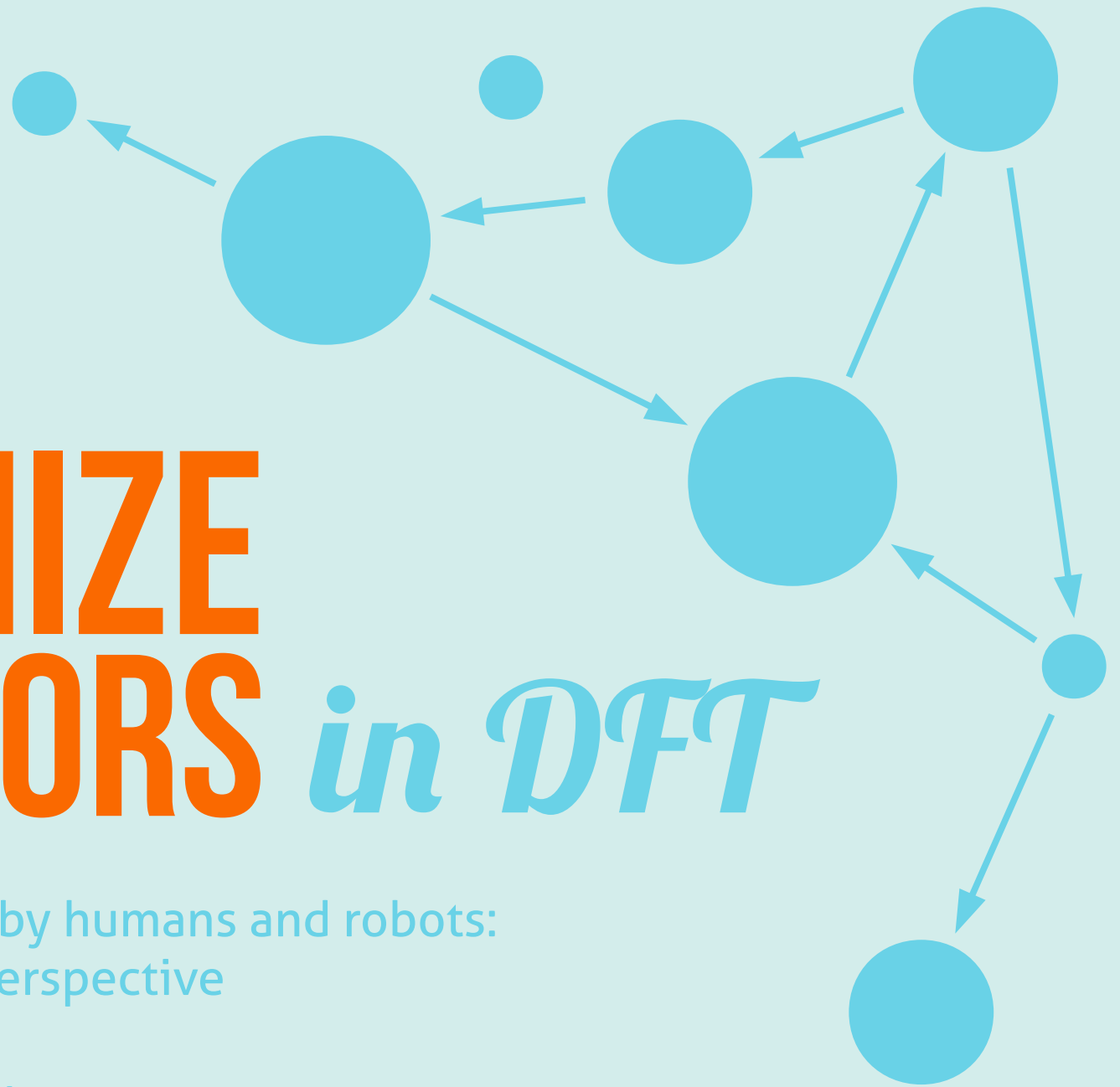


How to **ORGANIZE** **BEHAVIORS** *in DFT*



Movement generation by humans and robots:
a dynamical systems perspective

June 09, 2016

RUB, Bochum, Germany

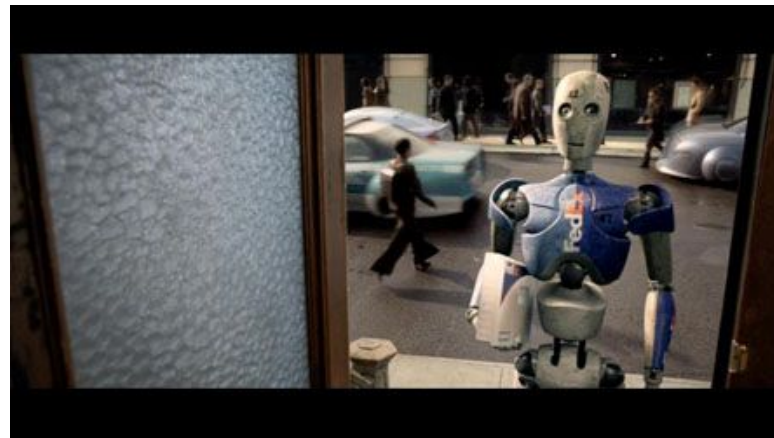
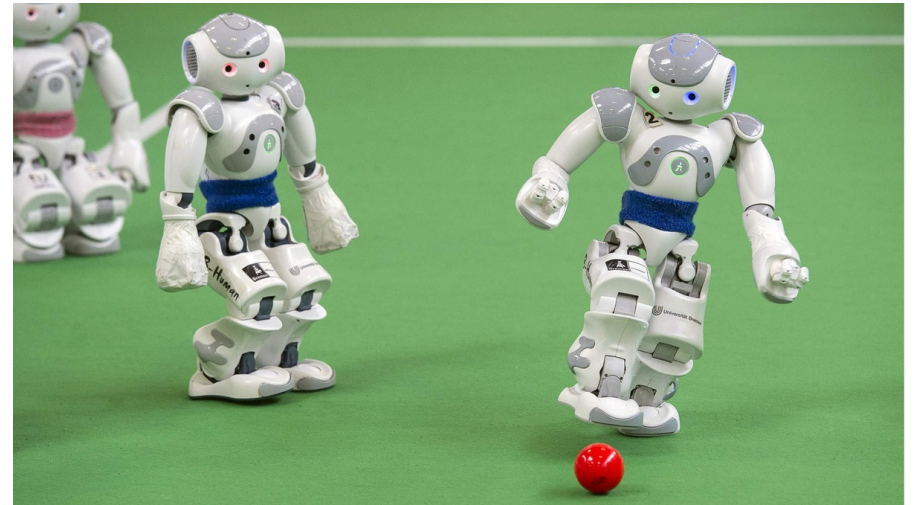
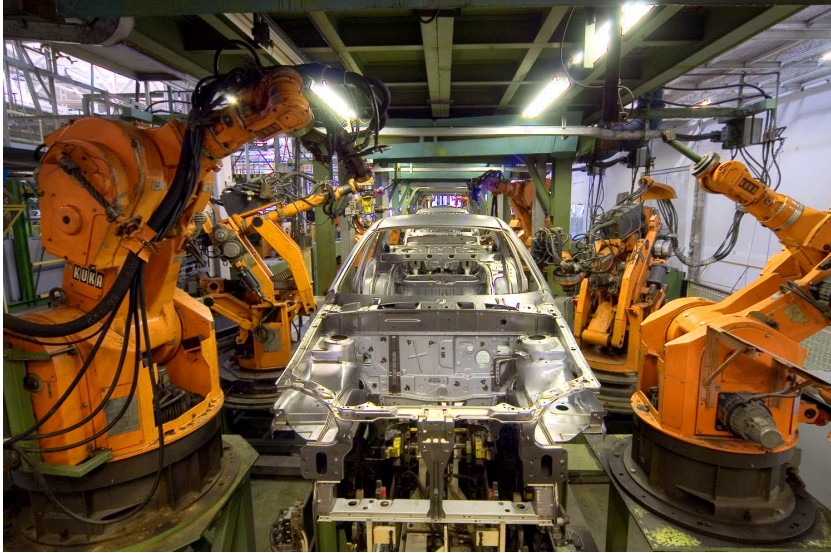
Mathis Richter

