

Diffusive emotional control, *a conditio sine qua non* for human-level AI?

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» cognitive system approach to AI «

pitfalls of traditional AI

**mainstream AI will not lead
to human-level cognitive systems (CS)**

- **the architectural conundrum**

AI: algorithmic optimization

CS: cognitive capabilities emergent from universal principles

- **the motivational problem**

AI: tasks given by external supervisor

CS: diffusive emotional control

the architectural conundrum

cognitive systems - universal principles

- universal time prediction tasks (Elman)
... abstract concept generation
 - behavioral complexity optimization (Sporns, Der, ...)
... sensori-motor loop
 - slow feature analysis (Földiák, Wiskott, ...)
 - autonomous internal dynamics (Gros)
... emergent ICA
- are all applicable for a wide range of environments

the complexity barrier

life-long utility maximization not feasible

- scarceness of resources
 - ▷ information / computational power / time

short-term survival

- ⇒ utility maximization
- survival parameters / instincts

life-long Darwinian fitness

- ⇒ general behavioral strategies
- diffusive emotional control

the motivational problem

organismic cognitive systems - autonomous goal generation

- proprioceptual survival parameters

- ▷ blood pressure, blood sugar level, pain signals, ...
- ▷ 'survival instinct'

hunger, reproduction, ...

- diffusive emotional control - neuromodulators (Dopamine, ..)

neuromodulators: diffusive volume effect

modulator control: thresholds, synaptic plasticities, ...

signaling: novelty, learning, ...

'explore when bored', ...

