

# Artificial Intelligence and school: a complex relation

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**Enrico Nardelli**

**Univ. Roma “Tor Vergata”**

**Director National Lab “Informatics & School” of CINI**

**Past President of Informatics Europe**



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# Albert Einstein on education (1931)

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- ... develop a **harmonious personality**, not a specialist (even for technical schools)
- ... develop a **general ability for independent thinking and judgement**, not acquisition of special knowledge
- ... will surely find their way and will be able to **adapt themselves to progress and changes** better than those who acquired detailed knowledge

# The aim of school education

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- To become citizens aware of the questions at stake and able to fully participate to a free and democratic debate
- Knowledge is fundamental to be able to decide
- Education is needed to give meaning to democracy

# Languages to represent knowledge

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- Natural language

If a cake is one kilo how much is three quarters of two thirds of it?

- Mathematics

$$\frac{1}{4} \times \frac{2}{3} = \frac{1}{4} \times \frac{2}{1} = \frac{2}{4} = \frac{1}{2}$$

# Testimonials

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- Peter Naur, 1967, and George Forsythe, 1968

Informatics, like natural language and mathematics, is a general-purpose language, useful for many subjects

- Bernard Chazelle, 2006

Informatics will play in XXI century the same role as mathematics in XX century

- Bruno Frey, 2017, and Brian Arthur, 2020

Reactive, verb-based disciplines are better described by informatics than mathematics

# The third fundamental “language”

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- Natural language: the language of social relations
- Mathematics: the language of quantitative relations
- Informatics: the language of *computing processes*  
= the language of  
*automated di processing of representations*

# Revolutions in the power relations

- Printing press: 1st revolution  
Breaks the **power of authority**
- Industrial revolution: 2nd  
Alters the power relation  
between **mankind and nature**
- Informatics revolution: 3rd  
Challenges intellectual superiority  
of **mankind over machines**



ENRICO NARDELLI

# La rivoluzione informatica

Conoscenza, consapevolezza e potere  
nella società digitale

## Cognitive Machines (1)

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- They relate, concatenate, and process **representations** of facts to derive new **representations**

# Cognitive machines (2)

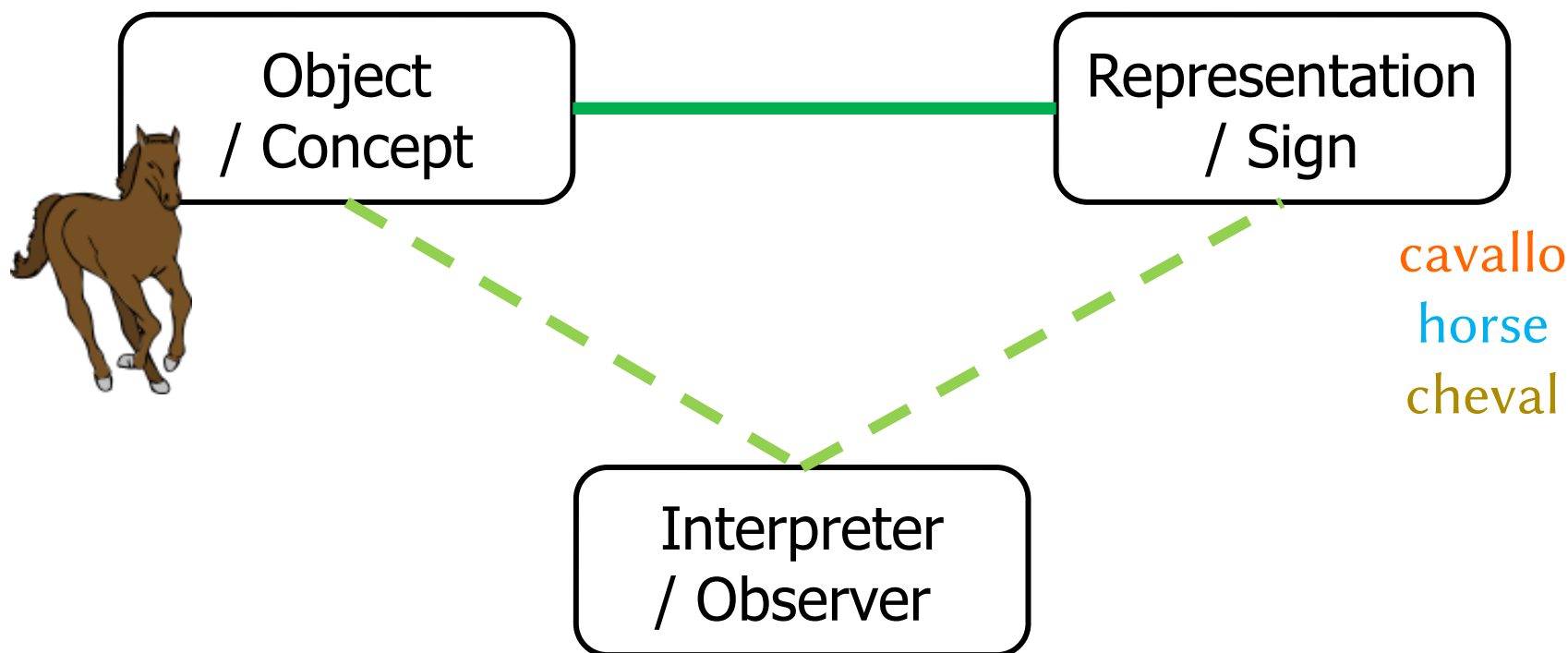
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- Many ways of knowing
- Intelligence is a multidimensional construct while these machines have only logic and pure rationality
- Amplifiers of our cognitive capabilities
- Cognitive machines are to our rational brain what industrial machines are to our physical body