SIMULATIONS OF
discrete nodes

ORGANIZING *behaviors*

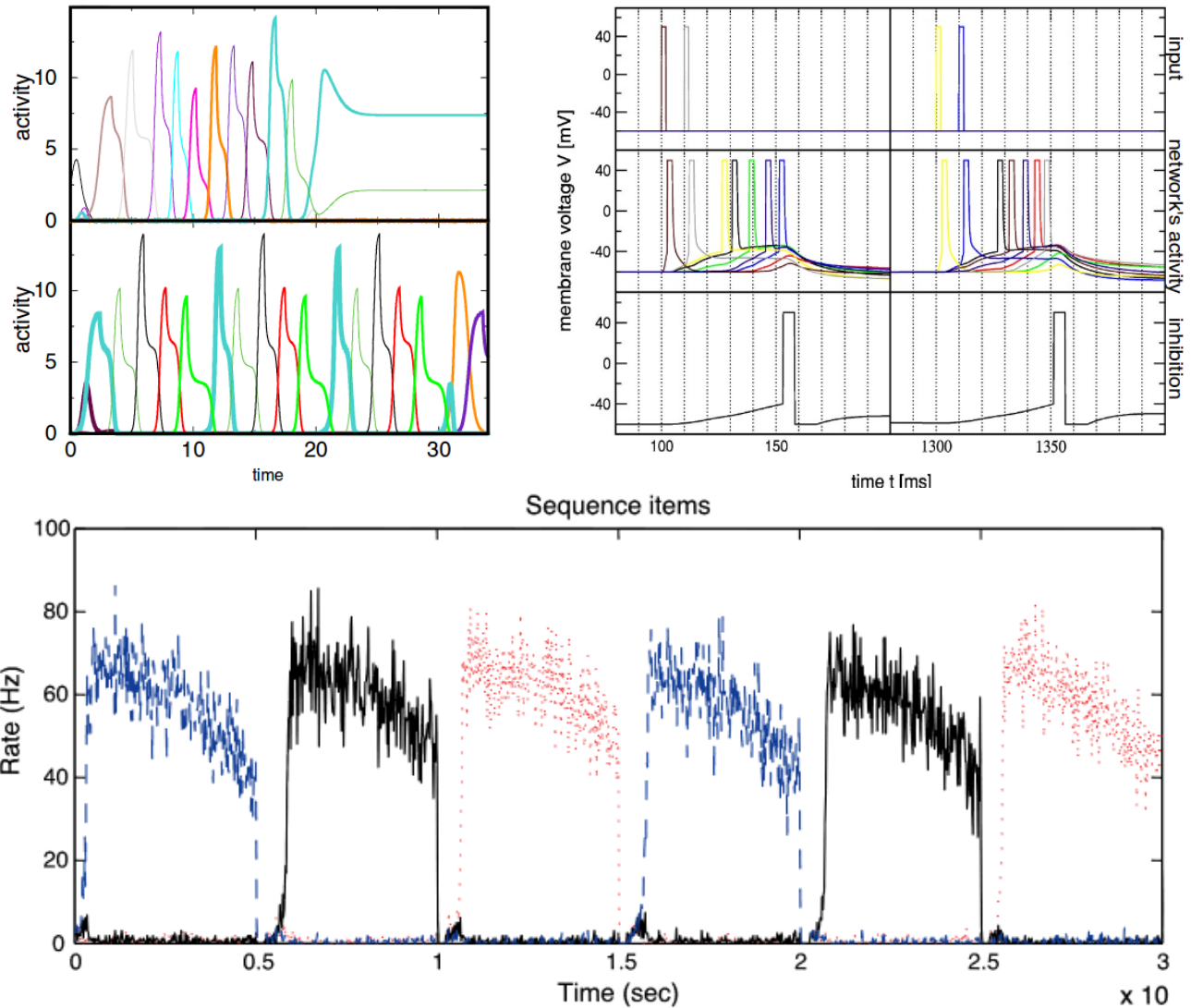


ORGANIZING *behaviors*



TRADITIONAL

sequence generation



IRREGULAR *timing*

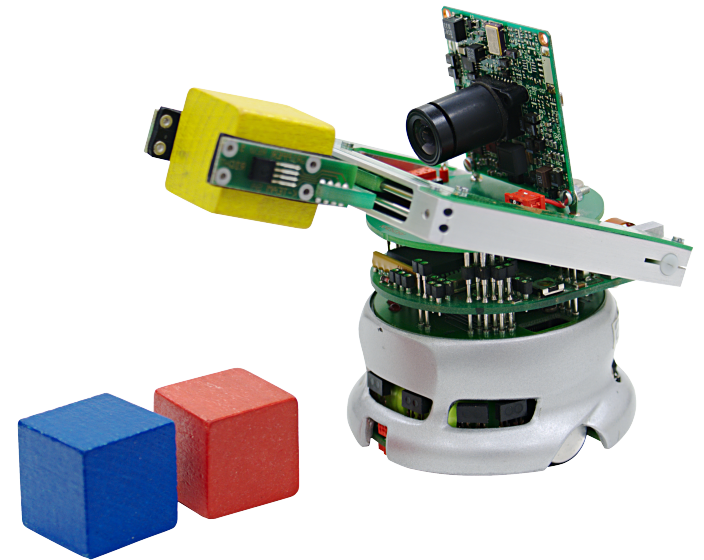


vs



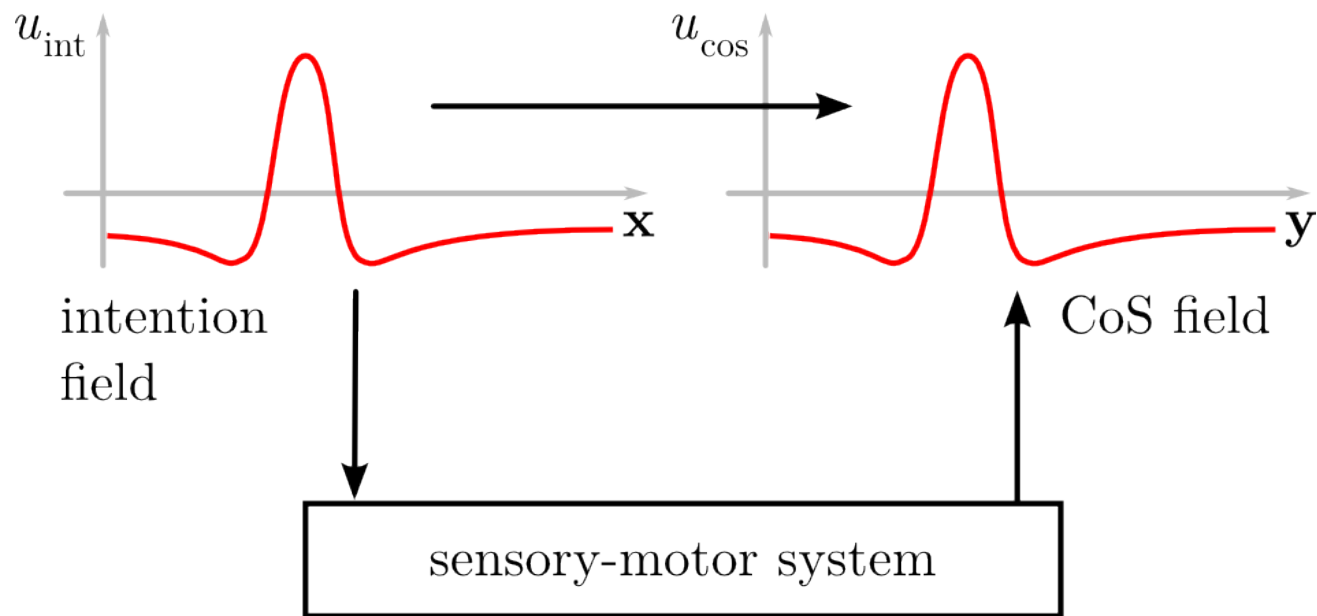
STABILITY

of action representation

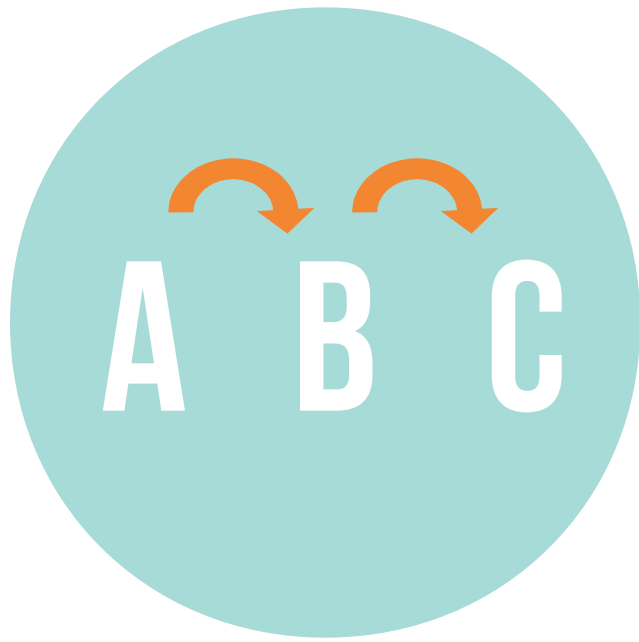


- conflict between stability and sequentiality
- there must be a structure in the (neural) representation of an action