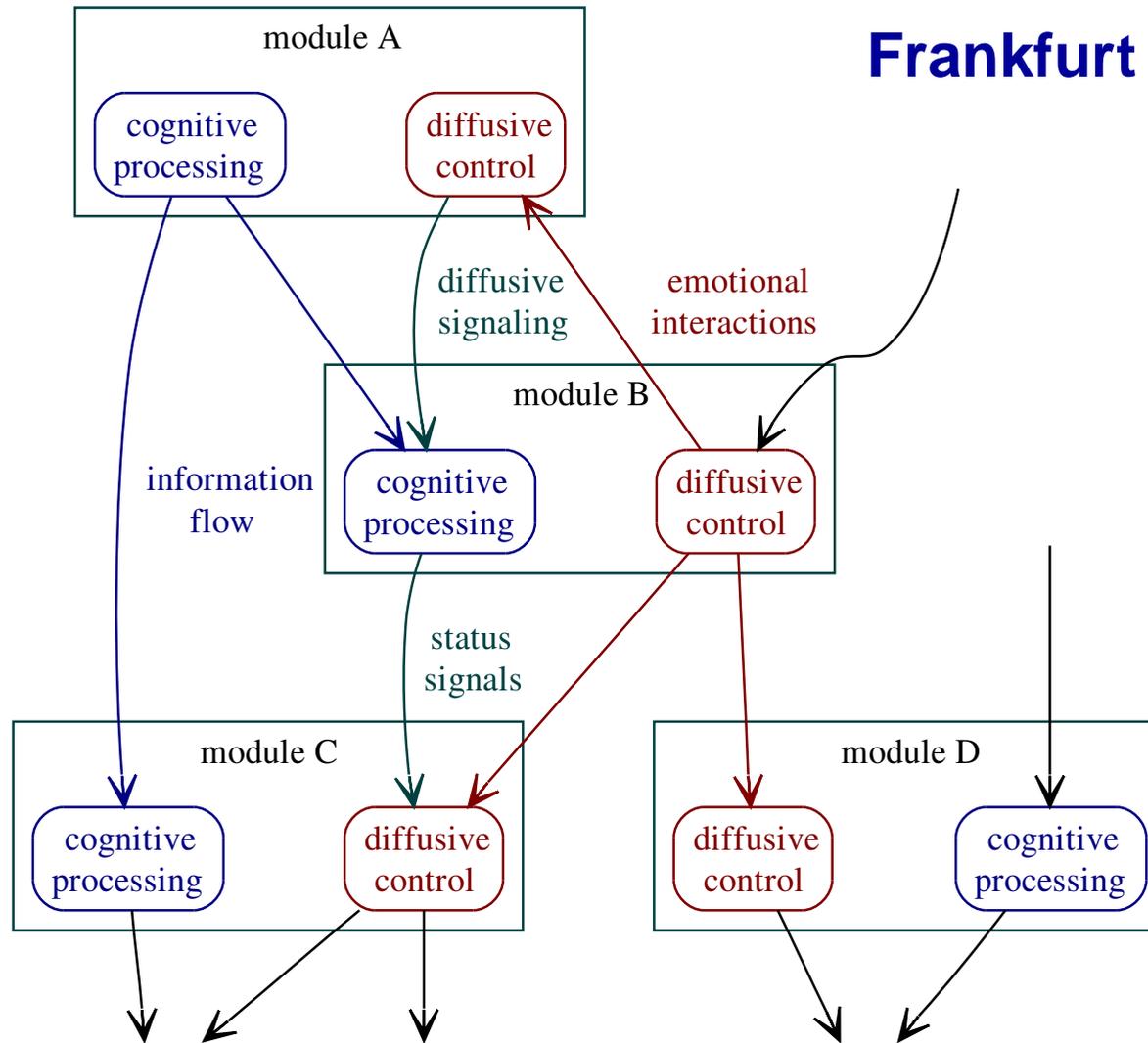
autonomous goal generation

organismic cognitive systems

- short-term survival
 - ▷ instincts
 - ▷ cognitive control (firing rates, ...)
- long-term Darwinian fitness optimization
 - ▷ diffusive emotional control
 - ▷ modulatory control (firing thresholds, ...)

» *a conditio sine qua non* for human-level AI? «

information processing vs. diffusive control



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- ▷ full online architectural configurability
- ▷ learning exclusively
 - : unsupervised
 - : online

current status

- ▷ autonomous dynamics
 - : transient states
 - : stimulus processing
 - : novelty signals

