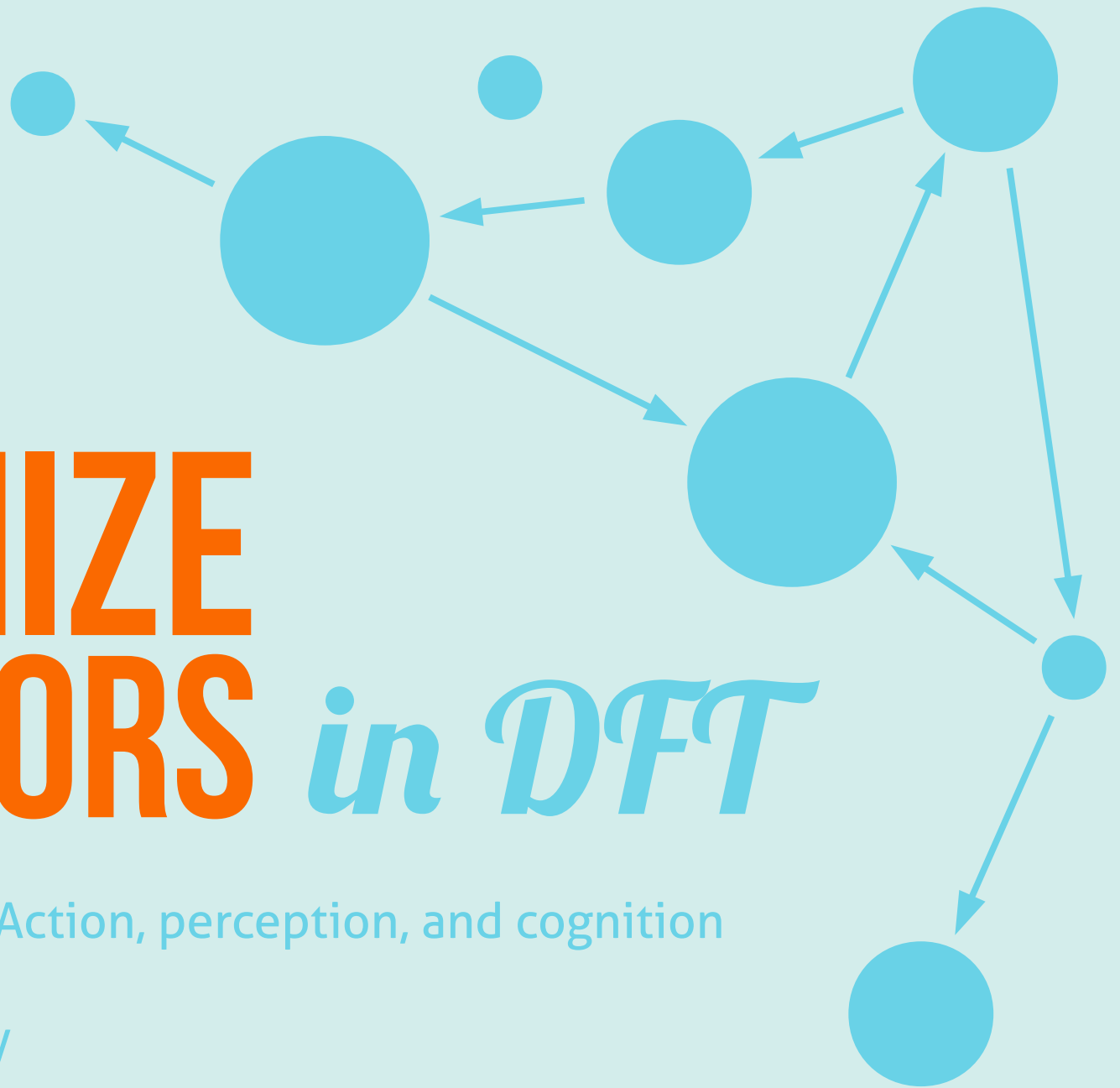


# *How to* **ORGANIZE** **BEHAVIORS** *in DFT*

Autonomous robotics: Action, perception, and cognition  
June 18, 2015  
RUB, Bochum, Germany