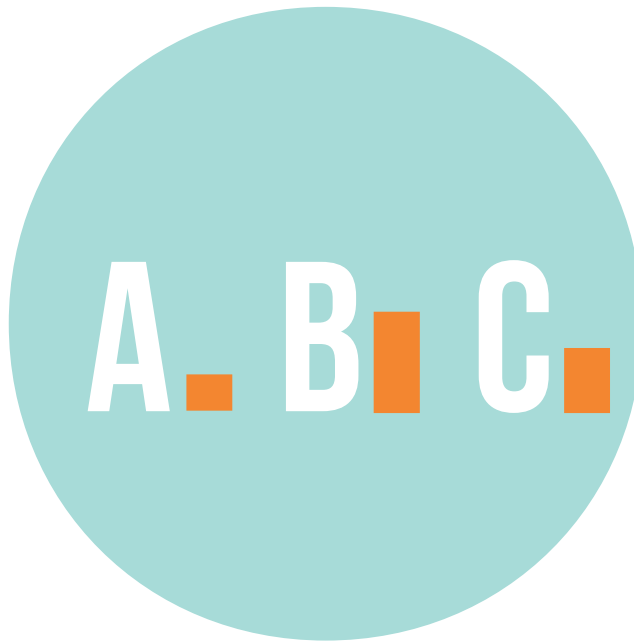
Elementary **BEHAVIOR**



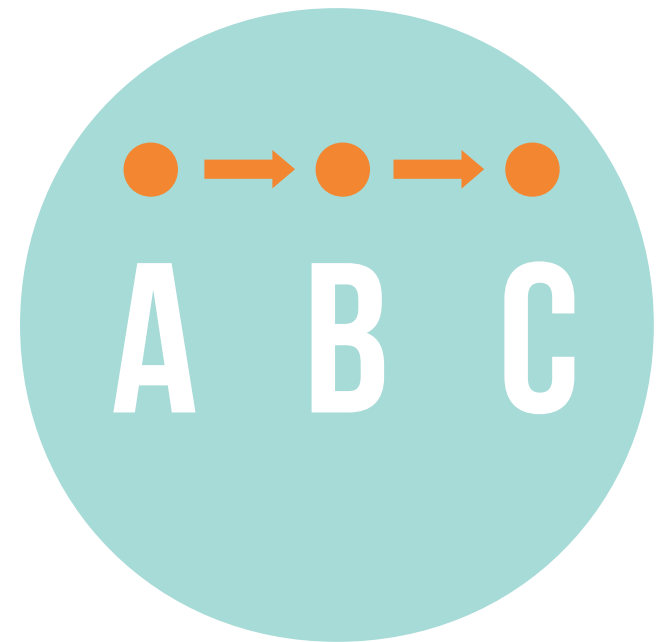
3 COGNITIVE MODELS *of sequences*



chaining



ordinal

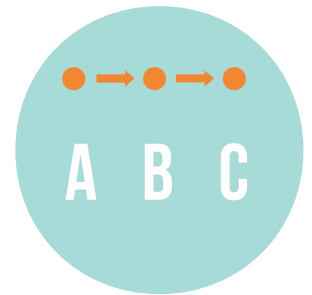


positional

2 TYPES *of organization*

