迎您参与

“来自上海的人工智能系列讲座”

Lecture 1

Intelligence — things can be seen differently

What it is and how it can be studied

17 October 2013

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

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- What is intelligence? Natural and artificial?
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Robots, artificial intelligence in the media

HAL, the "Hybrid Assistive Limb ®" Cyberdyne Inc.

Engkey, the Korean English language Teacher

Sex and marriage with robots? "It could happen" (David Levy)

Beer-serving robot

Engkey: the English language teacher

Korea to offer commercially viable English-speaking robots in 2013 한글

By Kim Tae-gyu

A total of 29 English-language education robots will be placed in 21 elementary schools in Daegu next week for a four-month feasibility study to check the commercial viability of robotic teachers, to go on sale in 2013.

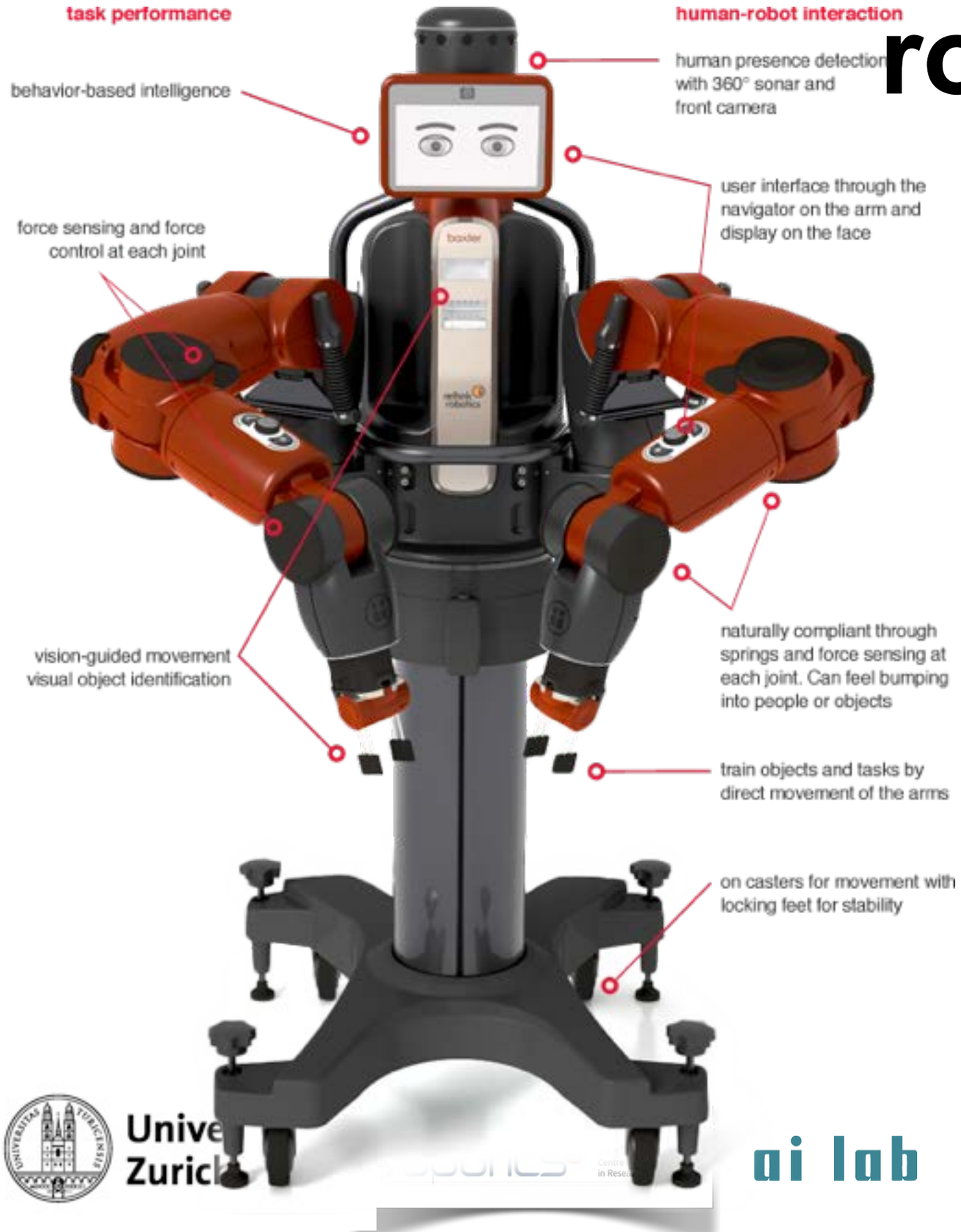
The state-run Korea Institute of Science and Technology (KIST) said Friday that the robotic assistants, dubbed "Engkey" combining "English" and "disc jockey," will help teachers during English classes.

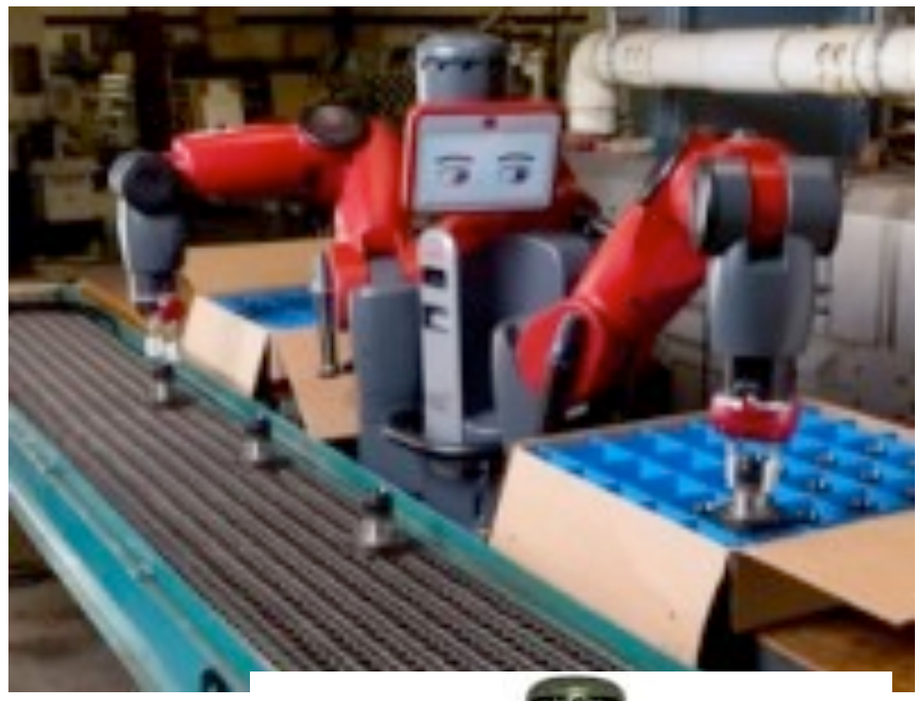
``We will carry out the second-phase pilot program with Engkey until next March after wrapping up the first project over the past year in Masan, South Gyeongsang Province," KIST spokesman Park Young-ho said.

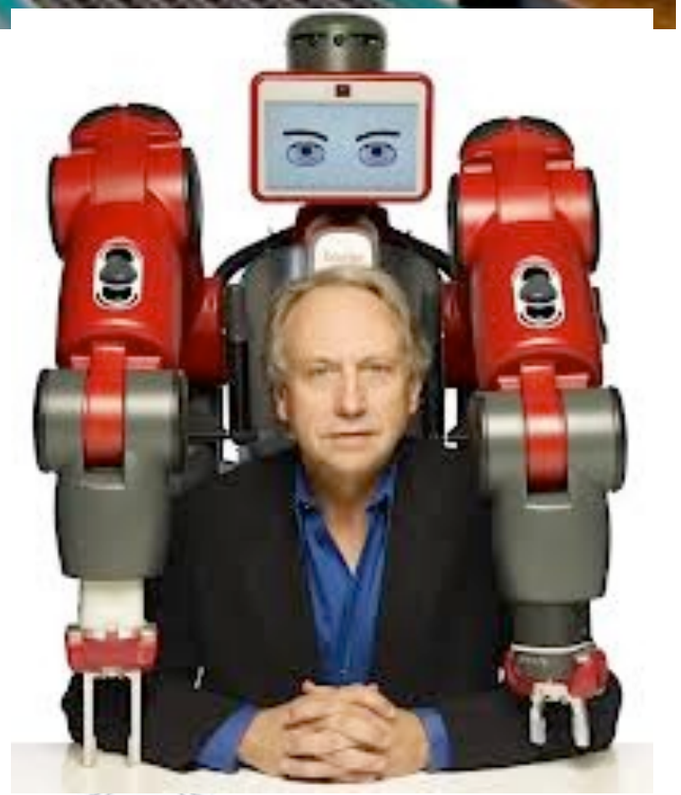
An English-language education robot named Engkey