Mathis Richter

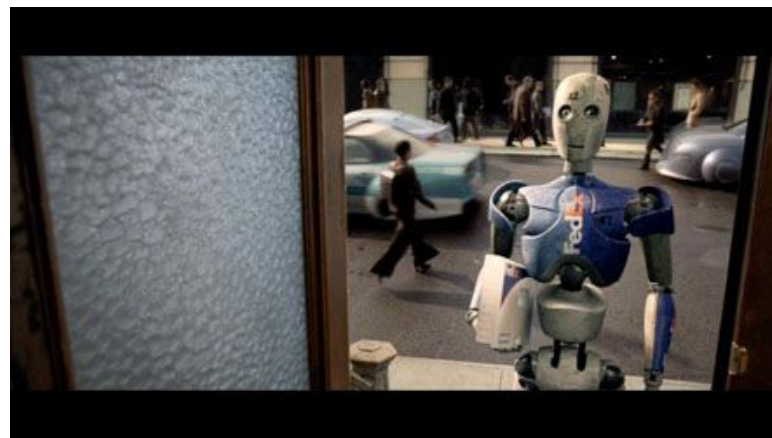
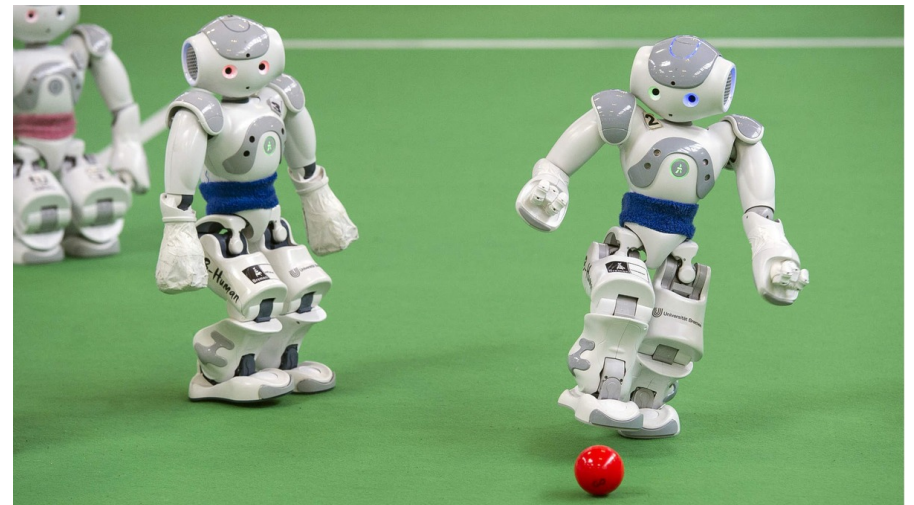
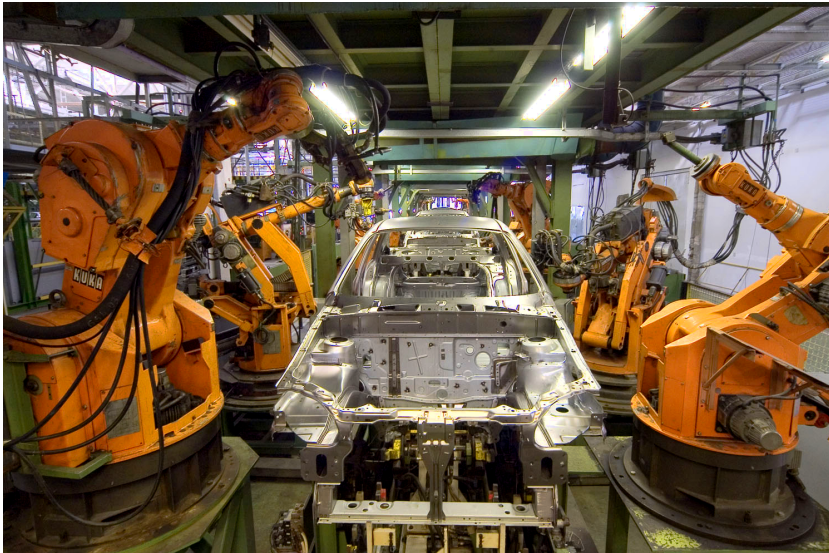