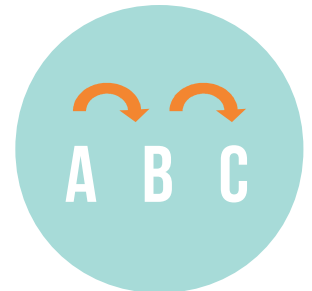
1

Serial order



2

Behavioral organization

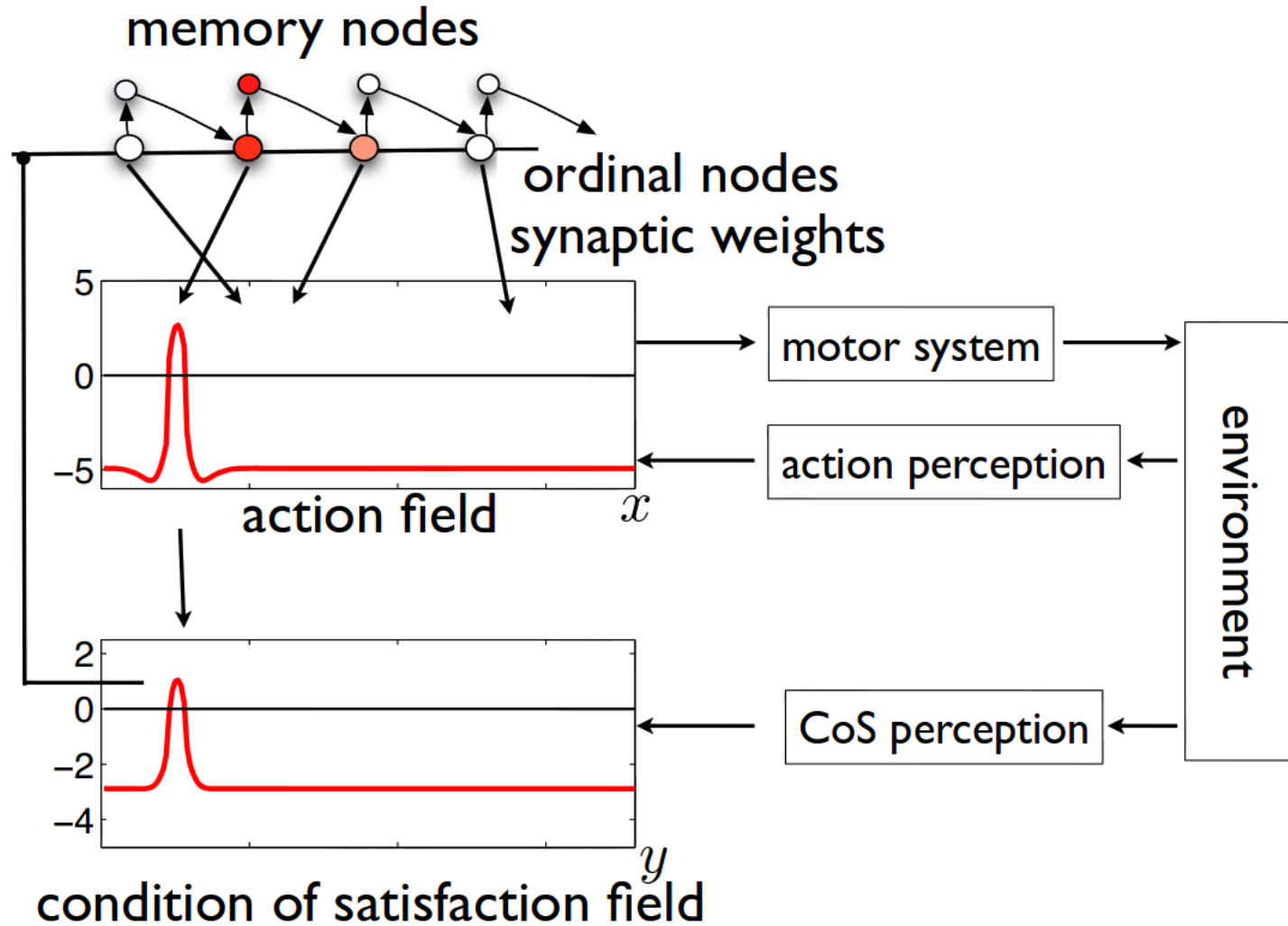


1 SERIAL ORDER

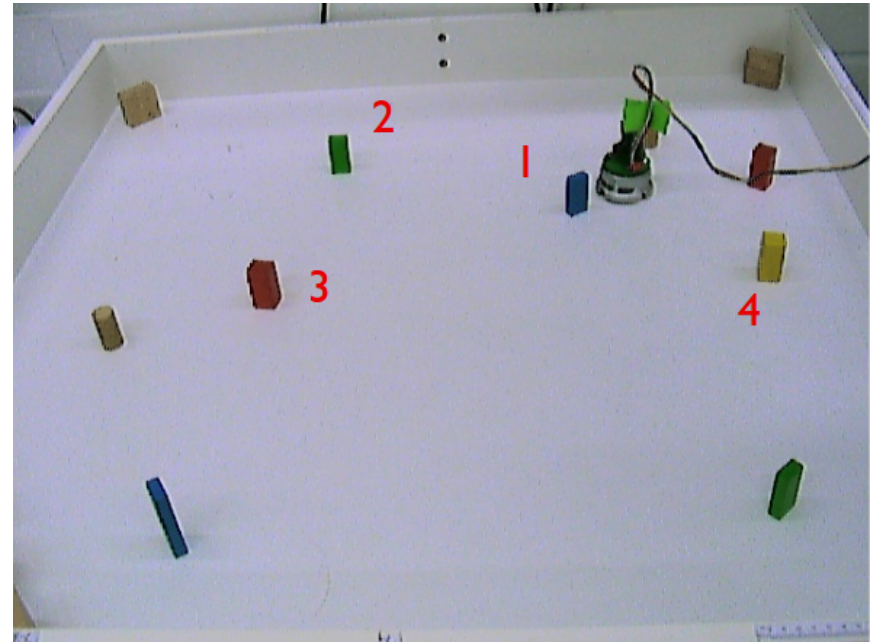
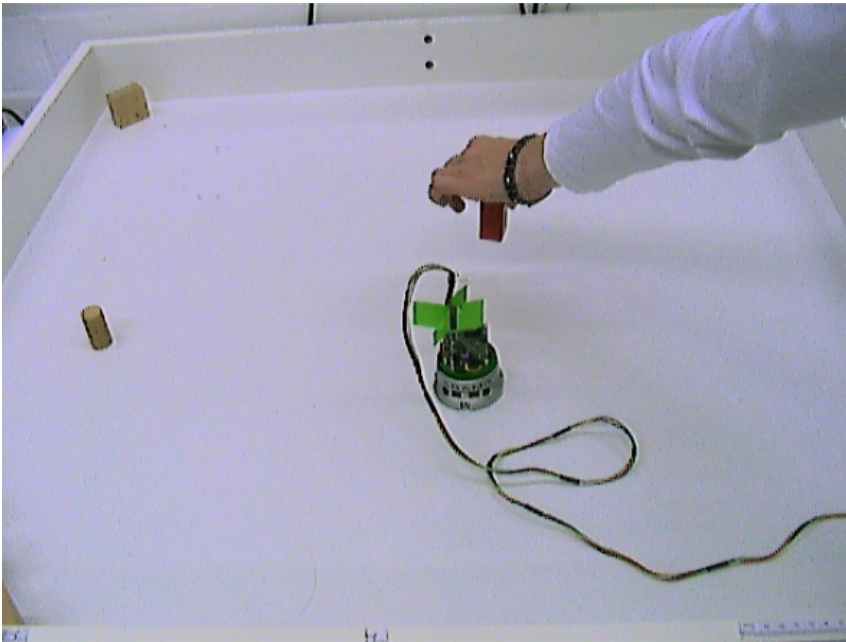
arbitrary sequences