rethink robotics

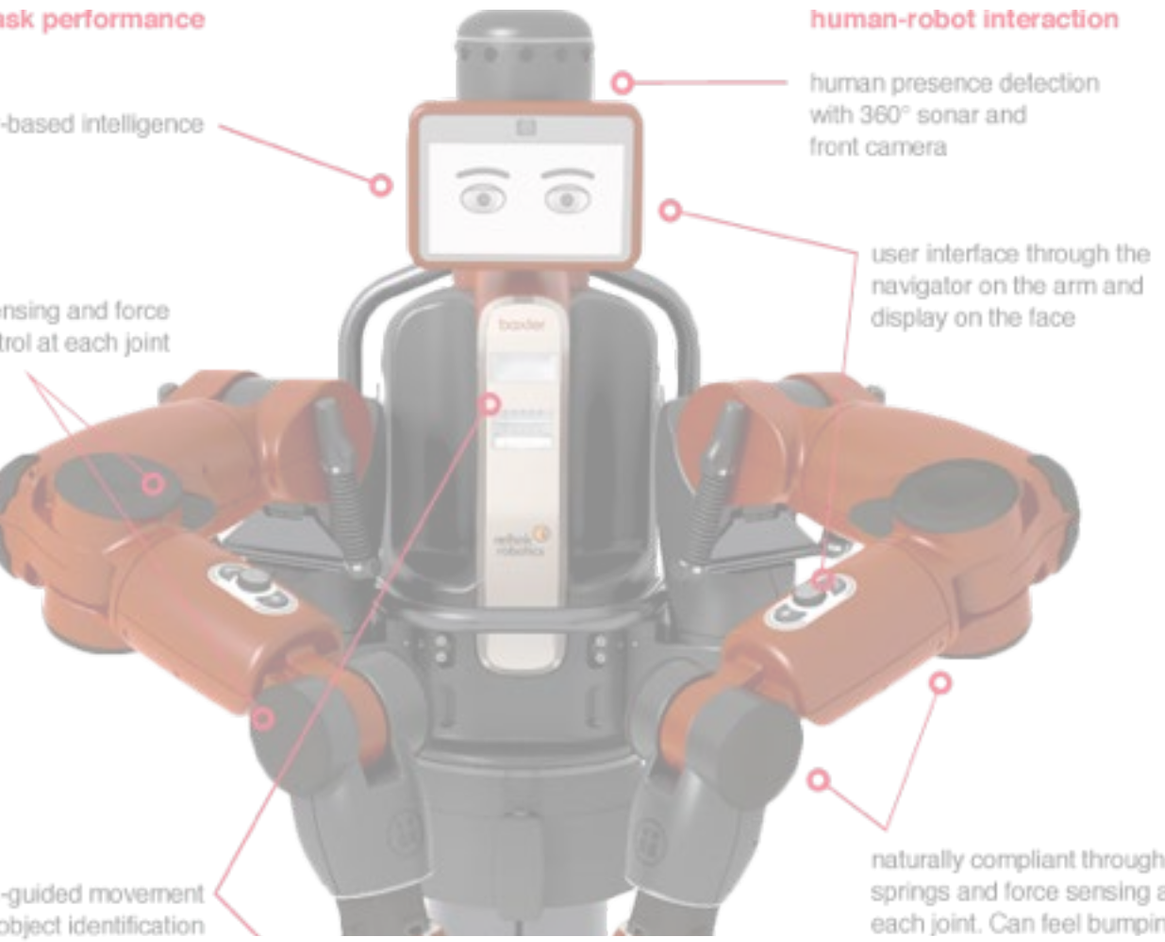
The factory “humanoid” robot “Baxter”

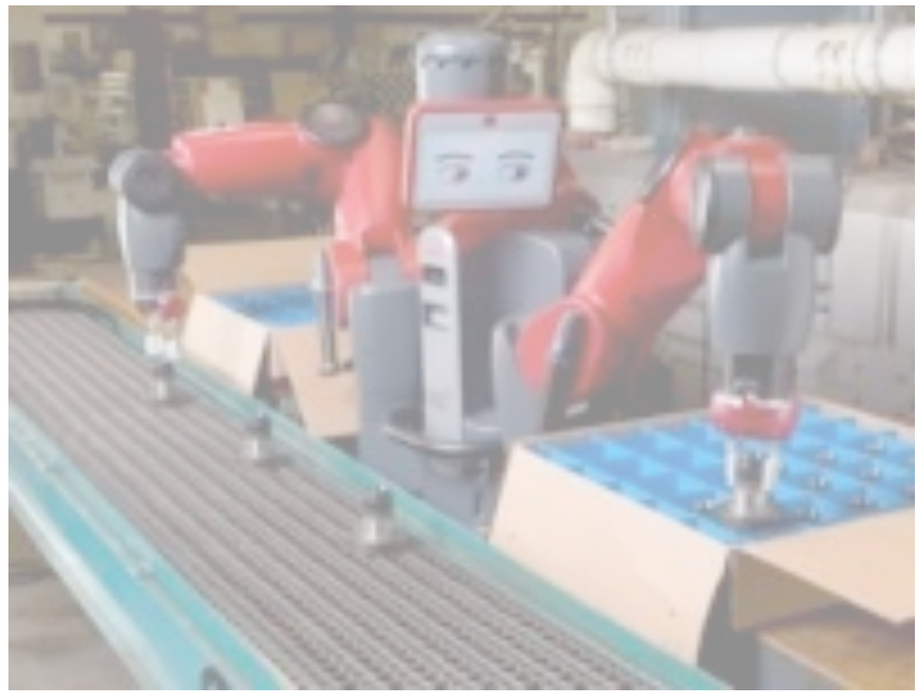






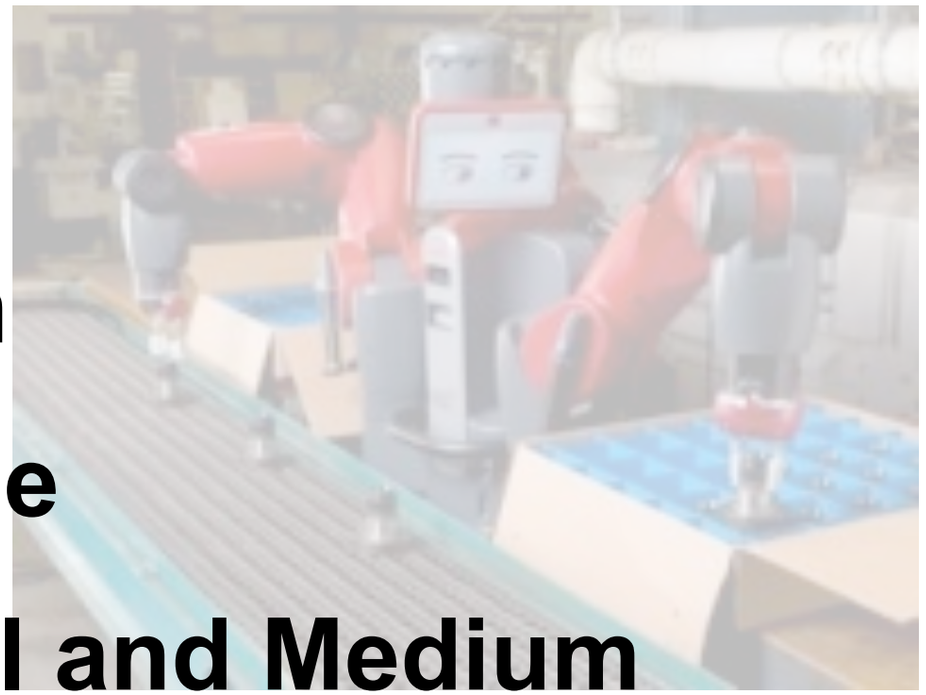
The factory “humanoid” robot “Baxter”





http://spectrum.ieee.org/robotics/industrial-robots/rethink-robotics-baxter-robot-factory-worker
http://www.xconomy.com/boston/2012/09/18/rod-brooks-and-rethink-reveal-an-industrial-robot-for-the-masses/
http://www.nytimes.com/2012/09/18/science/a-robot-with-a-delicate-touch.html
http://www.technologyreview.com/news/429248/this-robot-could-transform-manufacturing/
http://www.businessweek.com/articles/2012-09-18/smarter-robots-with-no-pesky-uprisings

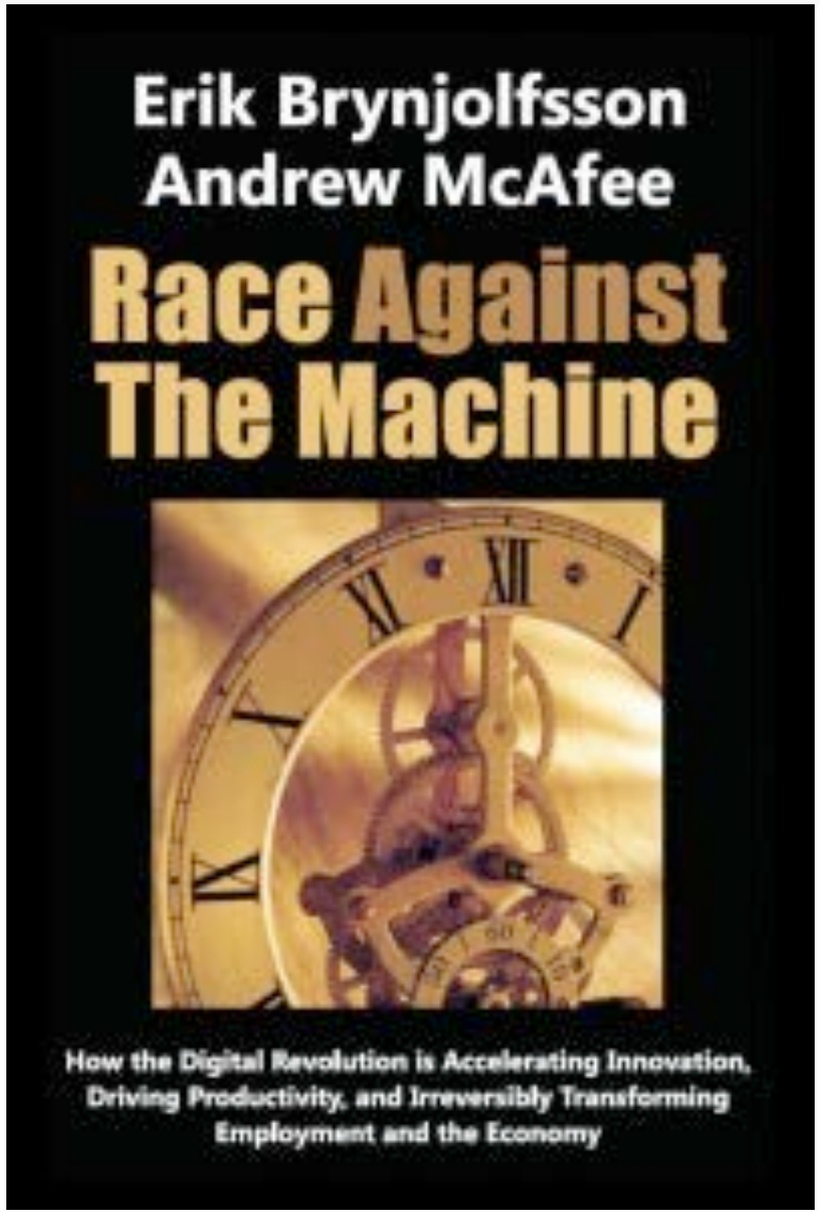
The factory “humanoid” robot “Baxter”