# **SIMULATIONS OF** *discrete nodes*

# ORGANIZING *behaviors*



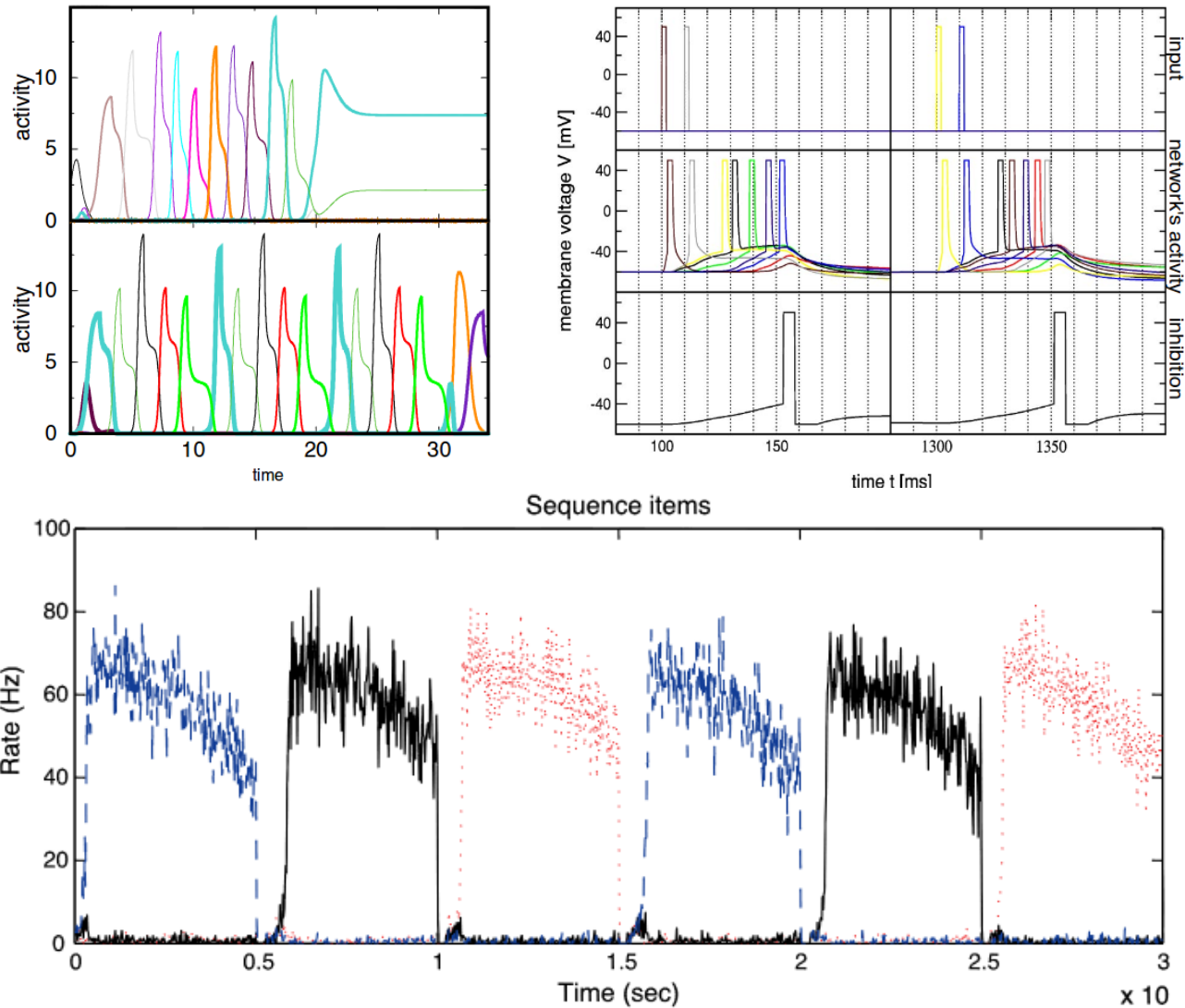
# ORGANIZING *behaviors*





# TRADITIONAL

## *sequence generation*



# IRREGULAR *timing*

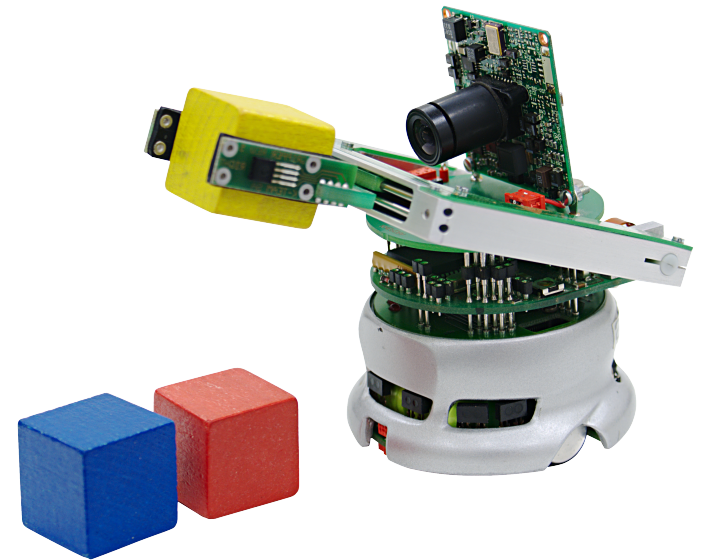


