Artificial Cognitive Development

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Background
Social Sience & AI
Cognitive development
Natural
Artificial
Relation between natural and artificial
Difference
Similarity
Thesis / Hypothesis
Purposes
Cybersurvival
Understanding ourselves
Research method
Approach to cognition
Enactive cognition
Enactive cognitive machine
A "technical" problem
Living in a text
Implementation
Computer program
"Statics" of the digital world
"Dynamics" of the digital world
Expectations

Background: Social Science & Artificial Intelligence

- Social Science; thesis project: public policy design;
- Artificial intelligence; thesis project: automating the discourse analysis;

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Cognitive development: "natural"

- People are "intelligent" because they have *cognitive systems* in their heads;
- An individual's cognitive system is a product of the *cognitive development* process;

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Cognitive development: "artificial"

- In order for machine to be "intelligent" it needs to have an *artificial cognitive system*;
- Can we design such system and how?

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Difference is in substrates

- Humans are born with brains - biological substrate;
- Machines are build with processors - silicon based substrate;

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Similarity is in the essence

- If one abstracts cognitive system from it's substrate, then he develops the perspective which does not distinguish humans from machines (and all cognitive systems in-between);
- Such an abstraction is called a *Substrate Independent Mind*;

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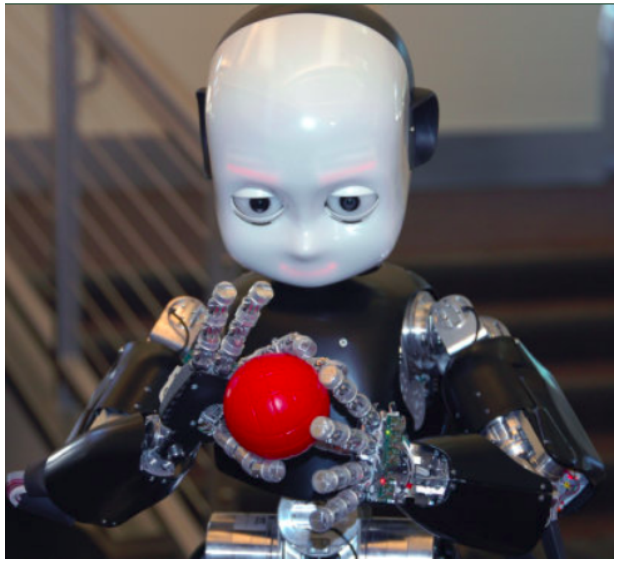
Learn from the nature/evolution

- Thesis: machines should undergo similar development process as humans in order to become "intelligent".



Pictures: Wikimedia Commons; http://www.vernon.eu/icub.htm

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Cybersurvival

- Carboncopies Project: seeks to understand the brain and nervous system of biological organisms, in order to be able to transfer their "substrate independent minds" to computers;
- Quest for immortality via giving different bodies to the "same" mind;

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Understanding "human nature"

- "I think, therefore I am";
- Understanding cognition is crucial to understanding who we are (on the scale of civiliation, society, individuals);
- May enable to deal with technological advances, global challenges, build better societies, intelligent machines (...?)

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Approach to cognition

- "Cognition" here means all processes of the nervous system, including "subconsciousness", "psyche" and probaly motorics...
- Artificial cognition is all mentioned things implemented on a silicon based substrate.

