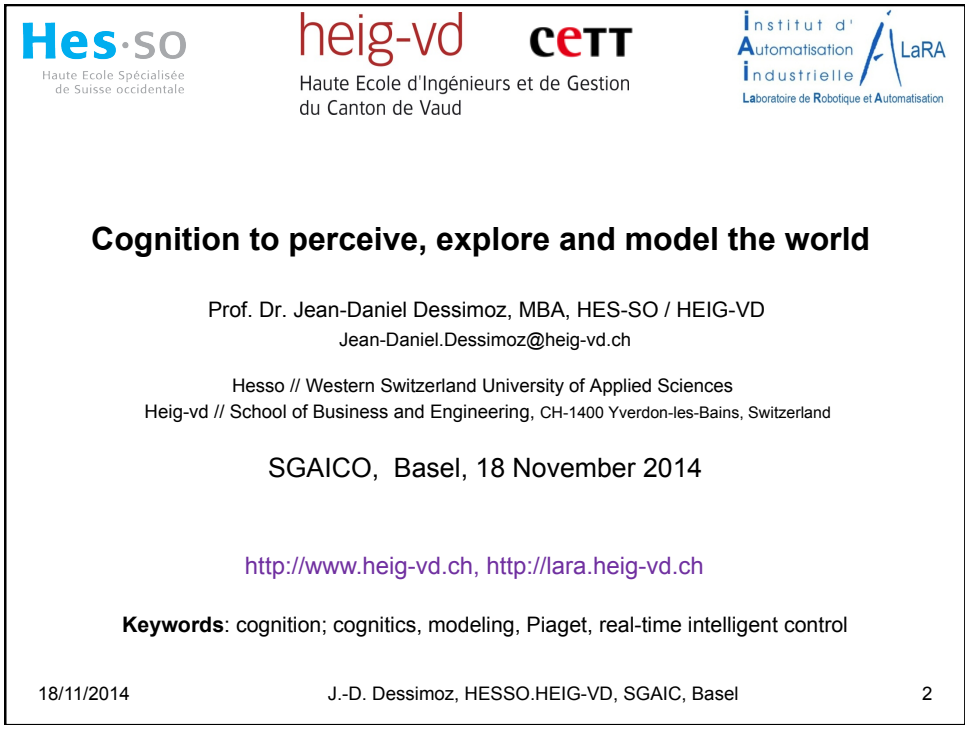

schweizer informatik gesellschaft
société suisse d'informatique
società svizzera per l'informatica
swiss informatics society
informiert sein
vernetzt sein
dabei sein
weiter kommen
SGAICO
18.11.2014 10:00 - 18.11.2014 18:00
Intelligent Systems and Applications, AI/CO Education
Universität Basel, Kollegienhaus, Fakultätenzimmer 112, Petersplatz 1, 4001 Basel
www.unibas.ch/unibas_lage/plan.cfm
Cognition to perceive, explore and model the world
Prof. Dr. Jean-Daniel Dessimoz, MBA, HES-SO / HEIG-VD
15:15 - 15:40, 18 November 2014
http://lara.populus.org/rub/3
18/11/2014
J.-D. Dessimoz, HESSO.HEIG-VD, SGAIC, Basel
1


Hes·so
Haute Ecole Spécialisée de Suisse occidentale
heig-vd
Haute Ecole d'Ingénieurs et de Gestion du Canton de Vaud
cett
Institut d'Automatisation Industrielle
LaRA
Laboratoire de Robotique et Automatisation
Cognition to perceive, explore and model the world
Prof. Dr. Jean-Daniel Dessimoz, MBA, HES-SO / HEIG-VD
Jean-Daniel.Dessimoz@heig-vd.ch
Hesso // Western Switzerland University of Applied Sciences
Heig-vd // School of Business and Engineering, CH-1400 Yverdon-les-Bains, Switzerland
SGAICO, Basel, 18 November 2014
http://www.heig-vd.ch, http://lara.heig-vd.ch
Keywords: cognition; cognitics, modeling, Piaget, real-time intelligent control
18/11/2014
J.-D. Dessimoz, HESSO.HEIG-VD, SGAIC, Basel
2

1. Introduction

- In general terms, cognition has made the condition of humans very attractive and successful, in comparison to other elements of nature as we know it [1].
- Progress in sciences, engineering, and especially ICT's, now allows to address with good chances of success automated applications relating to cognitive issues (for AI aspects, re. e.g. [2]).
- Five theses about cognition have recently been delineated [3] , which can be seen both as paths towards better insights in human and social nature and also as a roadmap for simultaneous and iterative processes capable to freely foster a better future for individuals and society
- The presentation develops the first of these five theses : cognition allows to know the world, to explore and perceive, to model.