*vs*



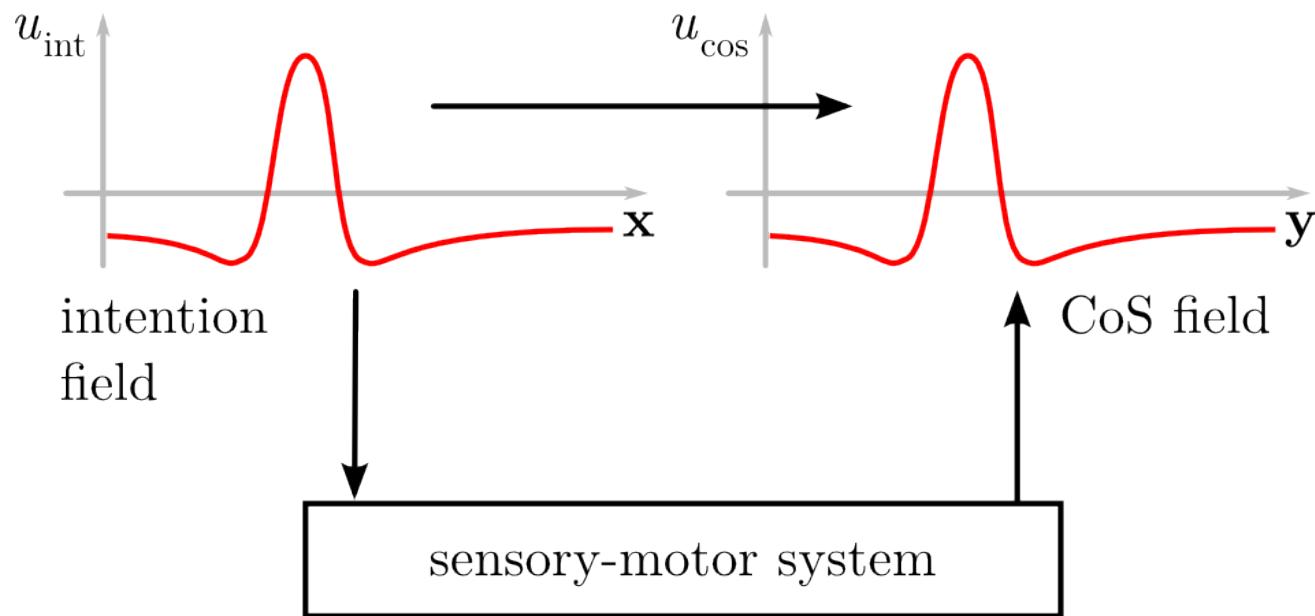
# STABILITY

*of action representation*

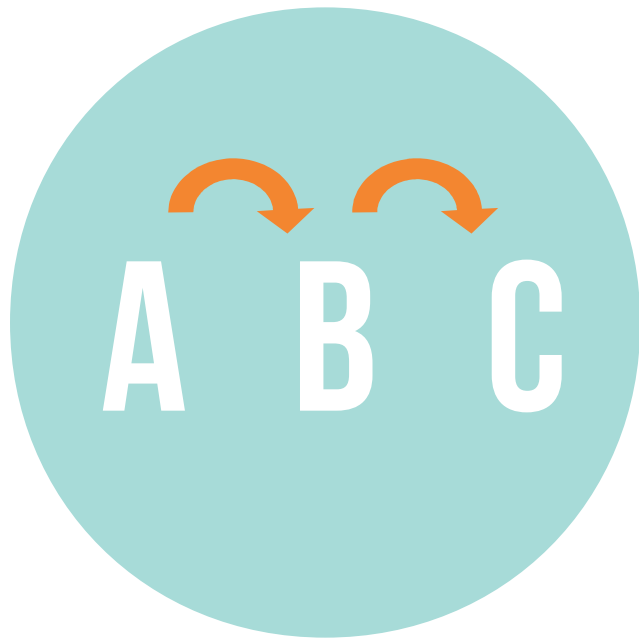


- conflict between stability and sequentiality
- there must be a structure in the (neural) representation of an action