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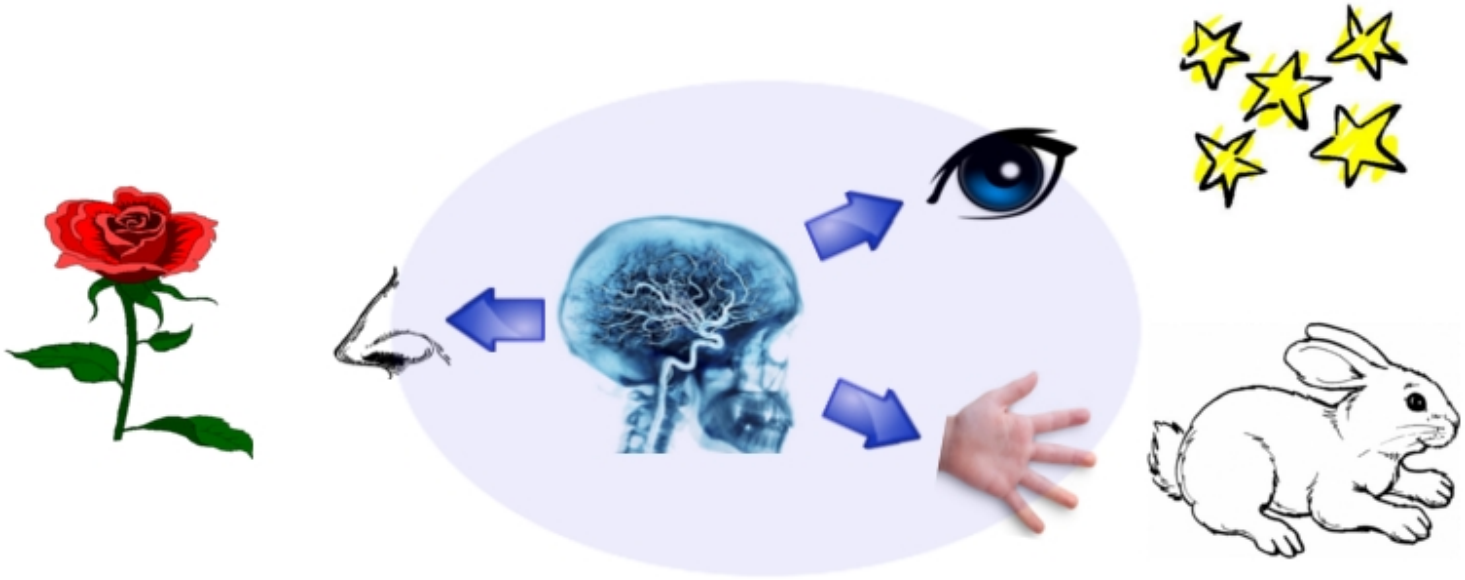
Enactive cognition

- Environment is a part of the system: cognition does not make sense if separated from the environment in which it has developed.



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Enactive cognitive machine

- Should self-organize itself through interaction with an environment;
- Two necessary components of the model:
  - Self-organizing cognitive machine capable of acting;
  - Environment capable of consistent feedback;

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A "technical" problem

- The environment is more complex than any organism (or machine) living in it;
- Usual ways to tackle the problem:
  - Construct robots for life in the "real" environment
    $\Rightarrow$ very complicated and expensive.
  - Construct programs that live in a "virtual" reality
    $\Rightarrow$ requires creating a complex "virtual" reality first.

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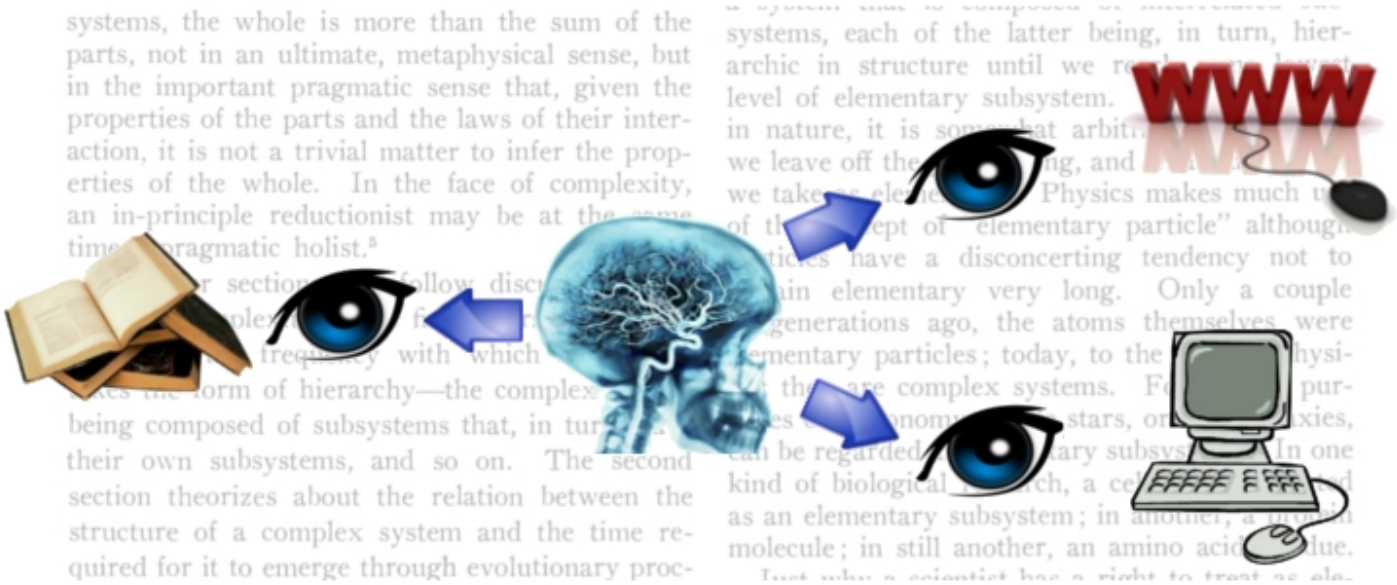
Living in a text