- no programming
- learning by demonstration
- highly flexible and versatile
- affordable for SMEs (Small and Medium Enterprises)
- “common sense”

—> re-insourcing of manufacturing tasks

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)

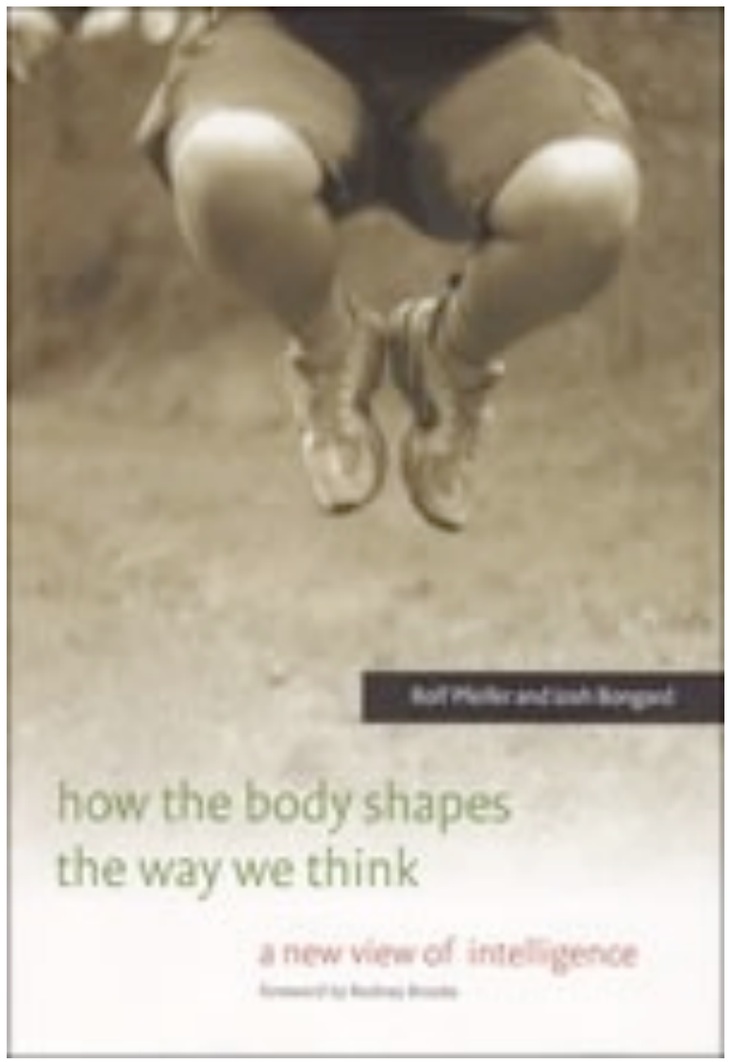
Goals

- 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**

Book for class

Rolf Pfeifer and Josh Bongard

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



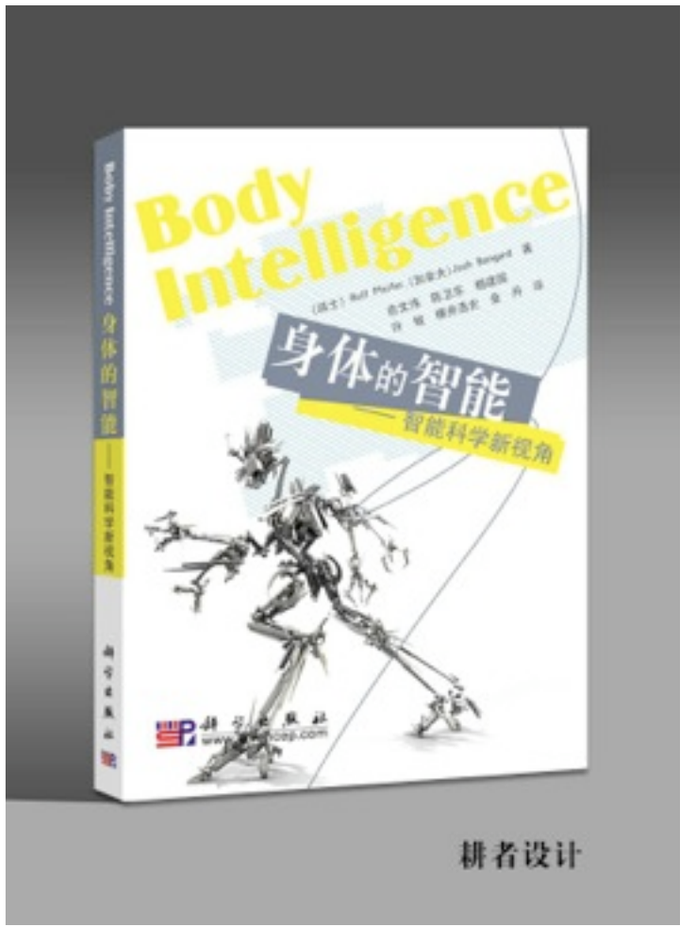
MIT Press, 2007

Illustrations by Shun Iwasawa

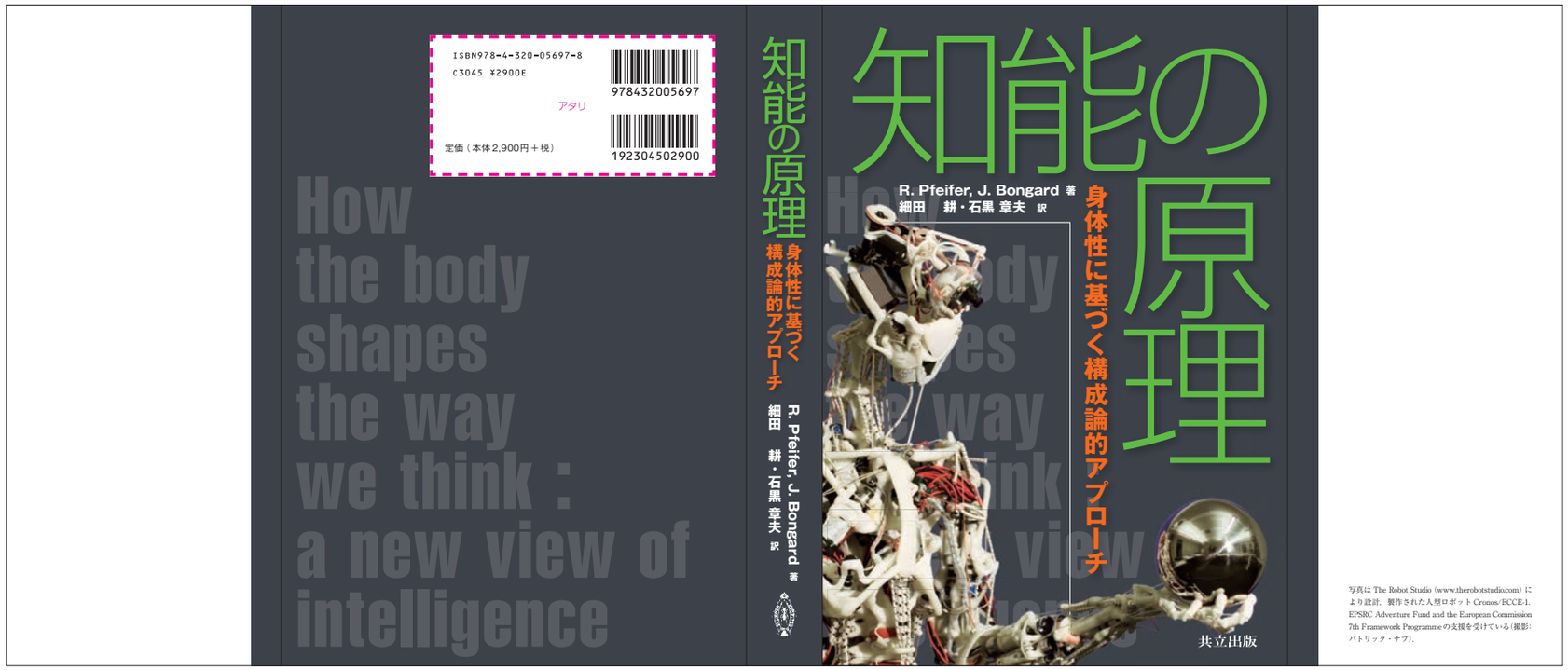
Chinese edition

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

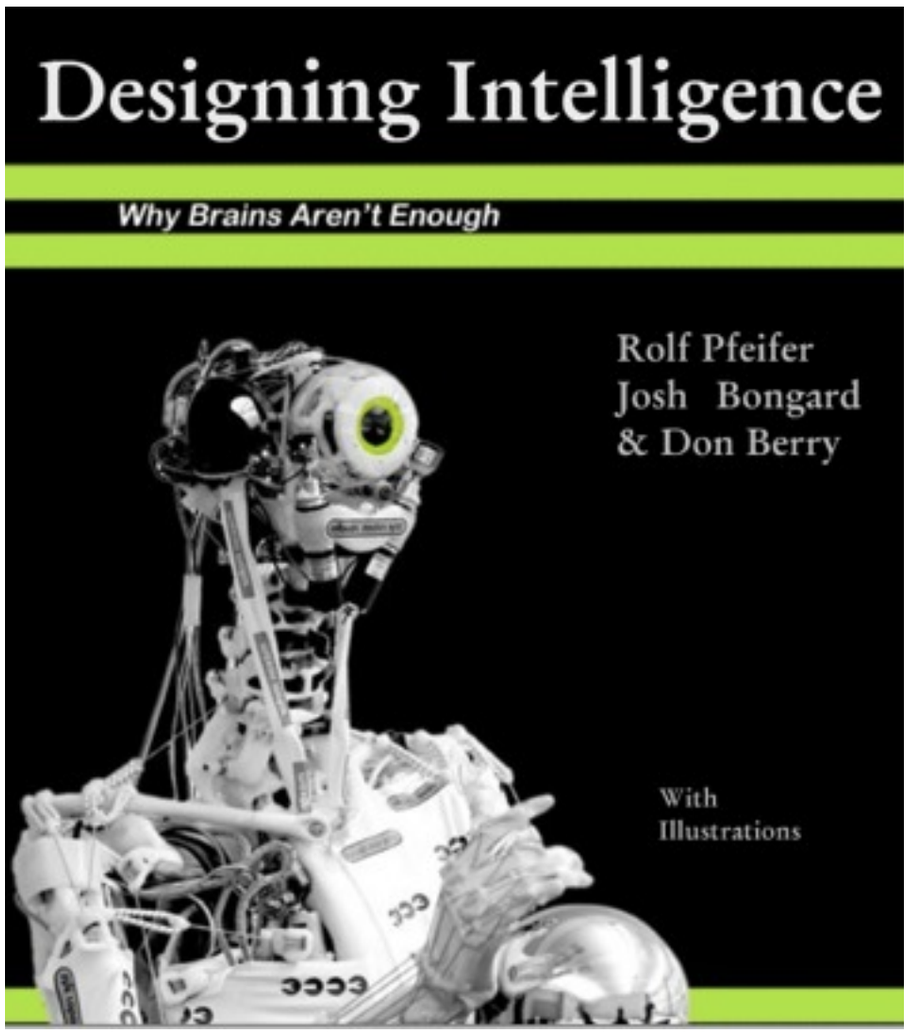
Short e-book version

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

Designing Intelligence

Why Brains Aren't Enough

Rolf Pfeifer
Josh Bongard
Don Berry