SERIAL ORDER *architecture*



a ROBOTIC example

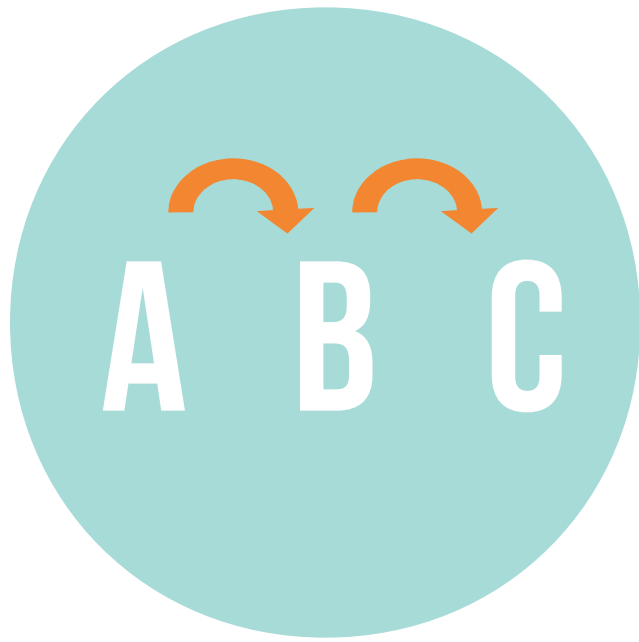


2 BEHAVIORAL ORGANIZATION

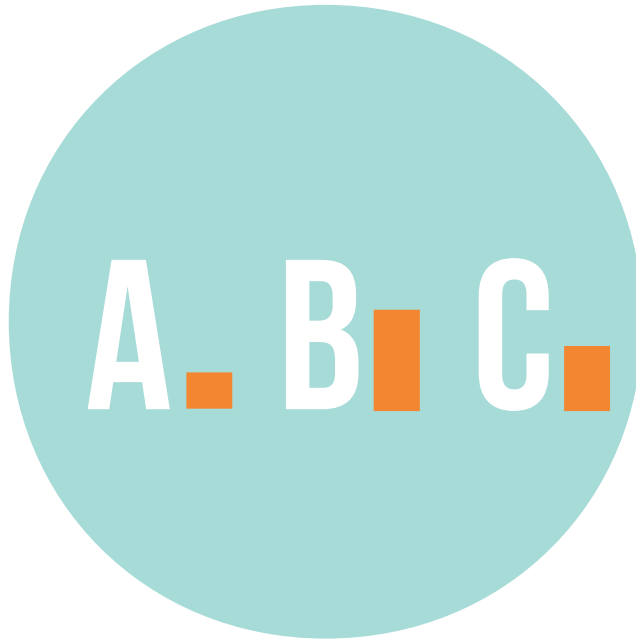
flexibility



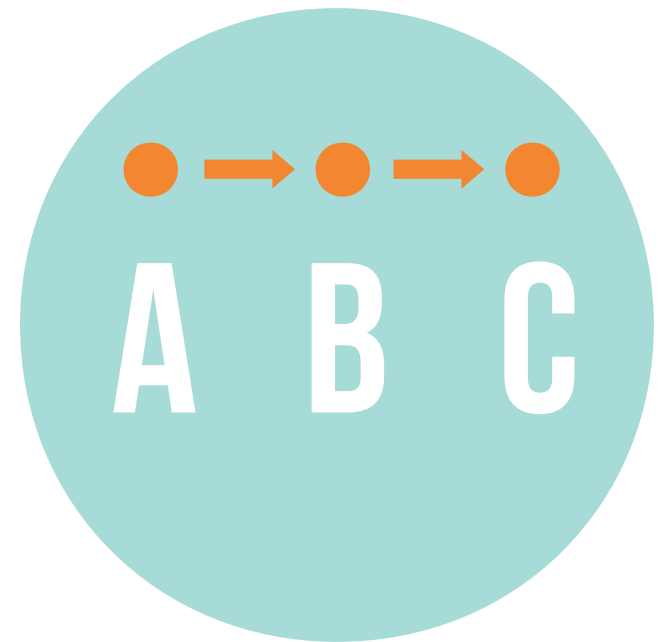
3 COGNITIVE MODELS *of sequences*



chaining

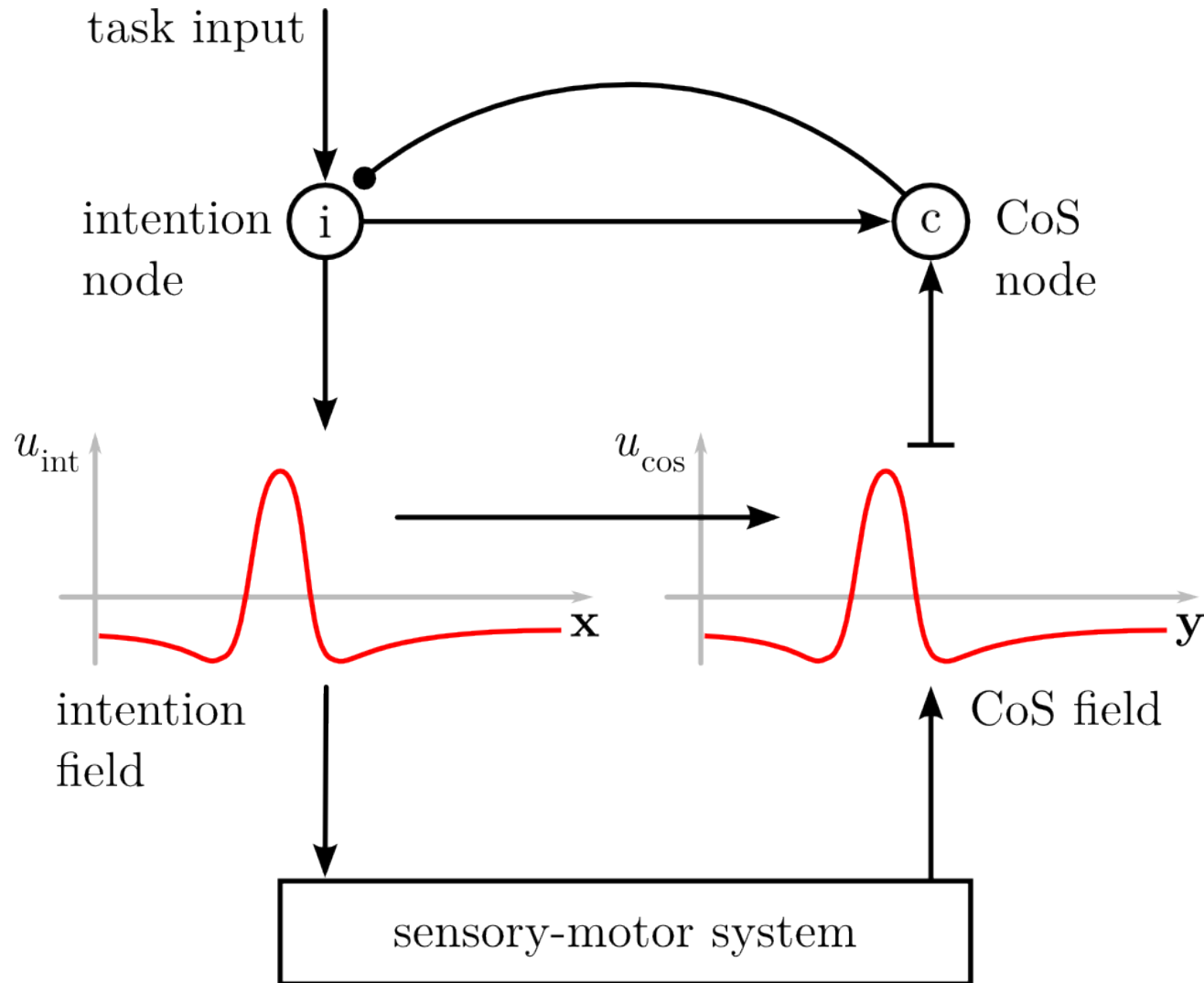


ordinal