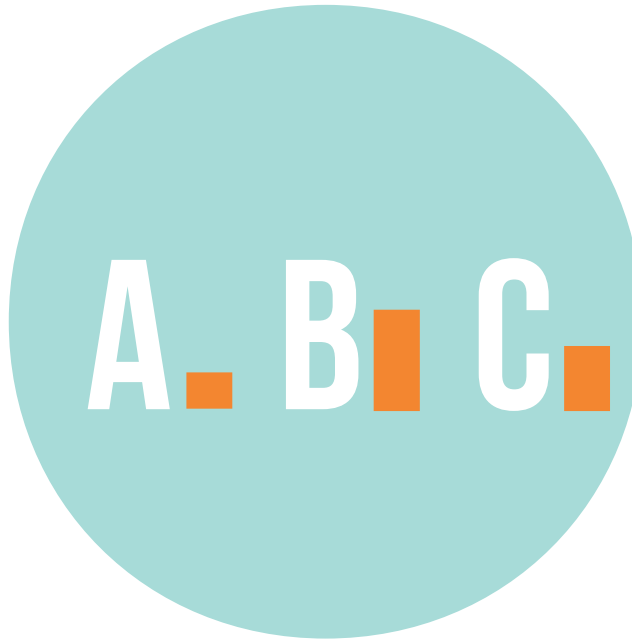
# *Elementary* **BEHAVIOR**



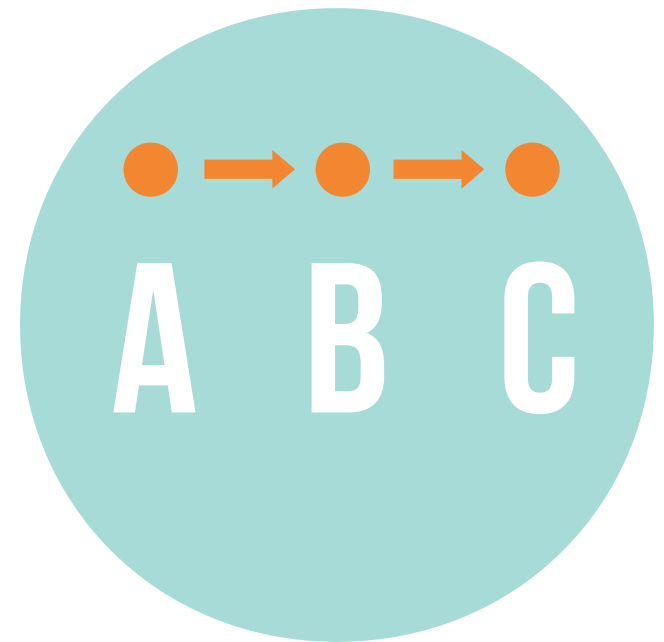
# 3 COGNITIVE MODELS *of sequences*



*chaining*



*ordinal*



*positional*



# 3 TYPES

*of organization*

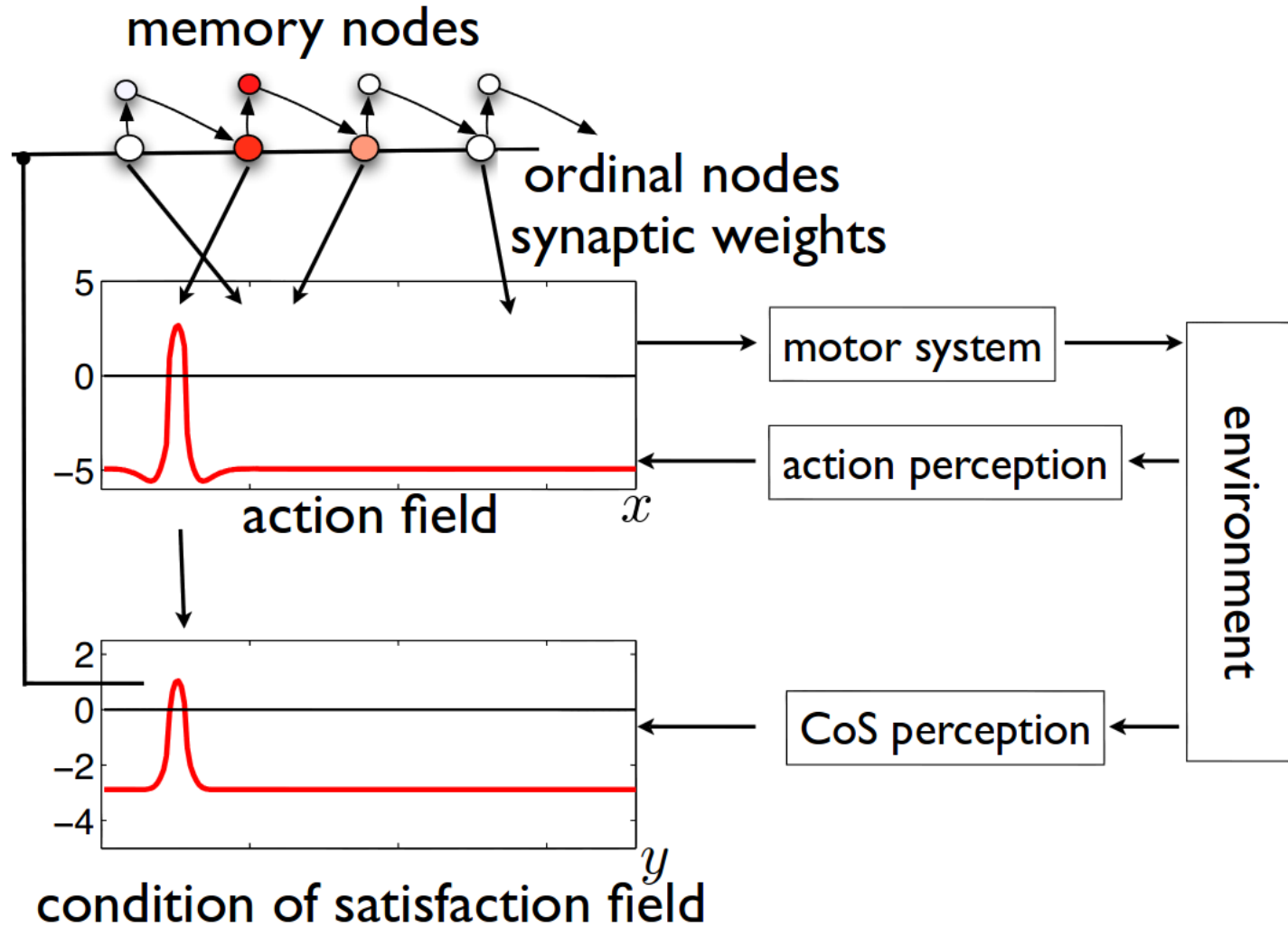
- 1 Serial order
- 2 Behavioral organization
- 3 Goal-oriented sequences