Content

Slides on website: http://lara.populus.org/rub/3
More text in comment fields

2. Context 1 of 2

- **Overview of the five delineated theses about cognition:**
  1. **cognition allows to know the world, to explore and perceive, to model;**
  2. **cognition allows for defining alternative worlds and possible futures, visions, for anti-causality;**
  3. **cognition allows for effective control;**
  4. **cognitics allows for a large scale, technical deployment of cognition;**
  5. **social cognitics can provide a foundation for team action and increased momentum for change.**

.

2. Context 2 of 2

•The presentation will develop the first of these theses: « Cognition is necessary to perceive, explore and model the world ».

Therefore:

- **first, cognition requires a better understanding**
- **then, making the underlying capability automated will boost its deployment**

• Cognition features two very different components:

- **elements of immaterial nature**
- **physical supporting infrastructure**

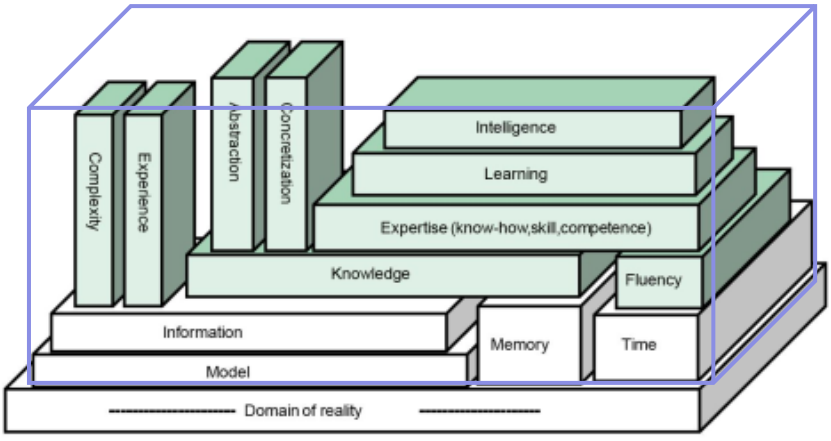
• Modeling is necessary for the creation/replication of cognitive systems, as well as for their evolution

Content

1. Introduction
2. Context
3. Immaterial aspects
4. Physical support infrastructure
5. Innate and acquired capabilities
6. The challenge of modeling
7. Conclusion

Slides on website: http://lara.populus.org/rub/3
More text in comment fields

3. Immaterial aspects 2 of 4



In cognition, conceptual elements (re. blue box) are immaterial (non-physical), even when they relate to reality [4] .

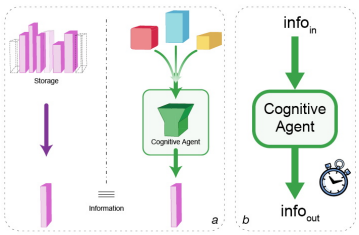
Content

1. Introduction
2. Context
3. Immaterial aspects
4. Physical support infrastructure
5. Innate and acquired capabilities
6. The challenge of modeling
7. Conclusion

Slides on website: http://lara.populus.org/rub/3
More text in comment fields

4. Physical support infrastructure 1

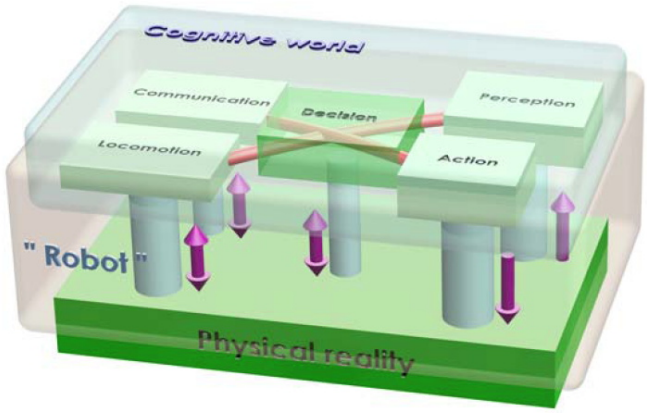
- **Information is carried by messages, and requires an implemention on physical supports ("signals").**
- **Cognition requires a physical infrastructure, an "engine", in order to yield pertinent output, as the latter information is usually not stored as such.**
- **For deployment in the real world, physical resources, such as energy or structural elements, are also required.**



Schematic view of cognition. (a) Cognition and, effectively, cognitive systems generate information.
(b) Cognitive properties can be quantatitatively estimated on the basis of the input-output information flows, and time.