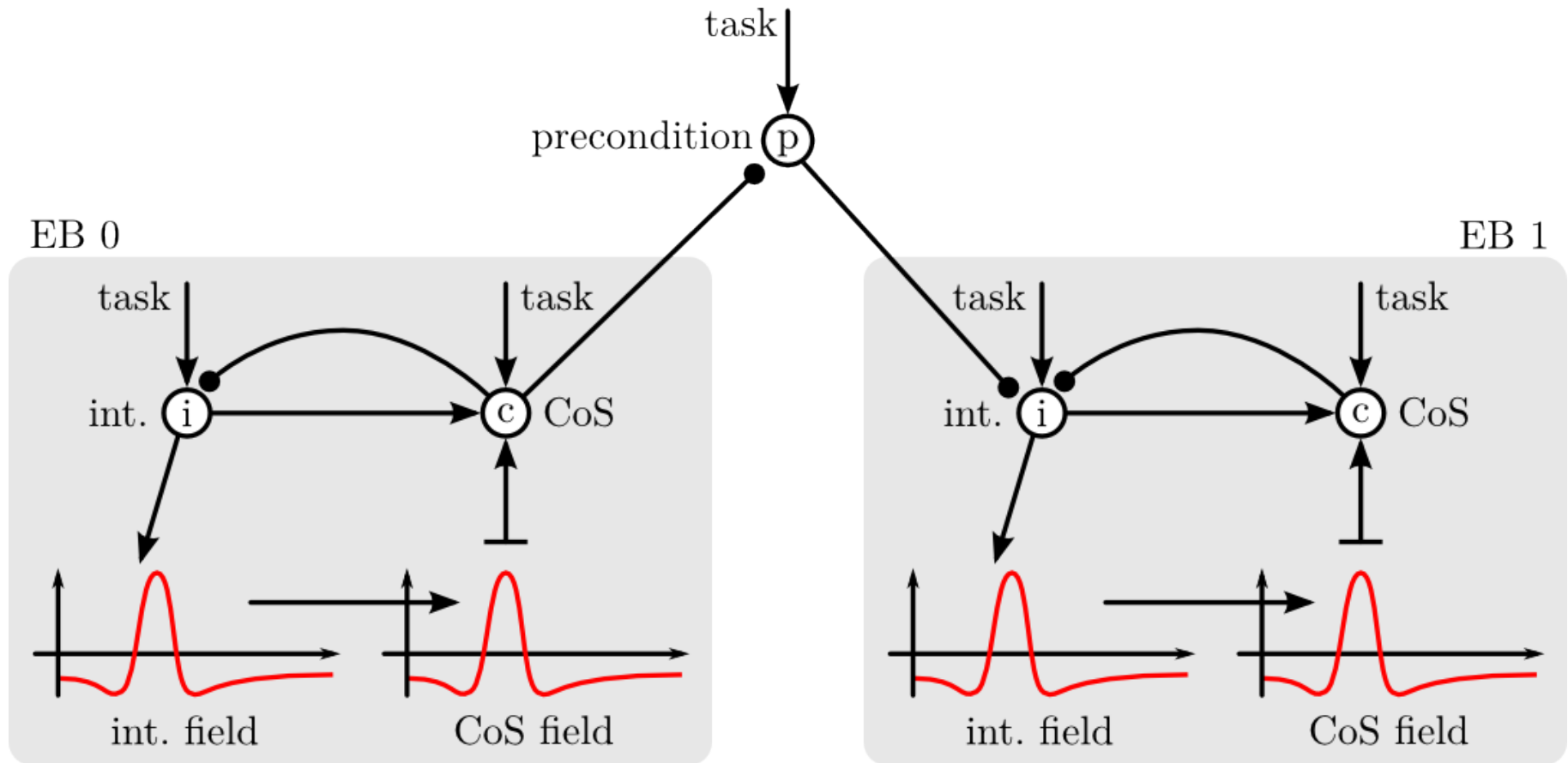


positional

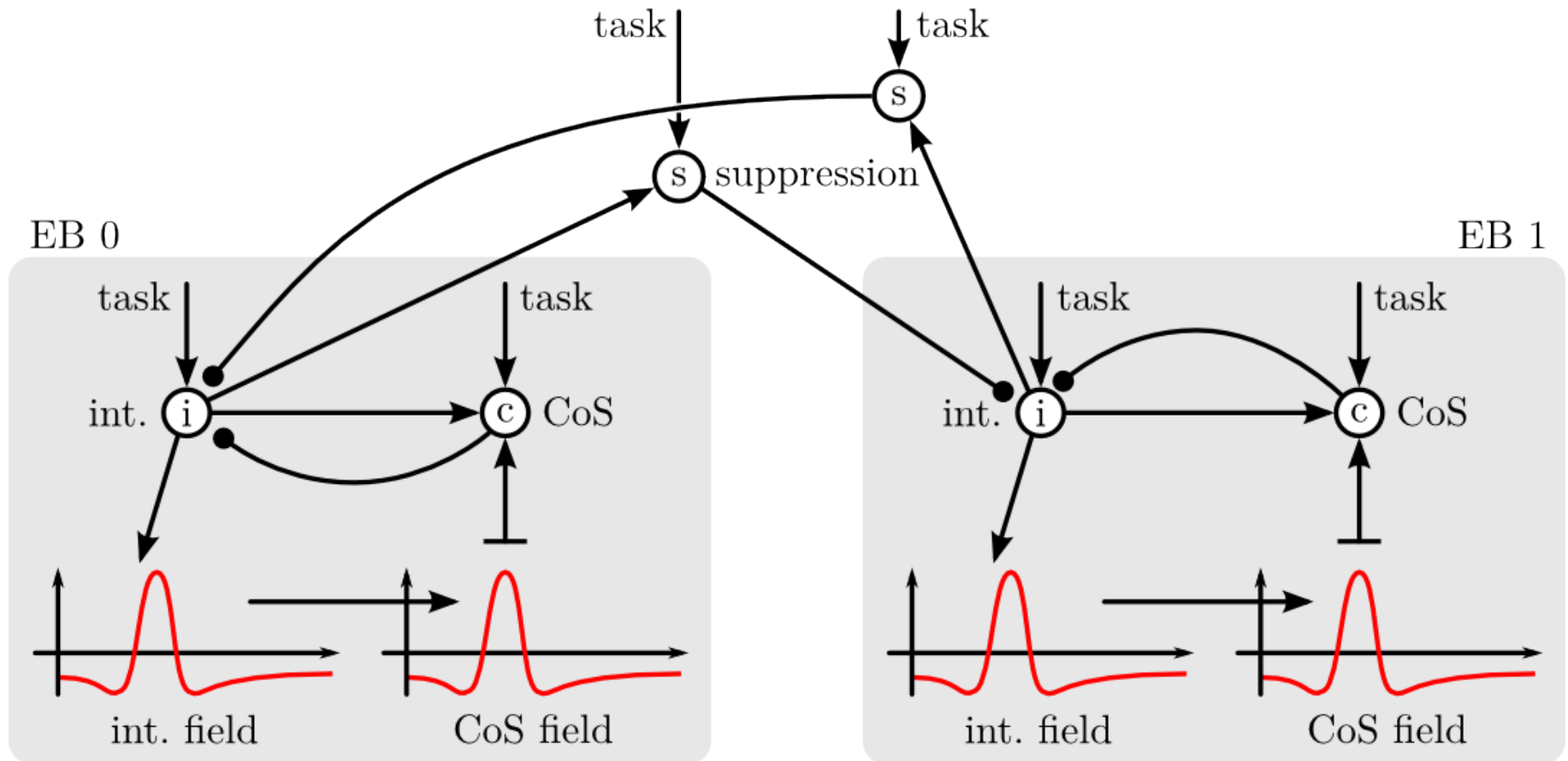
Elementary **BEHAVIOR**



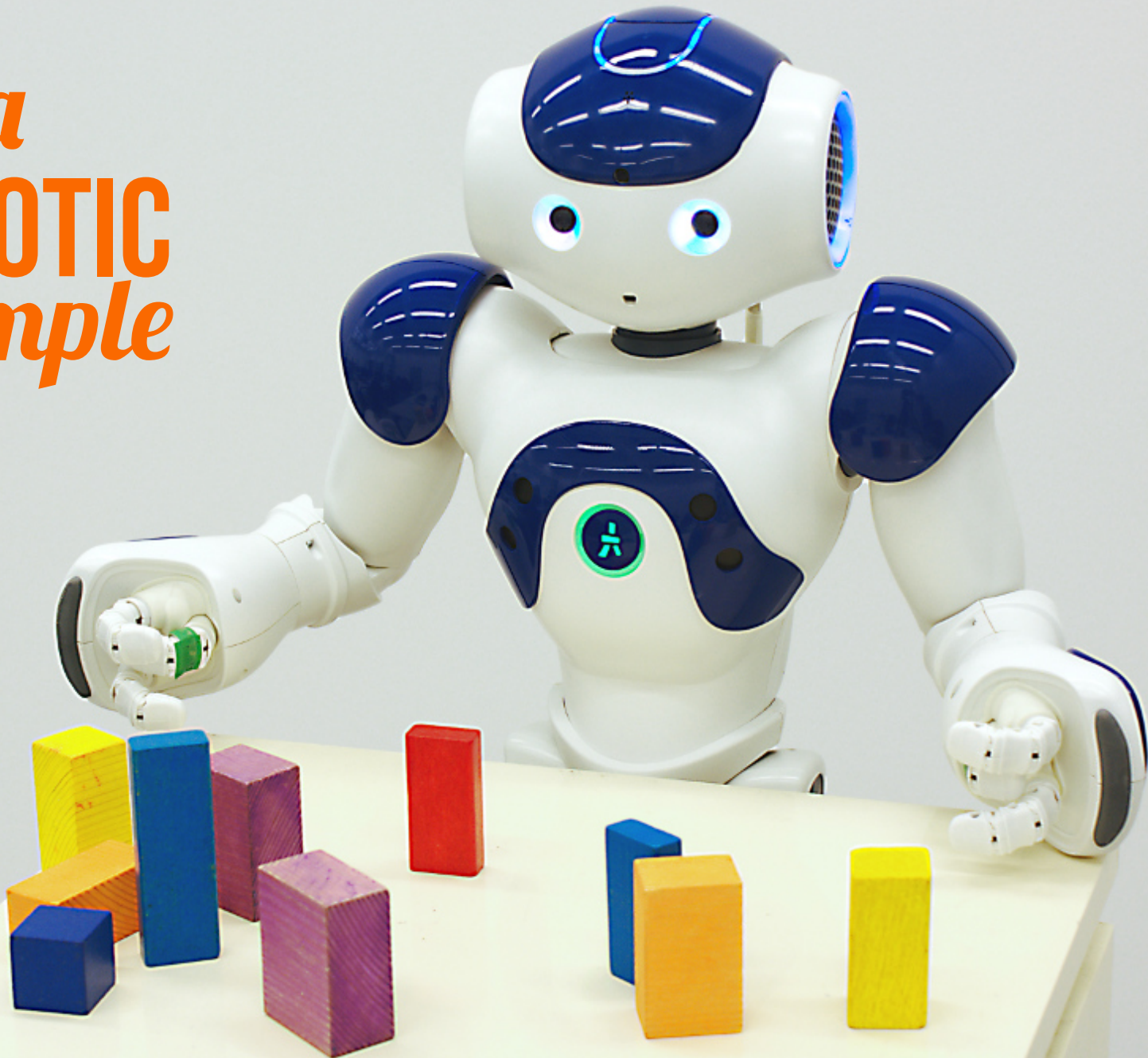
PRECONDITION *constraint*



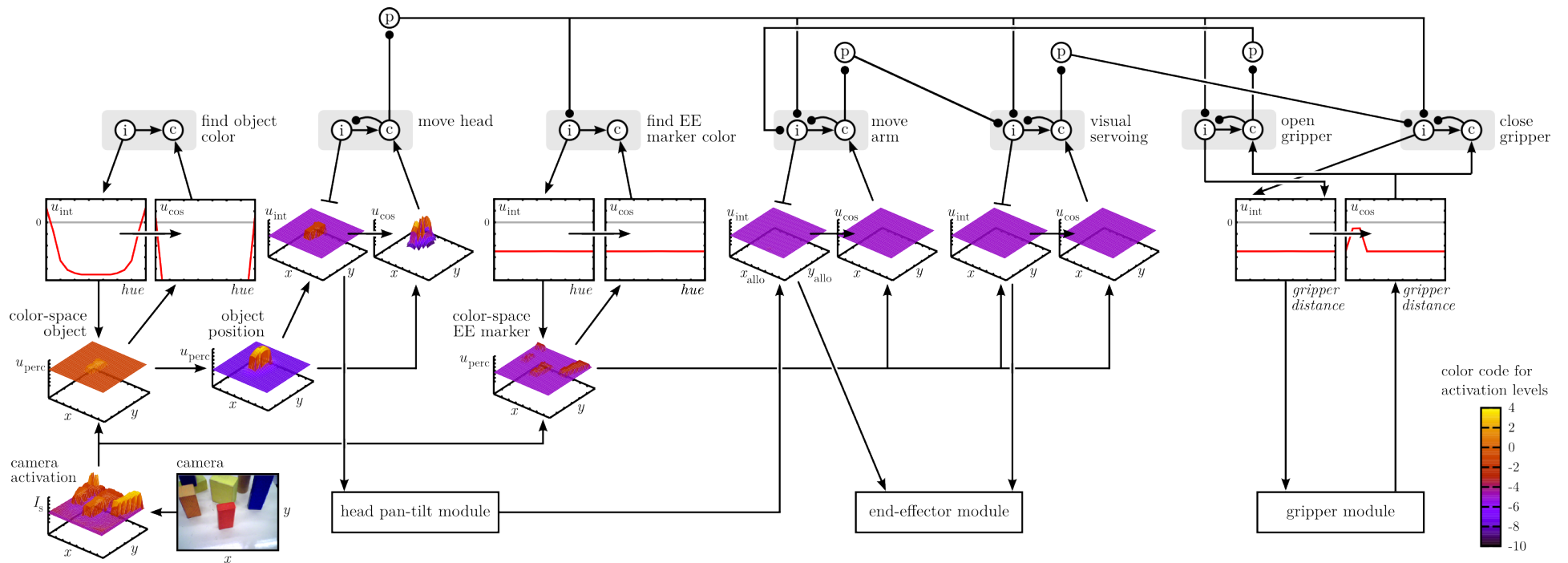
COMPETITION *constraint*

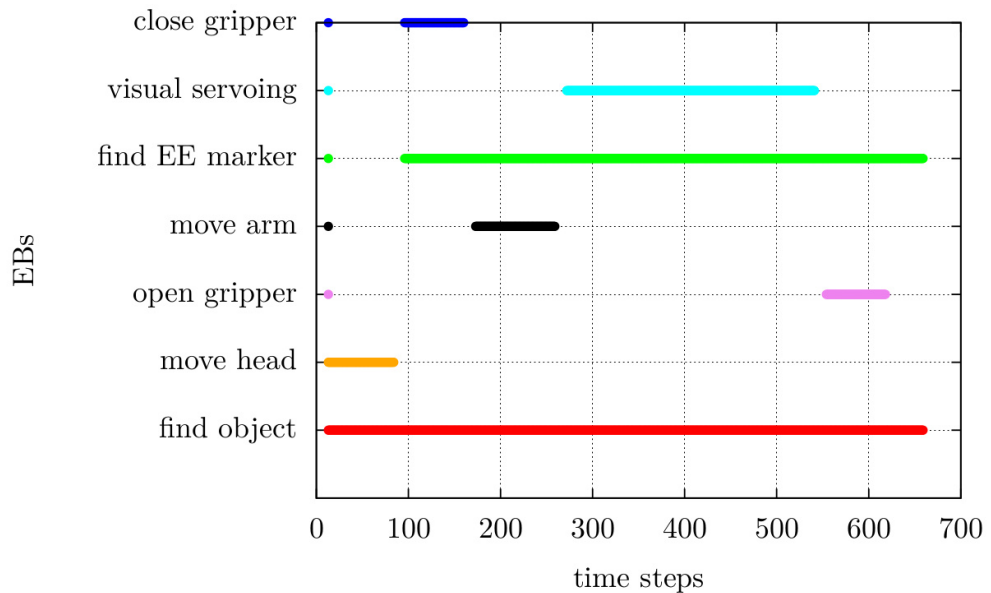