» emergent cognitive capability: ICA «

cognitive computation



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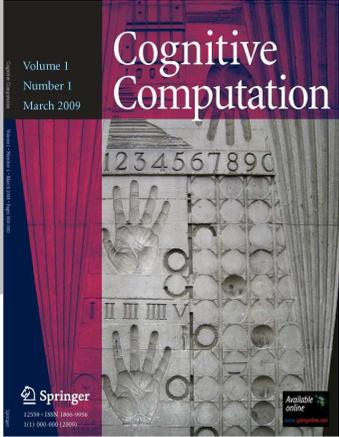
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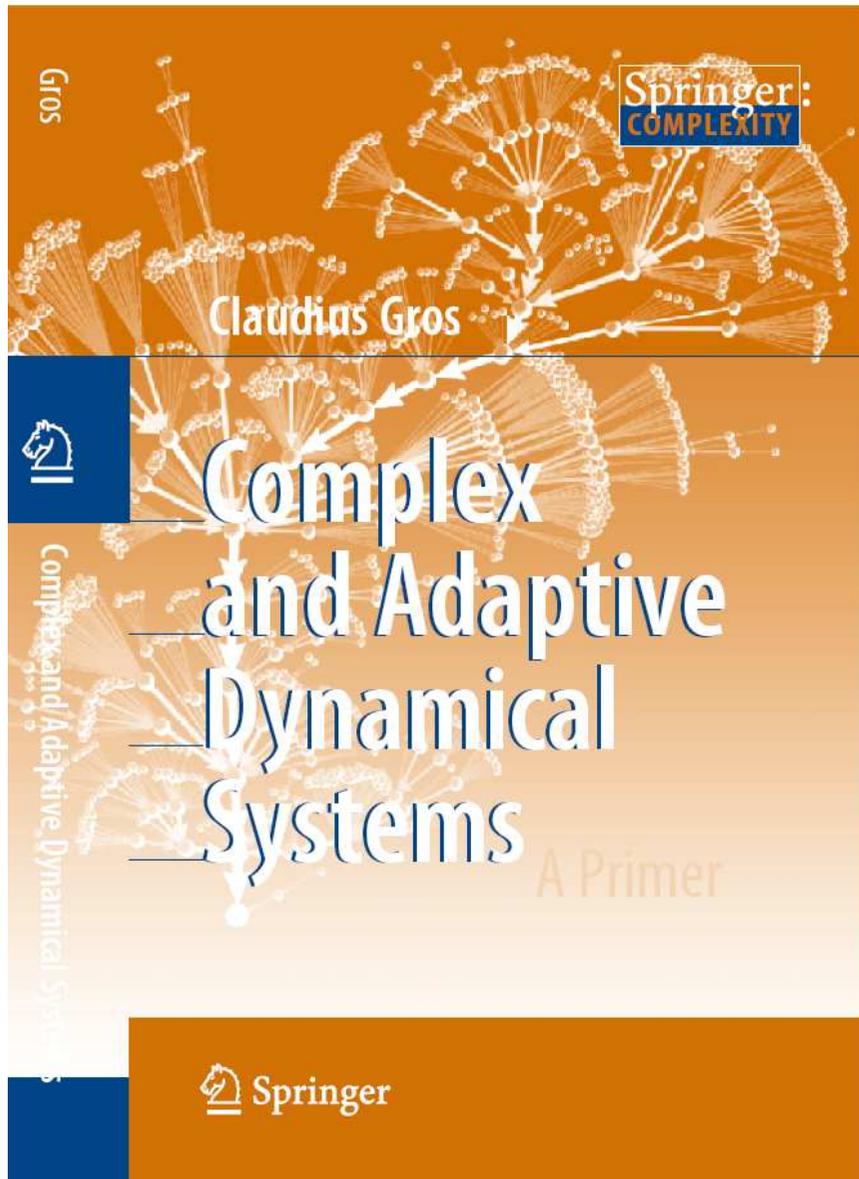
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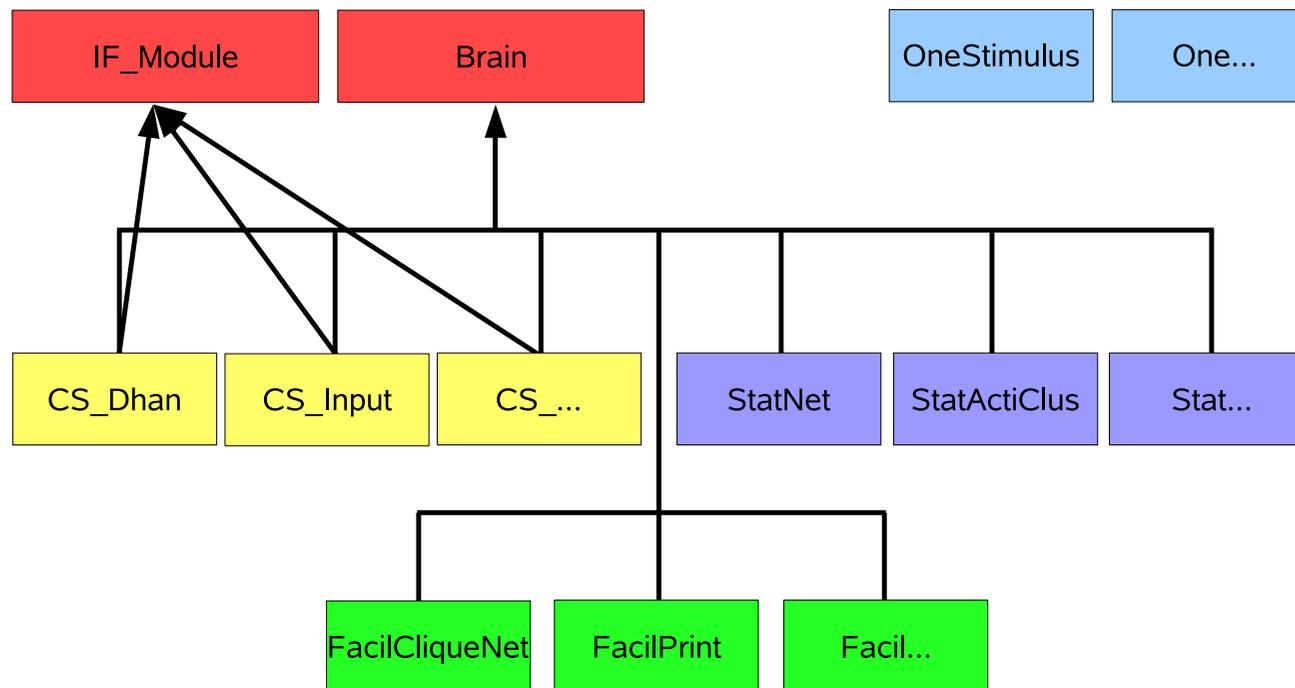
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(Springer, 2008)

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meta network of neural networks

- JAVA platform: class diagram



- flexibility: full on-the-fly architectural reconfiguration
- GUI (graphical user interface): auto adaptive