Can be downloaded from here:
http://www.grin.com/e-book/165548/designing-intelligence#inside

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robotics Swiss National Centre of Competence in Research

ai lab

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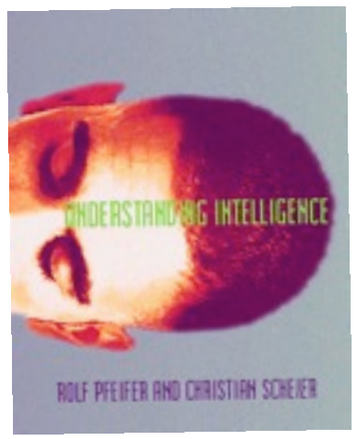
Can be complemented by

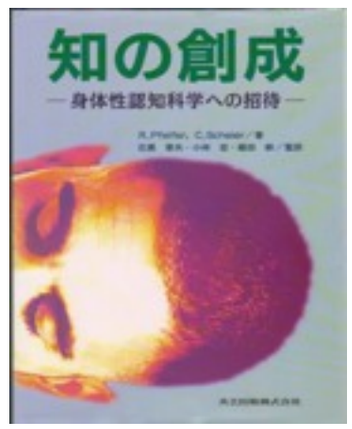
Rolf Pfeifer and Christian Scheier

Understanding Intelligence



MIT Press, 1999 (paperback edition)

知の創成、共立出版、２００１



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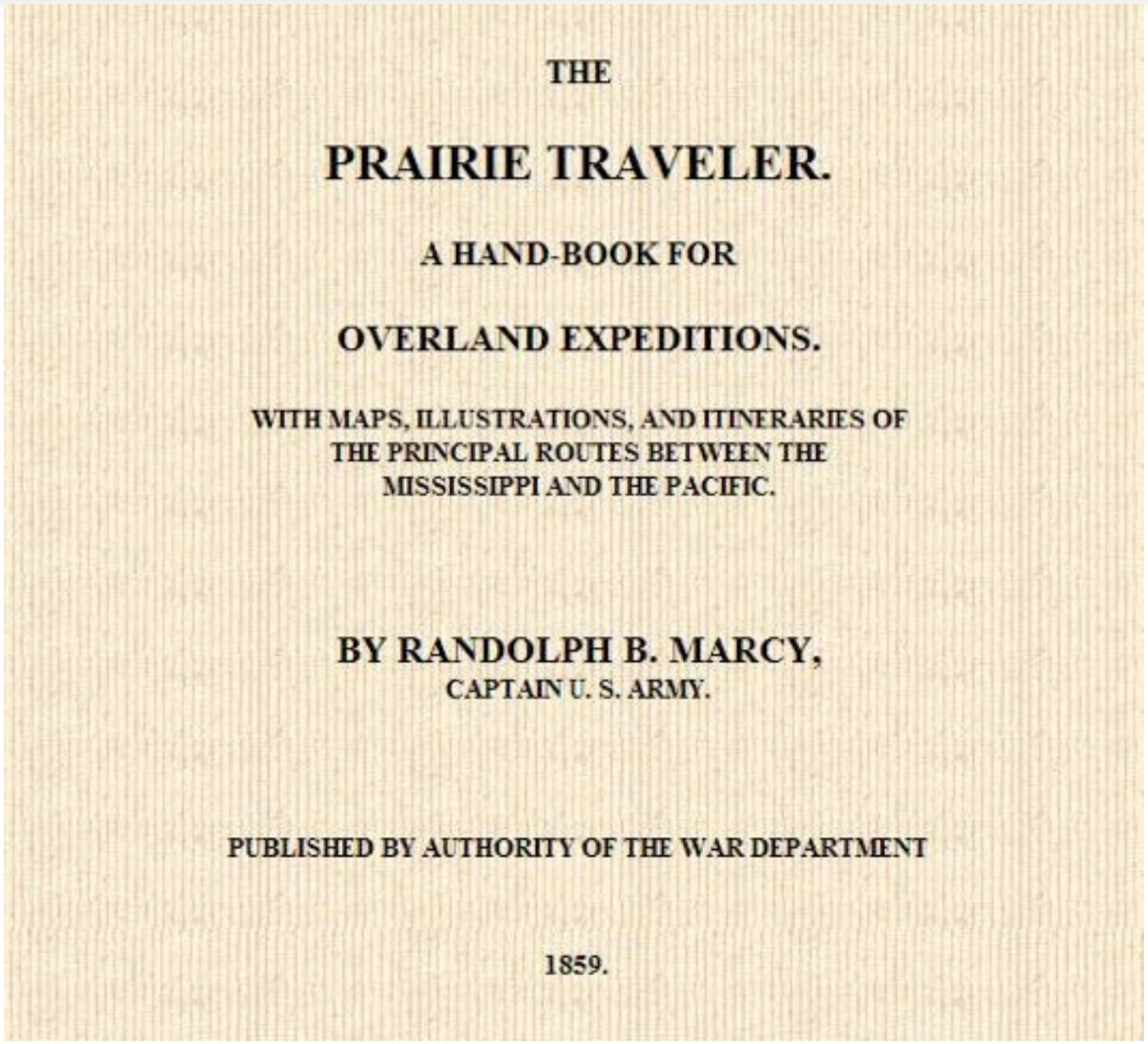
‘Caveat’



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 Markcus 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.

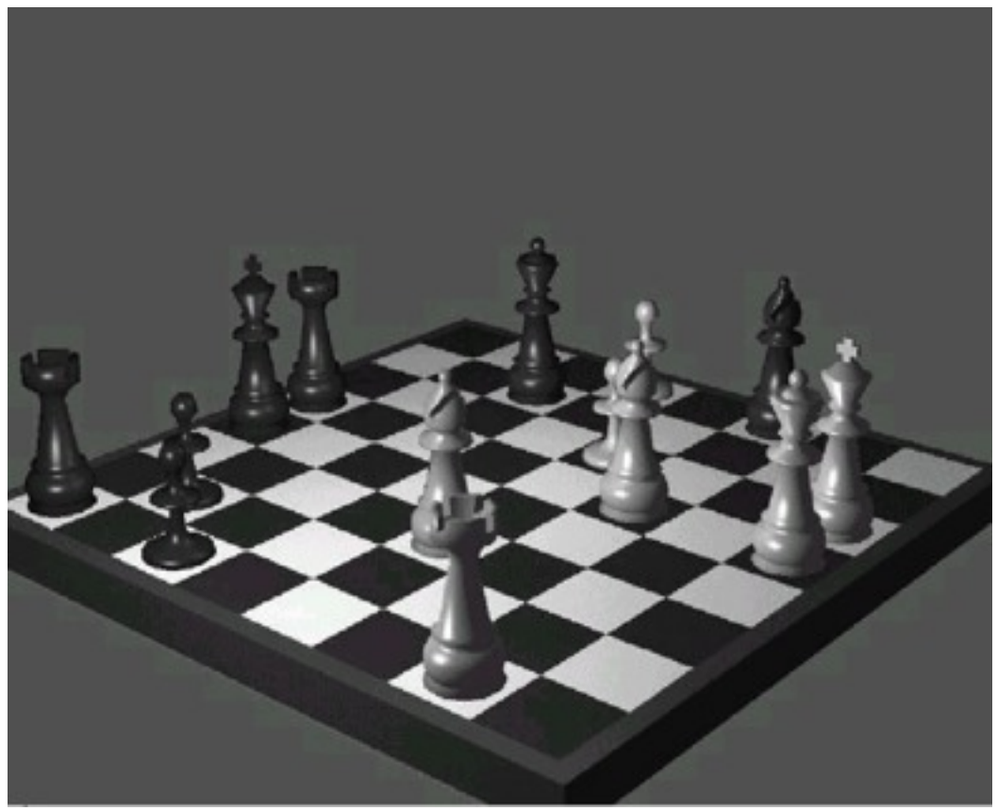
Is related to the agent's ability to succeed or profit with respect to some goal or objective.