# 1 SERIAL ORDER

*arbitrary sequences*

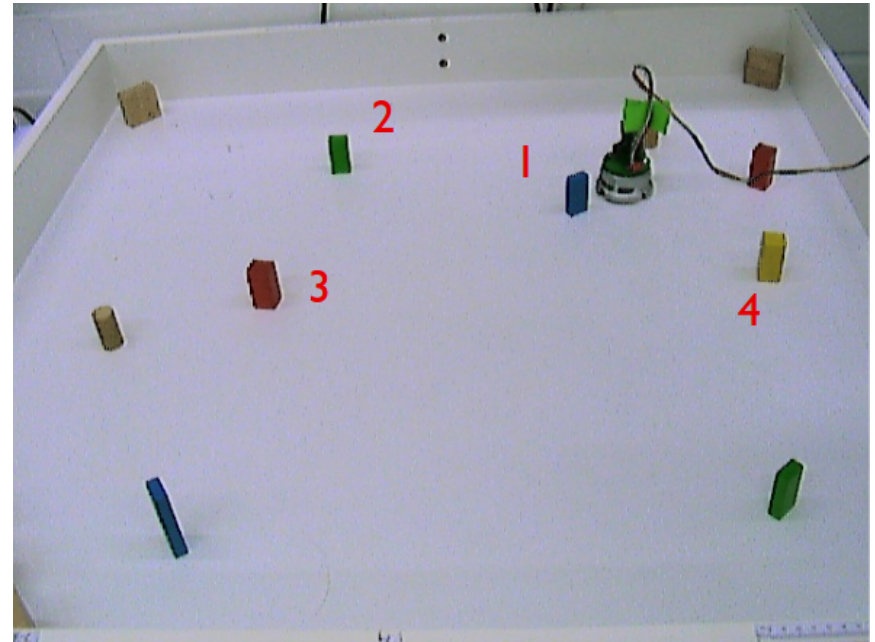
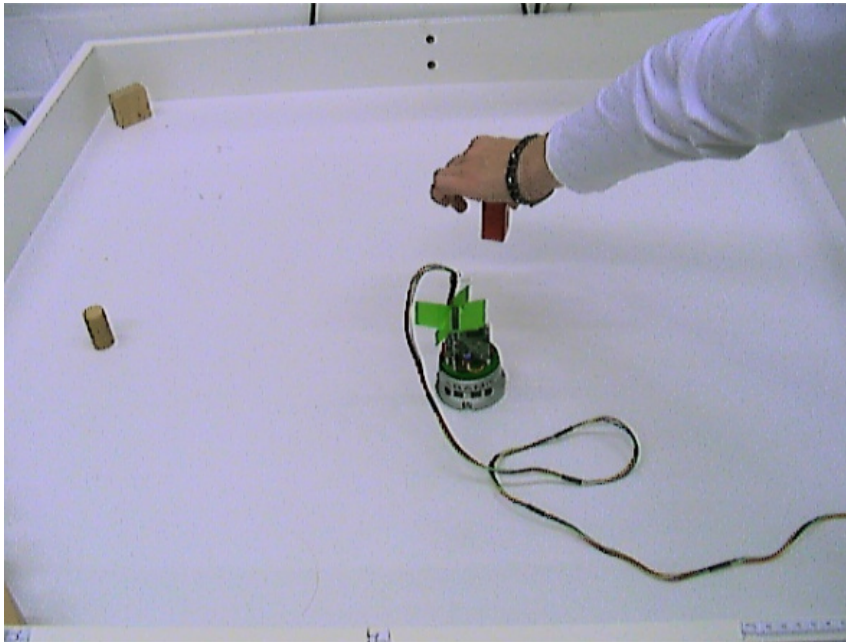