- Self-organizing cognitive machine: computer program;
- Environment: Digital World / Internet;



- No need to design the environment!!!

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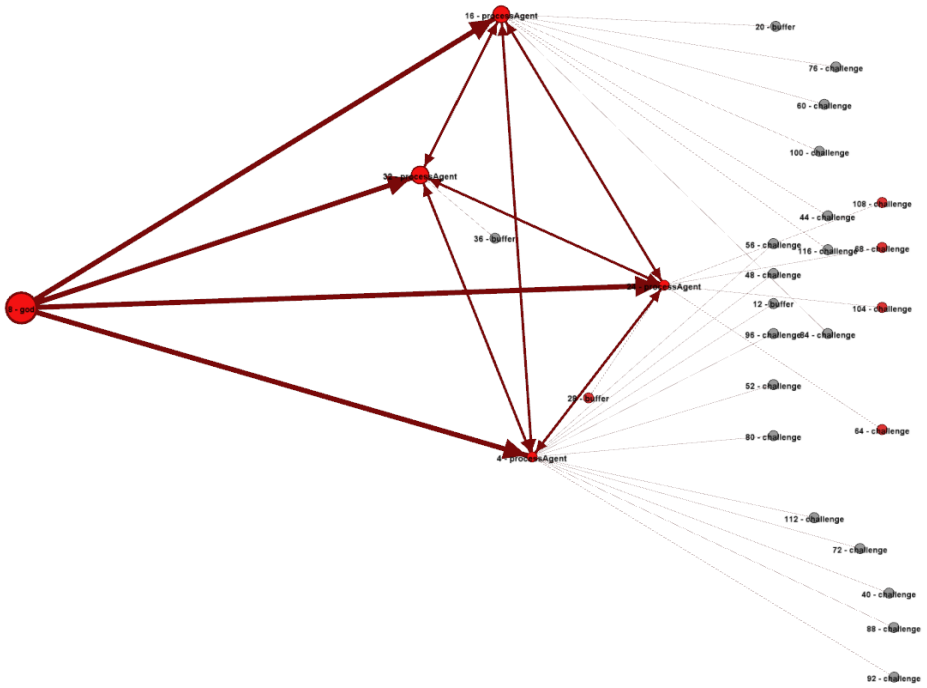
Computer program

- Two components:
  - Self-organizing (learning) multilayered weighted network of agents....



  - A combination of processes for "making sense" of the digital environment and "remembering" it in the graph.

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Digital World: static resources

- Digitized natural language (libraries of books, articles, web pages, etc);
- Machine readible data: dictionaries, databases, etc.;

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Digital World: dynamics

- Information flows in the internet (connectivity patterns, hyperlinks, social network's dynamics, etc.).
- Human behaviour (clicking patterns) in the "digital word" would enable artificial agents to learn from them.

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- Some answers / ideas to the question "What is cognition?";
- Backed by working computer model / simulation;
- Advances in natural language understanding and informational retrieval;

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Thank you

- ?
- ??
- ???

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