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

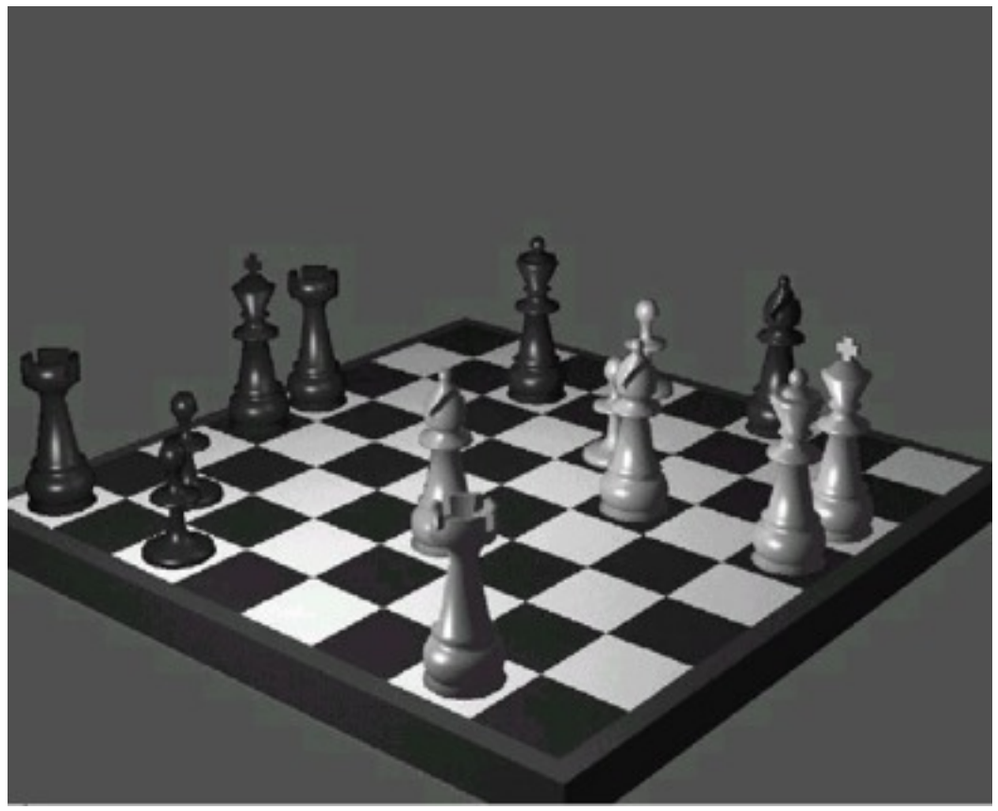


Rolf playing chess

Note: Fabio is obviously much better :-)

Subjectivity, expectations

Playing chess



Rolf playing chess

Rolf

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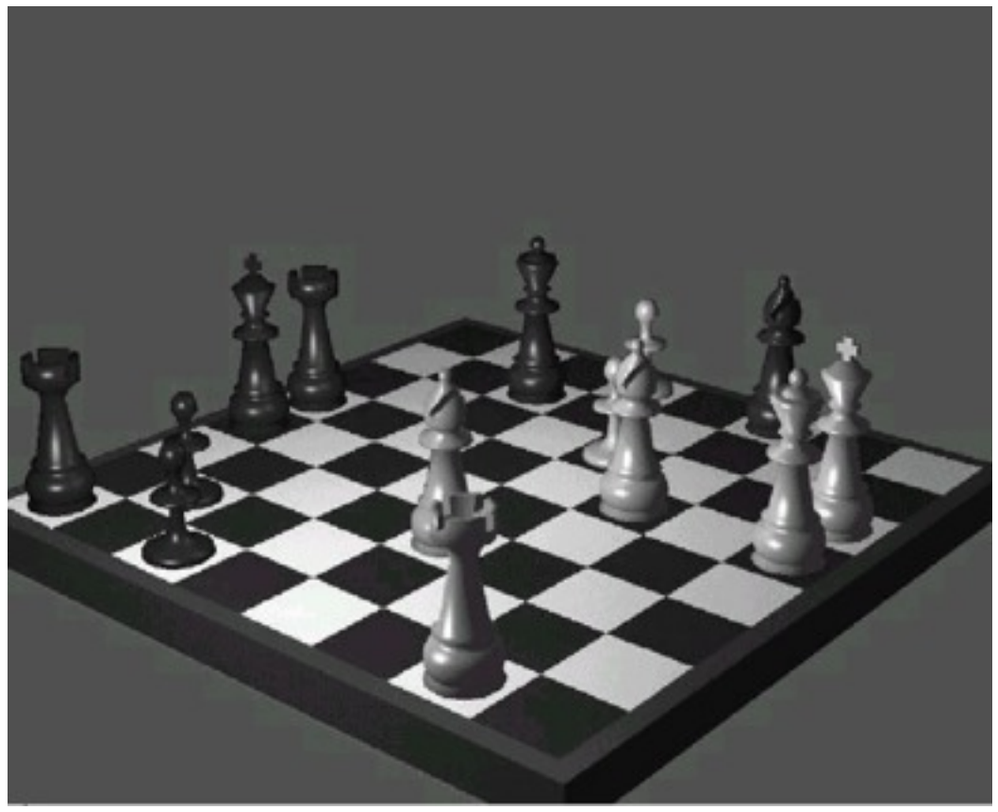
Subjectivity, expectations

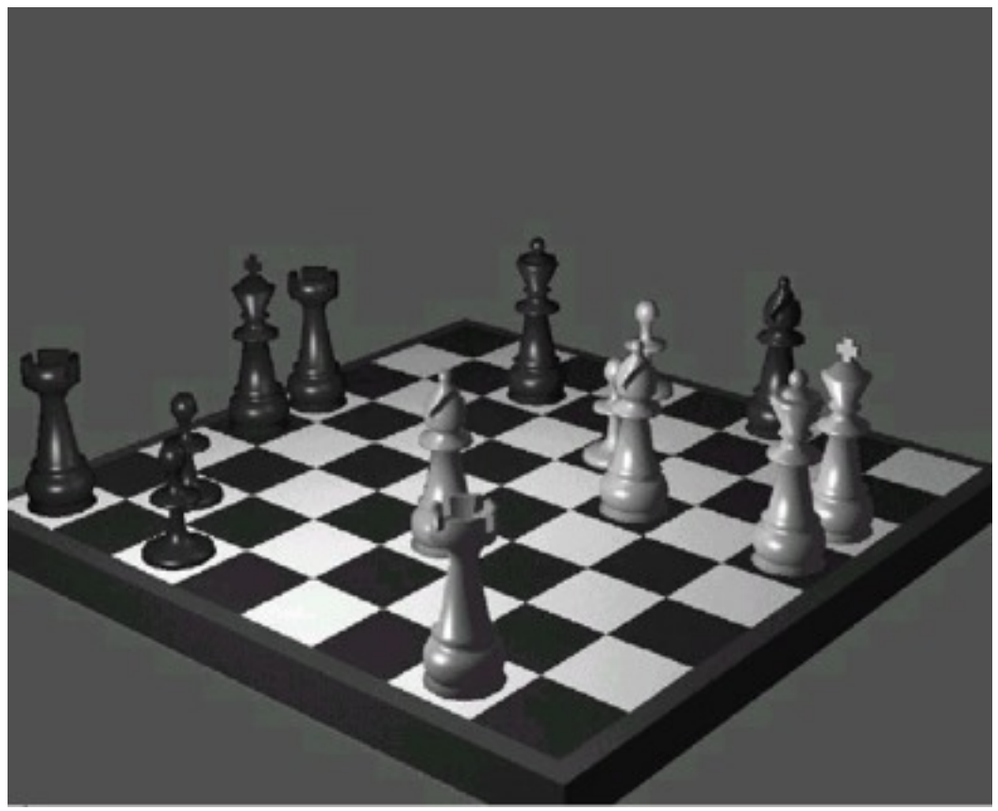
Playing chess



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

Video “Robovie”

Video “iCub attention”

Interaction and observation

videos:

intelligent?