# SERIAL ORDER *architecture*





# *a ROBOTIC example*





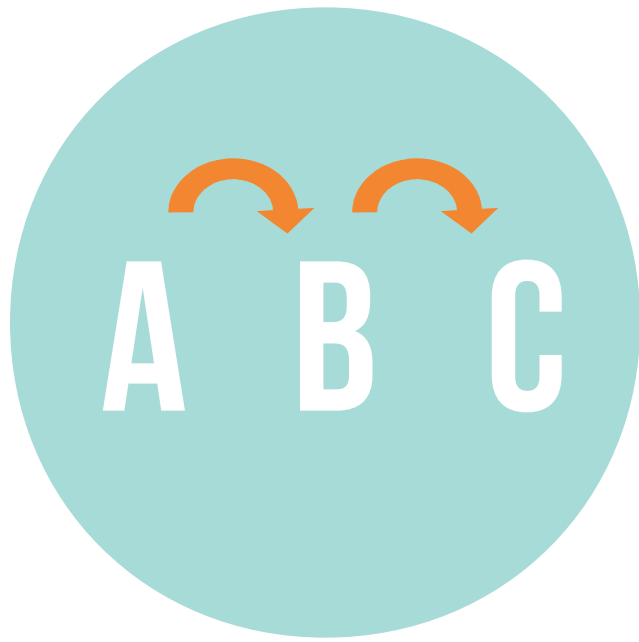
# 2 BEHAVIORAL ORGANIZATION

*flexibility*

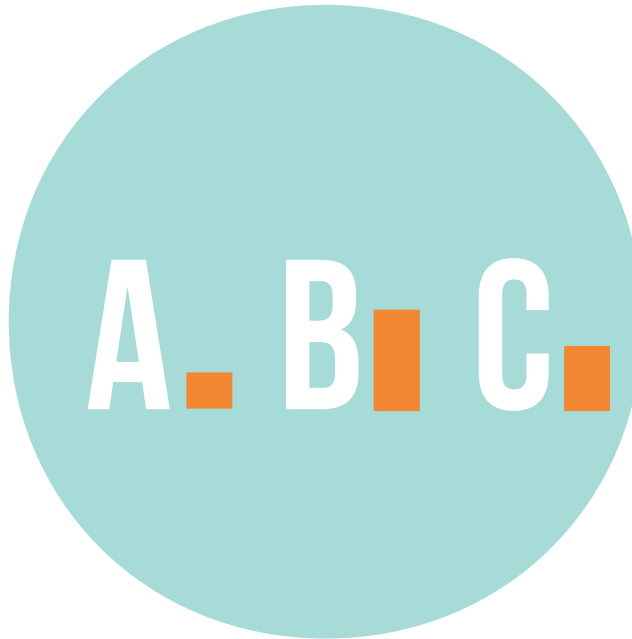