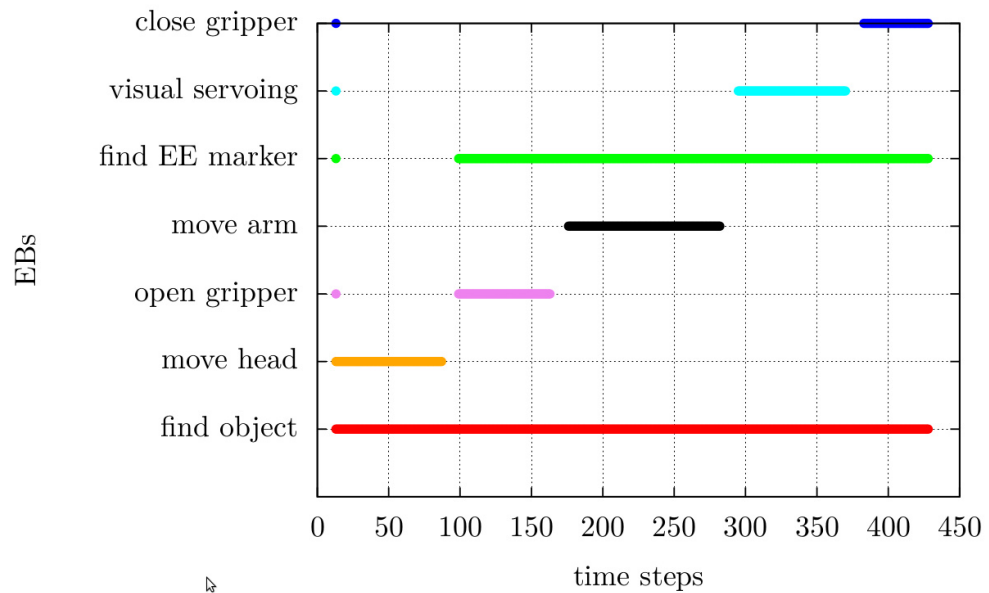


a
ROBOTIC
example



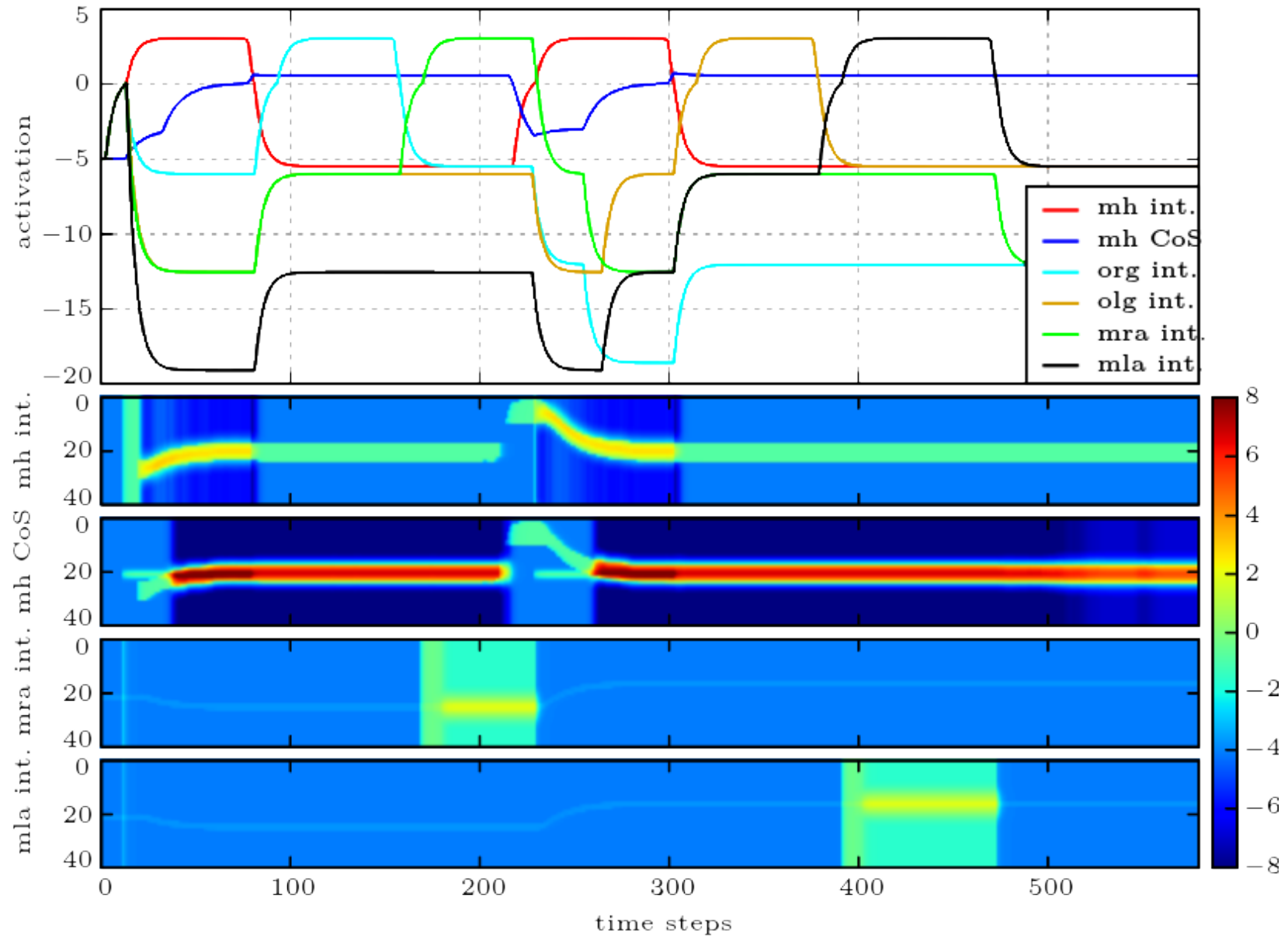
(almost) the whole ARCHITECTURE



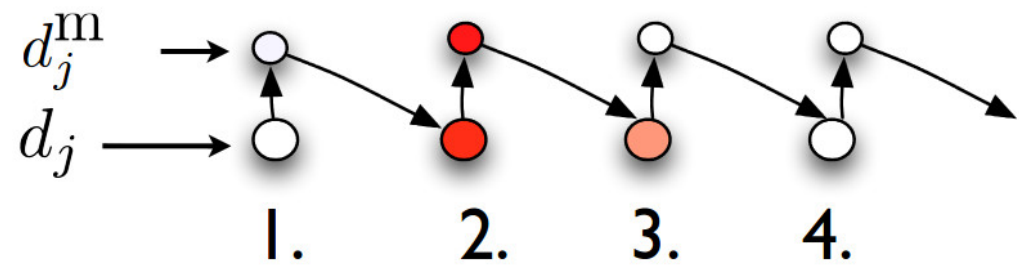


GRASPING *and* POINTING

ACTIVATION *over time*



Serial order EQUATIONS



$$\begin{aligned} \tau \dot{d}_i(t) = & -d_i(t) + h_d + c_0 f(d_i(t)) \\ & - c_1 \sum_{i' \neq i} f(d_{i'}(t)) + c_2 f(d_{i-1}^m(t)) \\ & - c_3 f(d_i^m(t)) - I_C(t) \end{aligned}$$

$$\begin{aligned} \tau \dot{d}_i^m(t) = & -d_i^m(t) + h_m + c_4 f(d_i^m(t)) \\ & - c_5 \sum_{i' \neq i} f(d_{i'}(t)) + c_6 f(d_i(t)) \end{aligned}$$

CREDITS



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