—> highly subjective

—> Turing suggests empirical test

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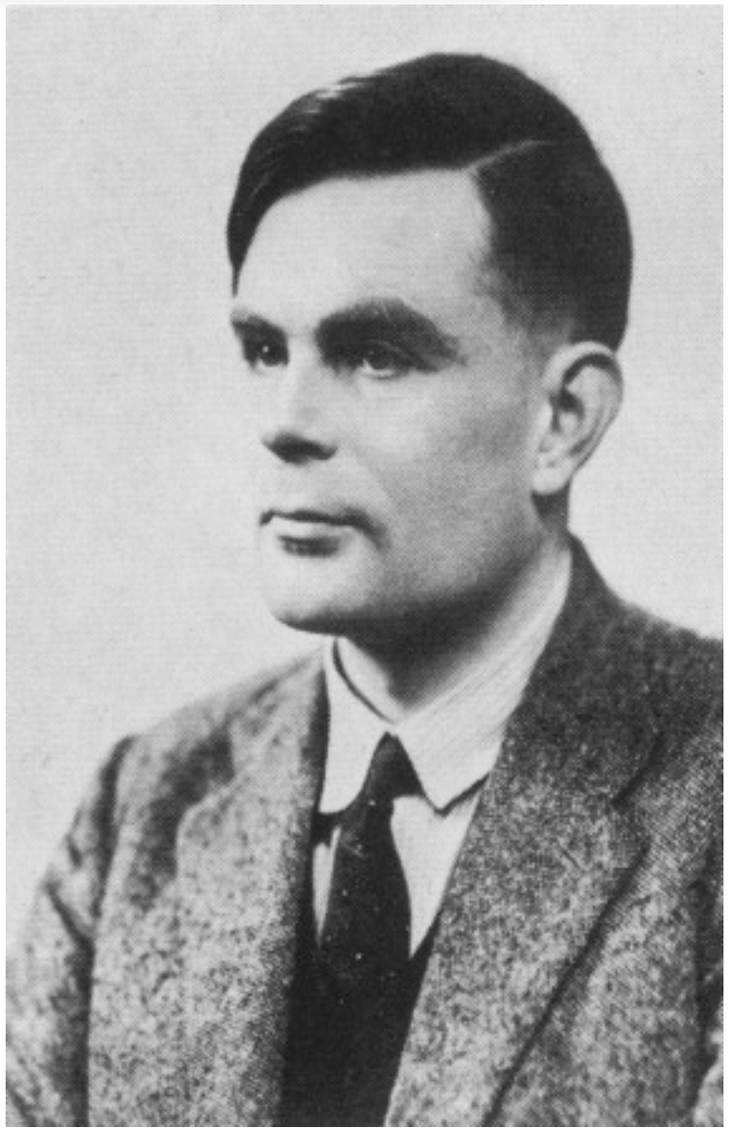
An empirical test?

Alan Turing (1912 – 1954)

- computer
- “computation”
- intelligence

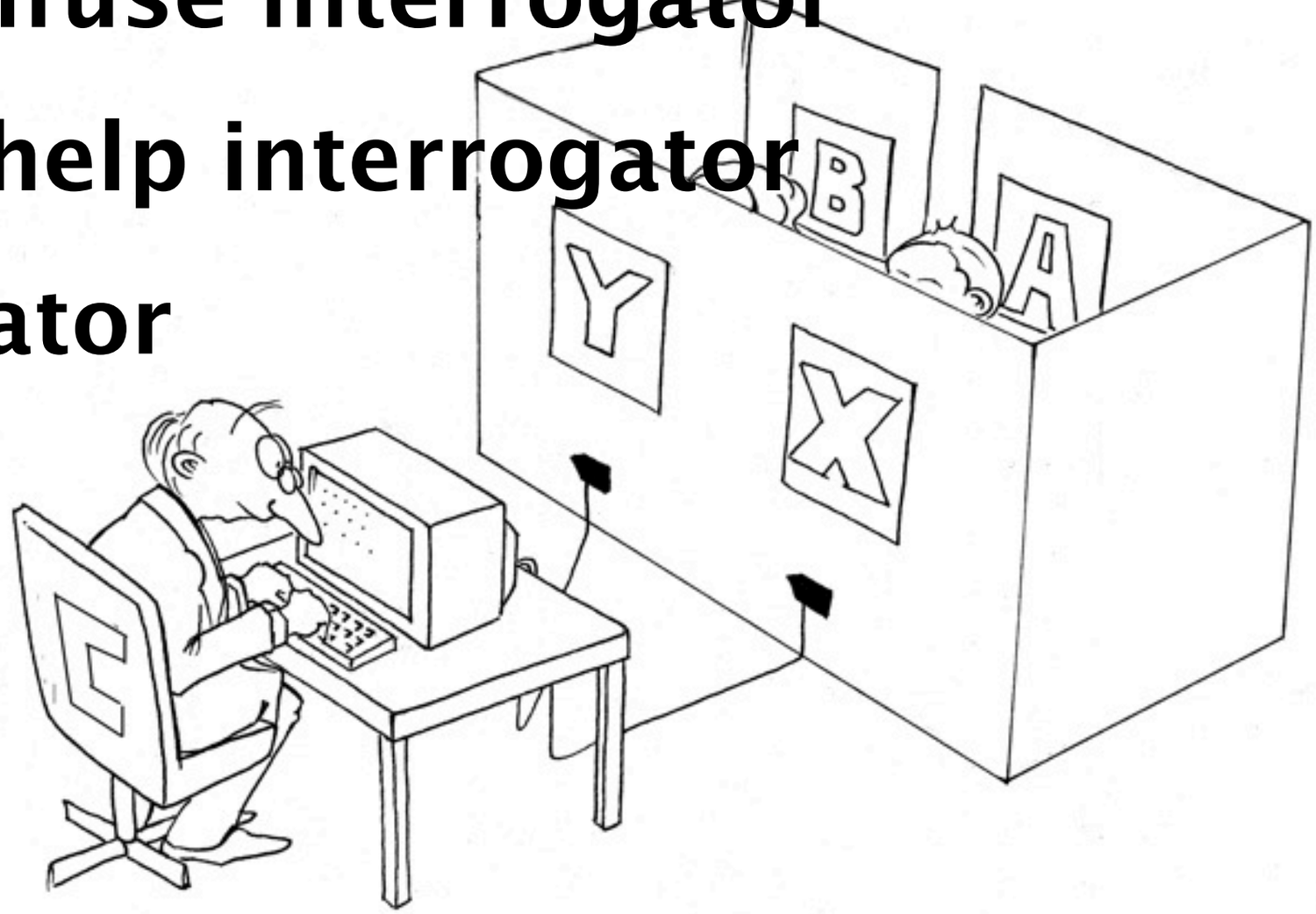


The Turing Test

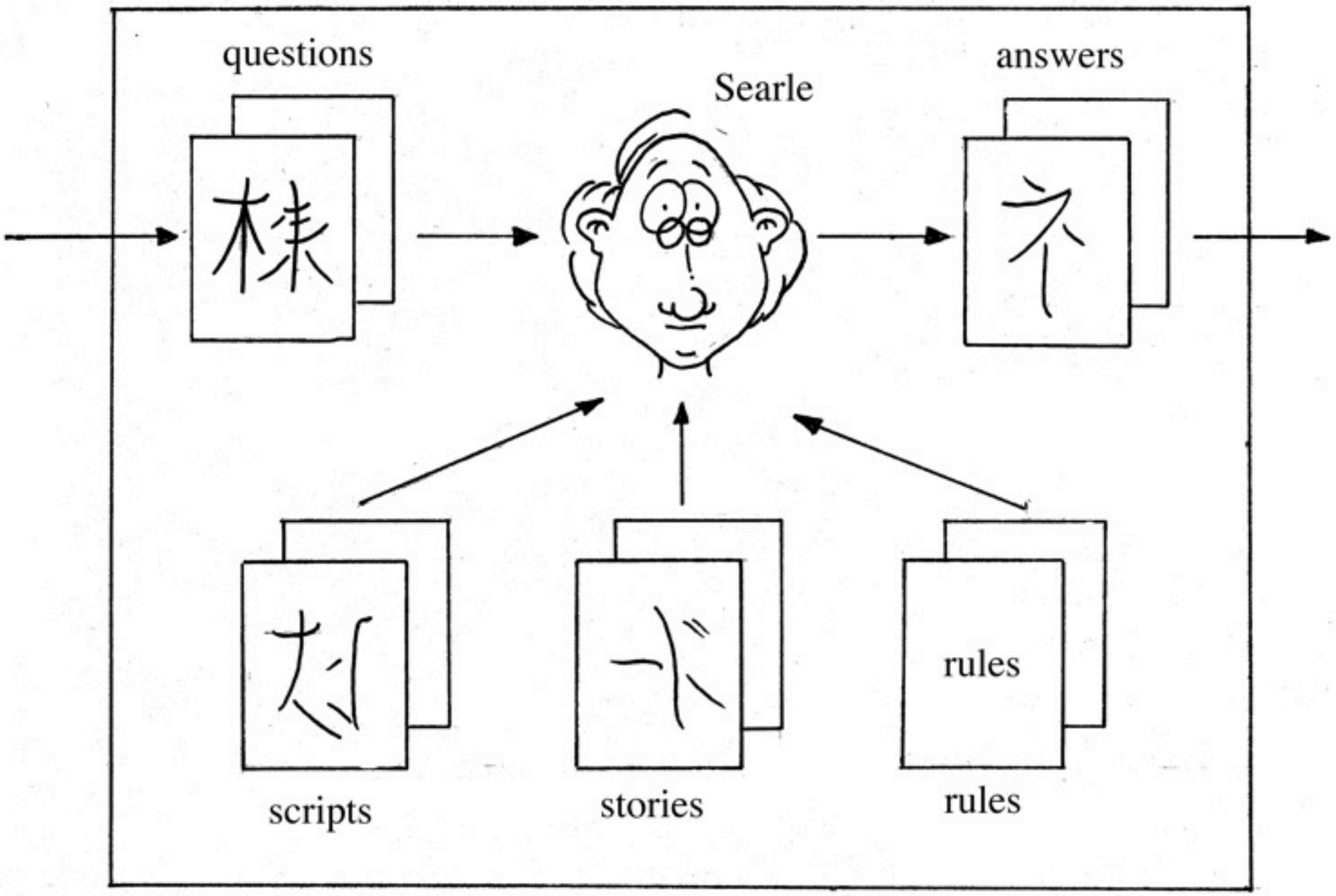
A: man, confuse interrogator

B: woman, help interrogator

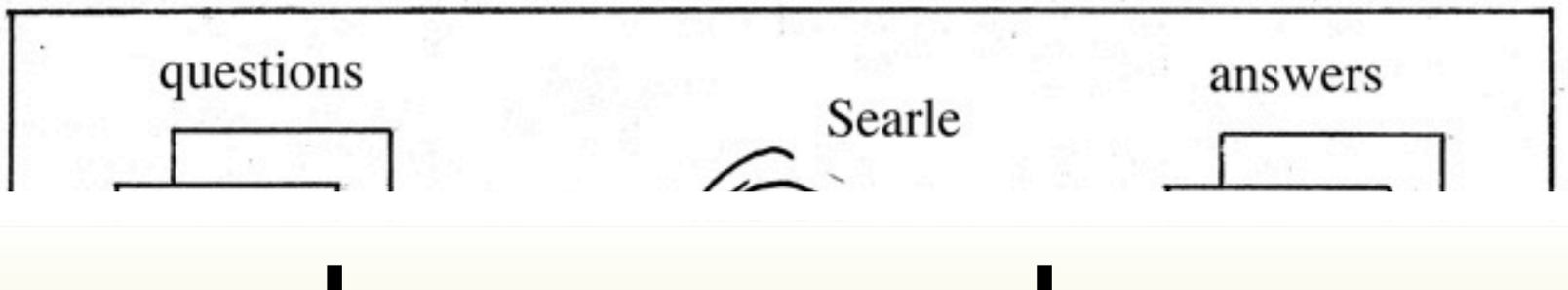
C: interrogator



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)

