Slide 1

4th International Conference on Cognitive Systems

University of Zurich

CogSys 2010

January 27 & 28, 2010, ETH Zurich, Switzerland

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Cognition for a Purpose, Cognitics for Control

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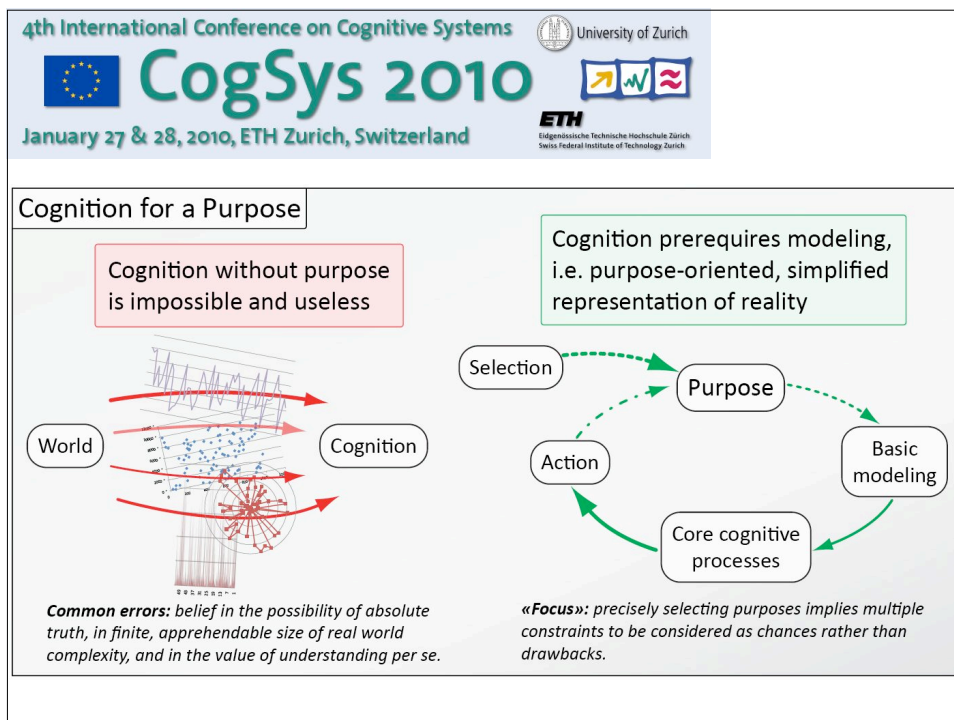CH-1400 Yverdon-les-Bains, Switzerland,

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heig-vd
Haute Ecole d'Ingénieurs et de Gestion
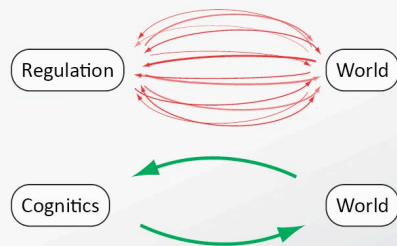du Canton de Vaud

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Slide 2

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Cognition for a Purpose

Cognition without purpose is impossible and useless

Cognition prerequires modeling, i.e. purpose-oriented, simplified representation of reality

World → Cognition

Selection → Purpose → Basic modeling → Core cognitive processes → Action → Purpose

Common errors: belief in the possibility of absolute truth, in finite, apprehendable size of real world complexity, and in the value of understanding per se.

«Focus»: precisely selecting purposes implies multiple constraints to be considered as chances rather than drawbacks.

Slide 1

Cognitics help Controlling

Cognitics extend the possibilities of classical regulation and often lead to drastic improvements in system dynamics and stability:

- identifying relevant factors and processes
- determining critical values
- sparing measurements
- reducing or sometimes even eliminating critical delays
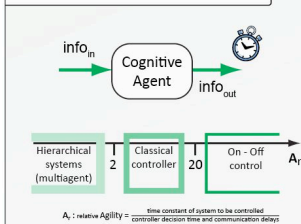- anticipating effects and compensating for disturbance

Regulation — World

Cognitics — World

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Slide 2

Quantitative Cognitics

$info_{in}$ → Cognitive Agent → $info_{out}$

Hierarchical systems (multiagent) — 2 — Classical controller — 20 — On - Off control — A_r

A_r : relative Agility = $\dfrac{\text{time constant of system to be controlled}}{\text{controller decision time and communication delays}}$

Example: Cooperating robot RH4-Y in Robocup@Home competition 2010, Graz

Evaluate metrically complexity, information flows, knowledge, expertise and other cognitive and dynamic properties

Information:	$n = \sum p_i \log_2(1/p_i)$ [bit]
Knowledge:	$K = \log_2(n_{out} \, 2^{n_{in}} + 1)$ [lin]
Expertise:	$E = K/\Delta t$ [lin/s]
Learning:	$\Delta E = E(t_1) - E(t_0); > 0$ [lin/s]
Experience:	$R = r(n_{in} + n_{out})$ [bit]
Intelligence:	$I = \Delta E / \Delta R$ [lin/s/bit]

References:

- Jean-Daniel Dessimoz, *"Cognition Dynamics; Time and Change Aspects in Quantitative Cognitics"*, Second International Conference on Intelligent Robotics and Applications. Singapore, 16 - 18 December, 2009
- Jean-Daniel Dessimoz, Pierre-François Gauthey, *"RH4-Y – Toward A Cooperating Robot for Home Applications"*, Robocup-at-Home League, Proceedings Robocup09 Symposium and World Competition, Graz, Austria, June- July 2009

27-28.01.2010   Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD   4/4