PROCESS → ACTION

4. Physical support infrastructure 2

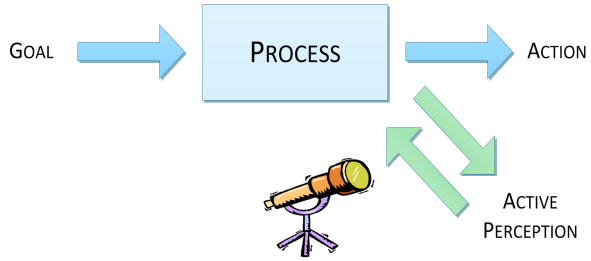


Schematic view of a robot, modeled as featuring 5 essential capabilities. Information flows are shown in red, and energy in purple color.

Content

Slides on website: http://lara.populus.org/rub/3
More text in comment fields

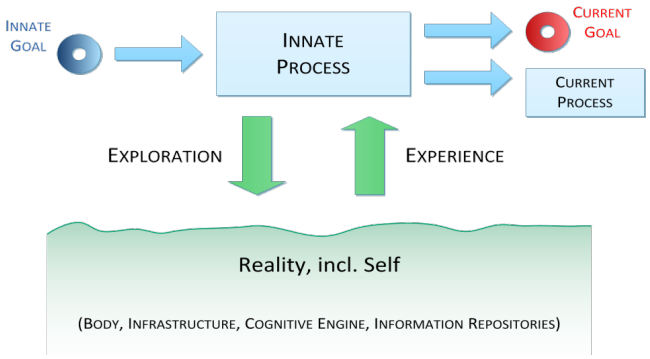
5. Innate and acquired capabilities 1



In cognition, backtracking is the rule.

From the selected goal, specifications are derived, which then lead the cognitive process, and in particular an active perception ("exploration") faculty capable of acquiring the non-physical experience necessary for action and possibly later improvements.

5. Innate and acquired capabilities 2



Current goals and processes may result from exploration performed and/or experience acquired by an agent, running a given cognitive process in a certain domain of reality.

Initial goals and processes are innate (or "wired").

Content

1. Introduction
2. Context
3. Immaterial aspects
4. Physical support infrastructure
5. Innate and acquired capabilities
6. The challenge of modeling
7. Conclusion

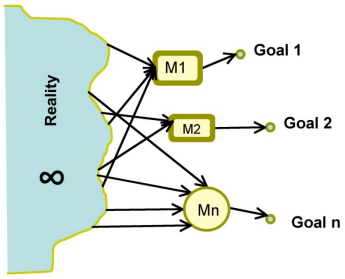
Slides on website: http://lara.populus.org/rub/3
More text in comment fields

6. The challenges of modeling 1

- **The complexity of reality is infinite**
  - **How to acquire information? (the perception problem)**
    - **How to sense**
    - **How to explore**
  - **How to induce information processing schemes? (the cognition problem)**
- **Chance and dedication can help**
  - **truly novel solutions typically occur by chance**
  - **observations and experiments should be recorded**
  - **critical elements should be identified, possibly by replicating experiments with systematic variations of parameters**
  - **Re-use best known, proven solutions**

6. The challenges of modeling 2

- **The complexity of models should be minimized**
- **Experts are said to be very good at ignoring non-critical parameters**
- **Trade truth and completeness (correspondance to reality) for wisdom (correspondance to goal) and effectiveness**



Content

Slides on website: http://lara.populus.org/rub/3
More text in comment fields

7. Conclusion

- Time as come for cognitics
- In cognition, modeling the world is the first challenge to address, starting with the modeling process itself
- The cognitive world is essentially non-pysical, immaterial
- Cognition requires though a physical support infrastructure, as well as "engine" and for mediating input-output resources (sensors and actuators) wrt real world
- Some initial cognitive capabilities must be innate/wired. Possibly, new capabilities may be acquired.
- Some hints have been given for addressing the main modeling challenges:
  - for probing the infinitely complex reality,
  - for reducing goal-oriented processes to tractable yet effective solutions

References

1 Robin Dunbar, "The social brain hypothesis", Evolutionary Anthropology, Wiley-Liss, pp178-190, 1998

2 "Intelligent Autonomous Systems, Foundations and Applications", Dilip Kumar Pratihar and Lakhmi C. Jain, Editors, Studies in Computational Intelligence, Volume 275 2010, ISBN: 978-3-642-11675-9 (Print) 978-3-642-11676-6 (Online), Springer-Verlag Berlin Heidelberg (2010)

3 Jean-Daniel Dessimoz, "Cognition, Cognitics, and Team Action – Five Theses for a Better World", NRF-IAS-2014 Position paper, Proceedings of the Workshop on New Research Frontiers for Intelligent Autonomous Systems (NRF-IAS) Venice (Italy), July 18-19, 2014, ISBN 978-88-95872-08-7, pp. 33-41.

4 Jean-Daniel Dessimoz, "Cognitics - Definitions and metrics for cognitive sciences and thinking machines", *Roboptics Editions*, Cheseaux-Noréaz, Switzerland, ISBN 978-2-9700629-1-2, pp 169, January 2011.