Turing tests

Video: “Blade runner”

Video “real dog vs. Aibo”

Measuring intelligence

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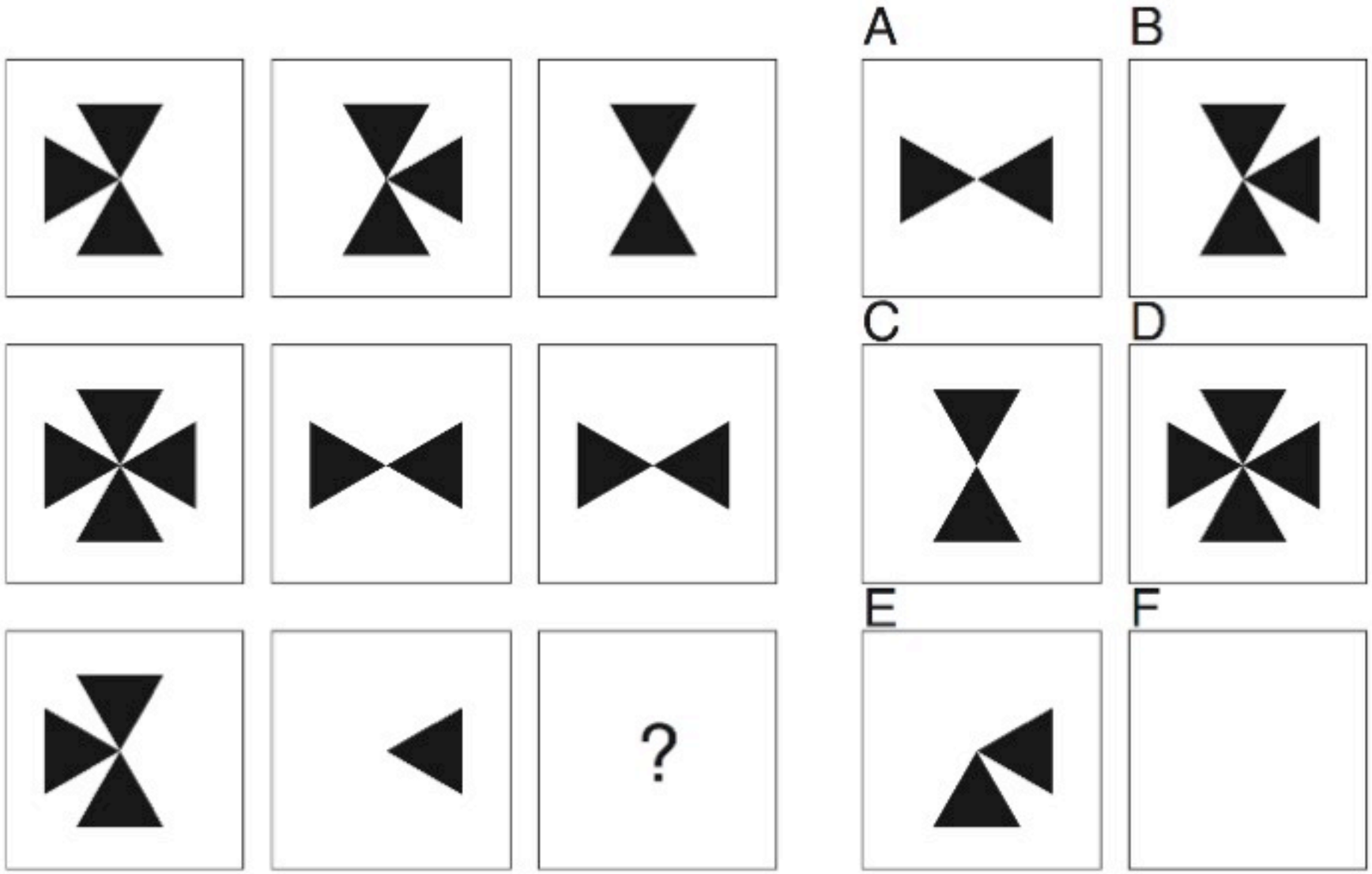
Measuring intelligence



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 and its goals**
- how to study intelligence: the "synthetic" methodology

Artificial Intelligence — goals

1. **Understanding biological systems**

animals

humans

2. **Making abstractions, developing theory**

3. **Applications**

vacuum-cleaner

beer-serving robot

Engkey

University of Zurich[UZH]

robotics Swiss National Centre of Competence in Research

vacuum cleaner

The ShanghAI Lectures 人工智能 上海授课

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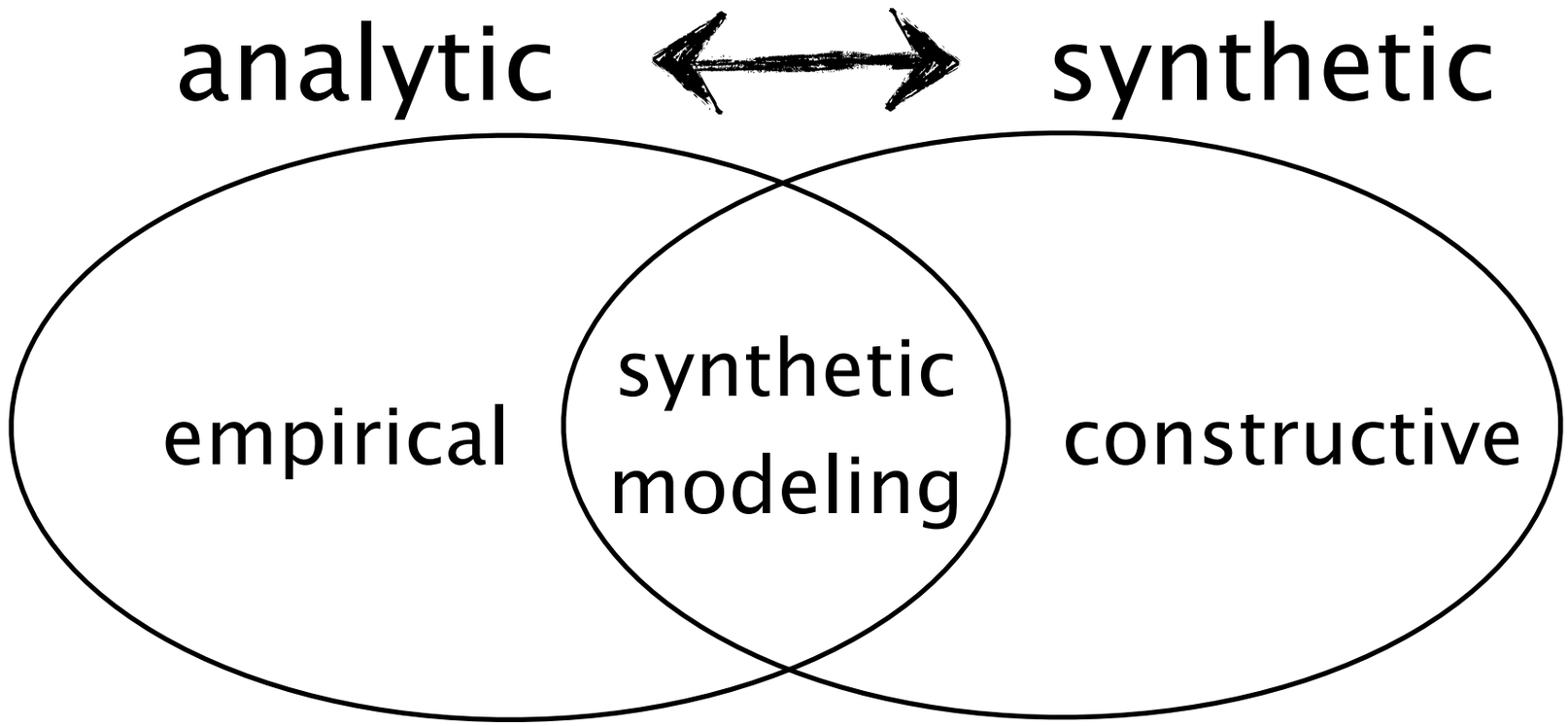
How to study intelligence?



psychology
biology
neuroscience

artificial intelligence
engineering
cognitive science

The synthetic methodology

Slogan:

“Understanding by building”

modeling behavior of interest

abstraction of principles

robots as tools for scientific investigation

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)