# The question of meaning

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- **Representations**, i.e. signs, are "symbols", they refer to a meaning, but only for a (human) interpreter



# Cognitive machines (3)

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- They manipulate symbols
  - whose meaning they do not know,
  - by executing instructions whose meaning they do not know,
  - but produces symbols that have meaning for humans
- This is the “power revolution”, however
  - Not “intelligence” artificially obtained (like “artificial heart”)
  - But “mechanical intelligence”

# Generative AI systems

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- AI is to informatics revolution what electricity has been to industrial revolution
- Can bring the power of cognitive machines to everybody
- Produce data from other data with a level of competence which appears similar to that of humans
- Production can be marred by error or inaccuracies
- One cannot trust the AI answer unless knows the TRUE answer

# Possible risks for generative AI (1)

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- We project onto their outputs the meaning which is within us
  - Intelligence is in the brain of the reader
- « *We are meaning-seeking creatures. Biologically, our nervous systems are organized in such a way that the brain automatically clusters incoming stimuli into configurations.* »

I.Yalom, *Love's Executioner and Other Tales of Psychotherapy*, 1989.

# Generative AI and puzzles

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- From Gary Marcus

Solve a puzzle for me.



**ChatGPT**

Sure, I'd love to help! What kind of puzzle would you like me to solve?



**You**

A man and a goat are on one side of the river. They have a boat. How can they go across?



**ChatGPT**

The man takes the goat across the river first, leaving the boat on the original side. Then, the man returns alone with the boat. He leaves the goat on the other side and takes the boat back to the original side. Finally, he takes the cabbage across the river.

# Possible risks for generative AI (2)

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- Not all technologies can be freely used by everyone (e.g., cars)
- Really dangerous technologies are severely restricted
- Children learning to walk
- Fatigue is a necessary and unavoidable component of training oneself to become competent in a certain field
  - Sport, arts, language
- To ban tools that can relieve of intellectual fatigue does not make sense unless there is a strong case for it, e.g. the learning process

# Possible risks for generative AI (3)

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- Allowing our children to use generative AI systems in an unrestricted way before their full development means undermining their chances of growth on the cognitive level
- Not prohibition, but awareness and education
- See what's happened with the use of digital technologies by children
  - European Parliament resolution (Dec.2023) on addictive design of online services
- Don't rush with the crowd

# What is education

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- Teaching by means of AI tools implies substituting the personal relations between teacher and student
  - which has an important affective component – as Plato discussed in his Dialogues, and
  - which requires being together in the same physical place
- with a dis-embodied relation mediated by digital technology
- **This is the death of the pedagogical endeavour**

# How to really improve education ?

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- Personalized learning → More teachers
- Improving learning → More tutors, more libraries, more laboratories
- Some repetitive task could be done by tools, however:
  - Privacy is the key issues
  - Risk of mechanizing people

# Some reflections

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- Home assignments less and less important
- Classroom work more and more important
- Showing “here and now” what one has learned and is capable to do
- **Creative production = generating + filtering**
- Generative AI tools can help instructors in generating
  - plans for lessons and courses
  - exercises and exams
  - material for students’ practice
  - presentations for lectures
  - summaries of text
  - text from a table of content
- However, the ultimate responsibility always lies with the instructor

# 5 key points for informatics education

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1. Prepare teachers

2. Start early in school

3. Go slowly

4. Pay attention to gender diversity in teaching

5. Take care of the social impact



# Manifesto on Digital Humanism

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- Vienna, may 2019

<https://dighum.ec.tuwien.ac.at/dighum-manifesto/>

- Democracy and inclusion
- Privacy and freedom of speech
- Fairness and transparency
- Regulations of the markets
- Decisions affecting individual or collective human rights must be made by human beings.

# THANKS!

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Enrico Nardelli

Univ. Roma “Tor Vergata”

<http://www.mat.uniroma2.it/~nardelli/>



@enriconardelli



<http://www.linkedin.com/in/enriconardelli>



<https://www.facebook.com/enrico.nardelli>