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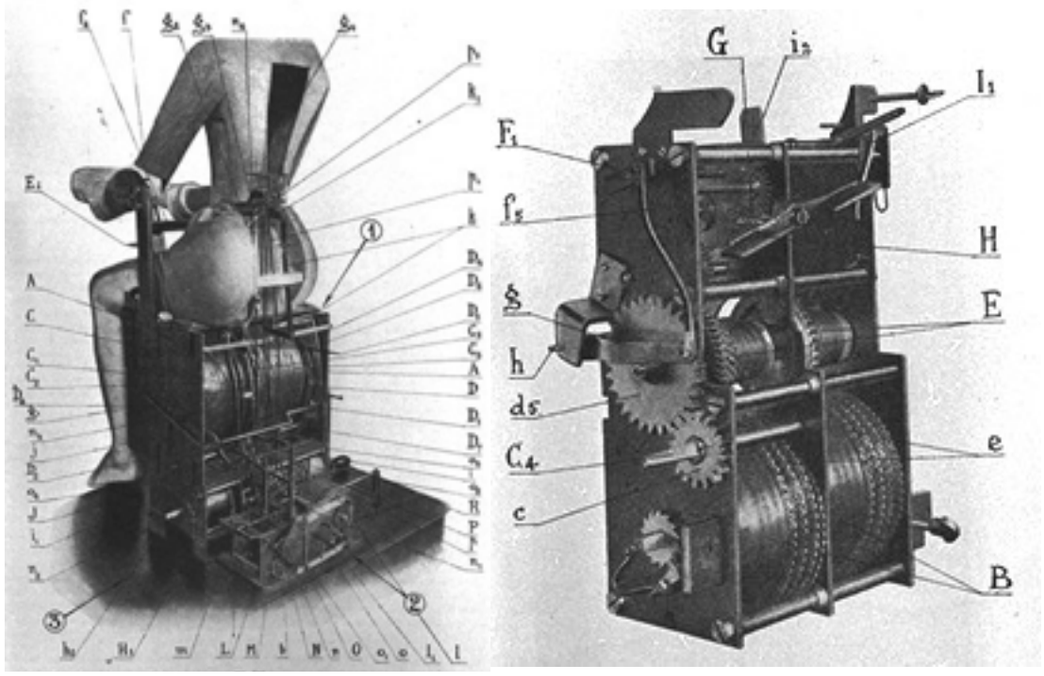
Aristoteles dixit

“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

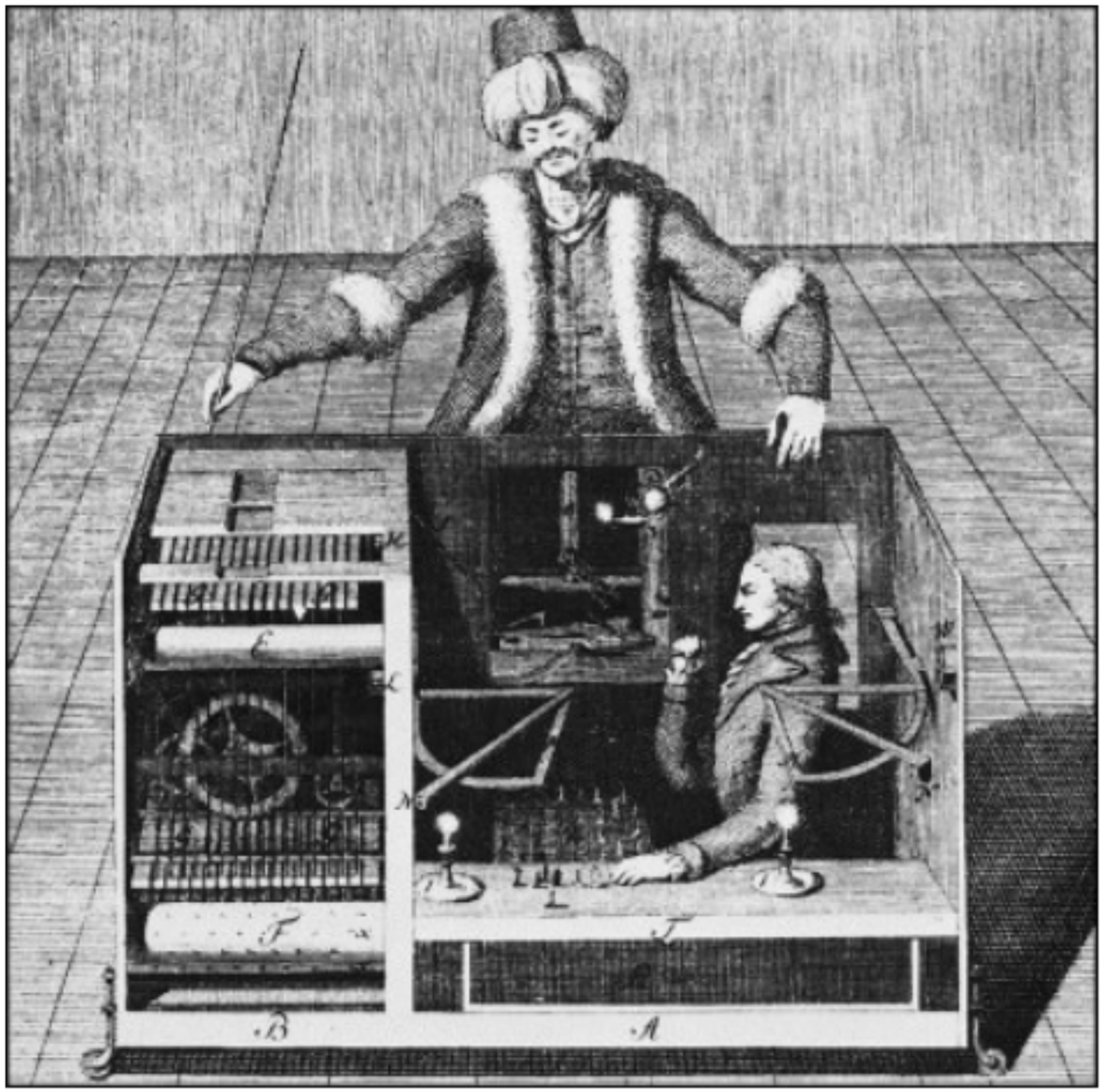


Jaquet-Droz Brothers
(1720-1780)

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

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 [illegible] standard IQ [illegible] ile IQ ha[illegible]r for pr[illegible] that so[illegible] are pr[illegible] thers are[illegible]

homework:
think about this issue
student presentation
next week

Issues to think about: an unfair comparison

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

- Next lecture on 24 October 2013: "Embodied Intelligence".
- Read chapters 1 and 2 of "How the body …"
- Additional reading materials (on web site)

End of lecture 1

Thank you for your attention!

stay tuned for lecture 2

"The need for an embodied perspective on intelligence"

Fabio Bonsignorio
Prof, Univ. Carlos III of Madrid and
CEO and Founder Heron Robots
Santander – UC3M Chair of Excellence

Research interests

- **embodied intelligence**
- **cognition/AI and robotics**
- **synthetic modeling of life and cognition**
- **self-organization and emergence**
- **novel technologically enabled approaches to higher education and lifelong learning**

The ShanghAI Lectures 2013

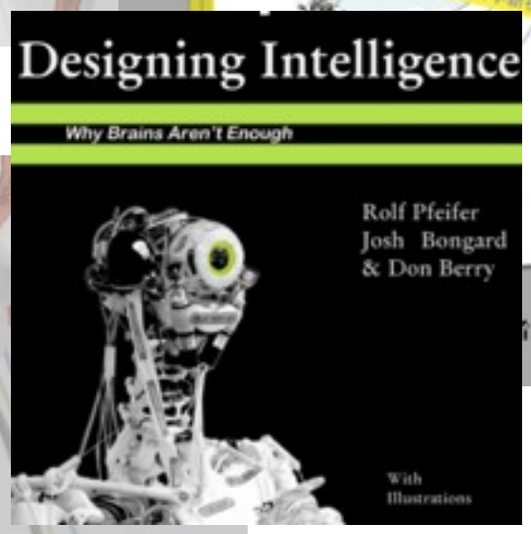
Rolf Pfeifer
Director AI Lab, Univ. of Zurich and
NCCR Robotics (Swiss National Competence Center for Research in Robotics)

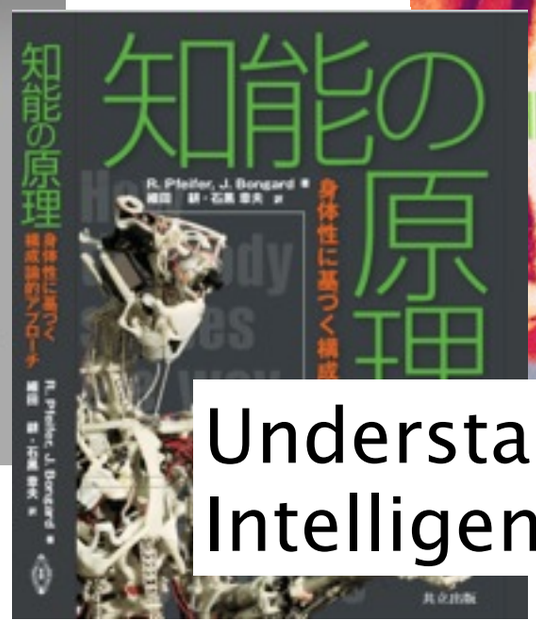
How the body shapes the way we think

MIT Press

Research interests

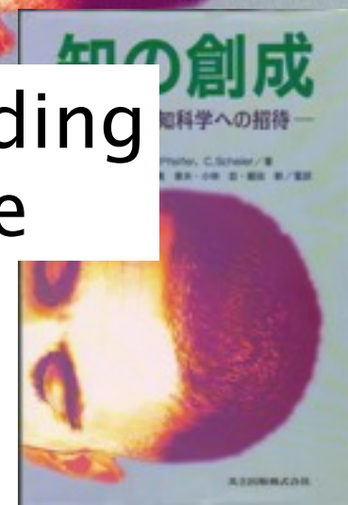
- **embodied intelligence**
- **bio-inspired robotics**
- **self-organization and emergence**
- **educational technologies**





Understanding Intelligence

The ShanghAI Lectures



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