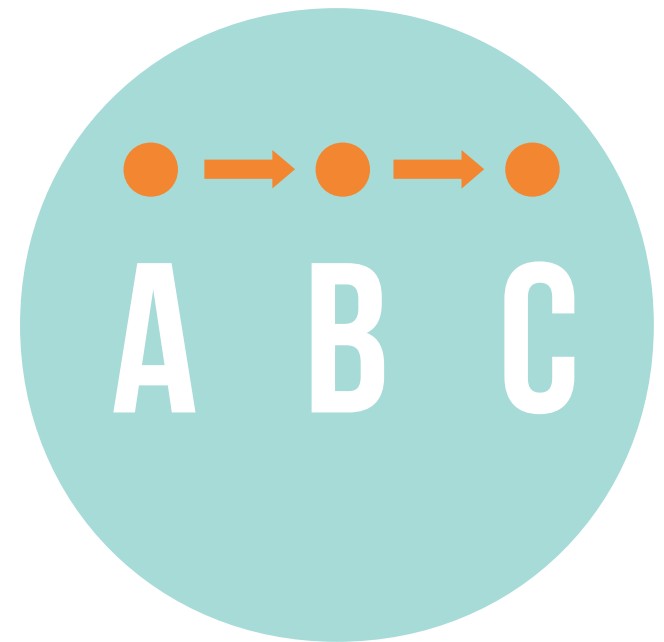
# 3 COGNITIVE MODELS *of sequences*



*chaining*

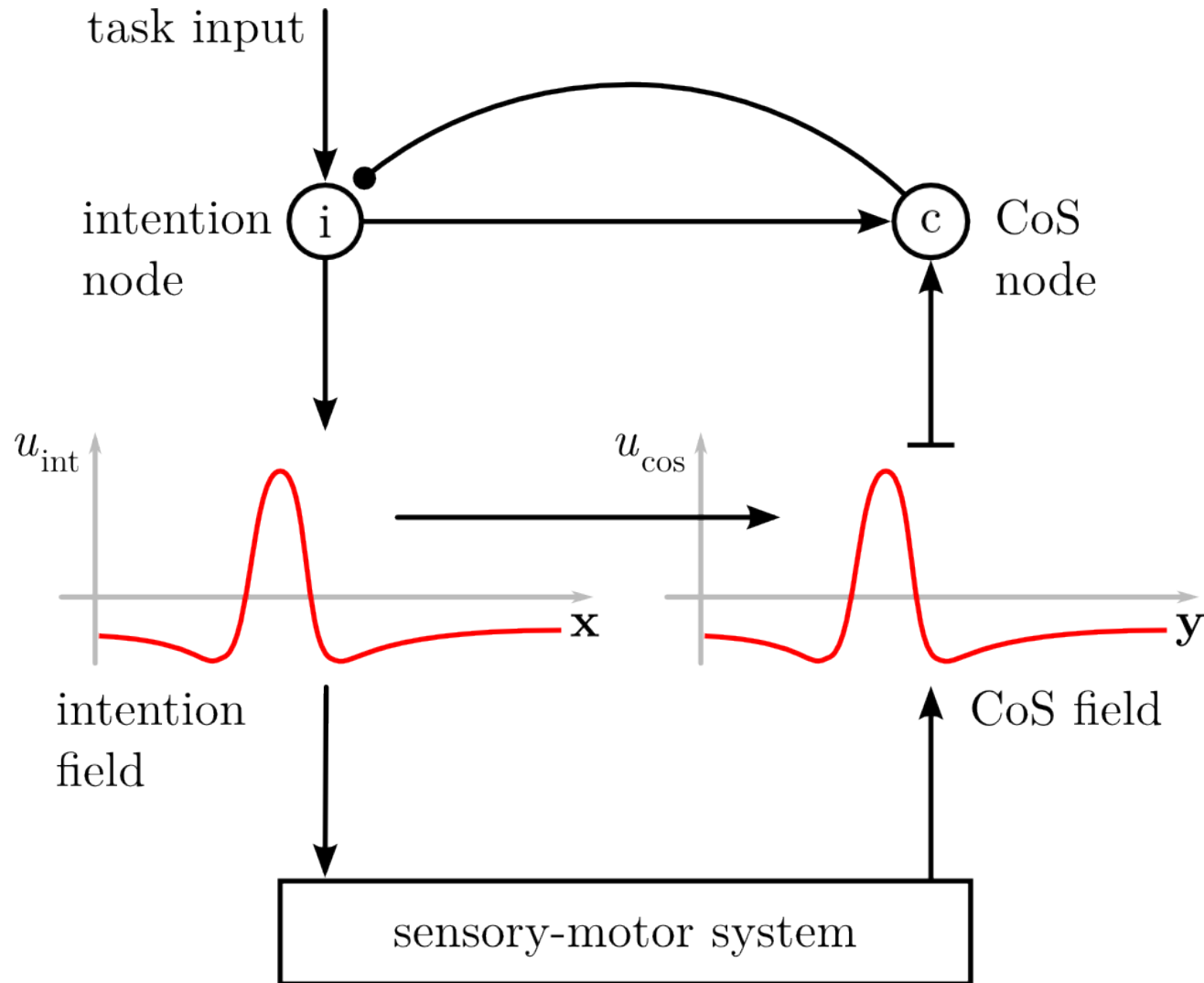


*ordinal*

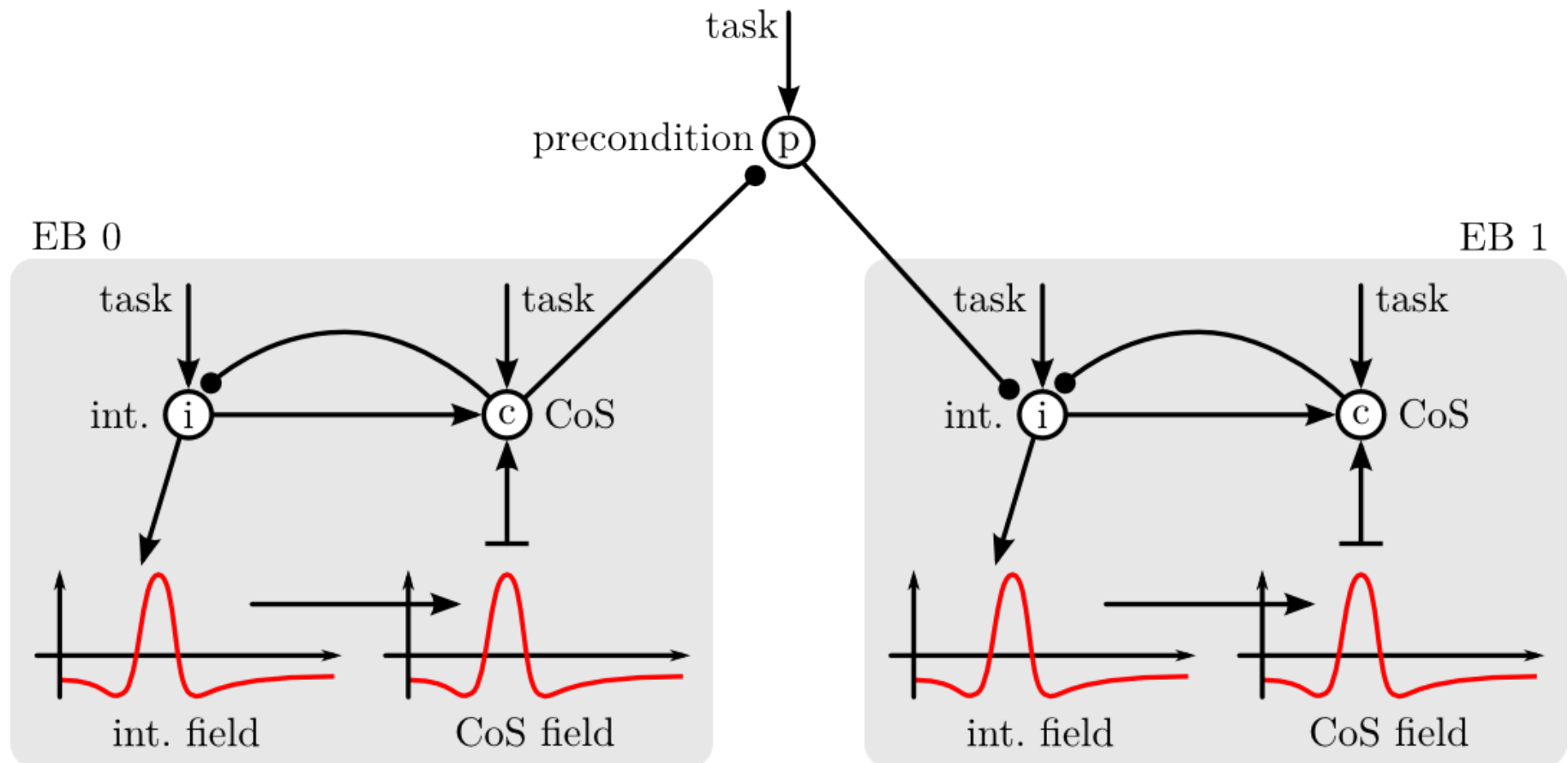


*positional*

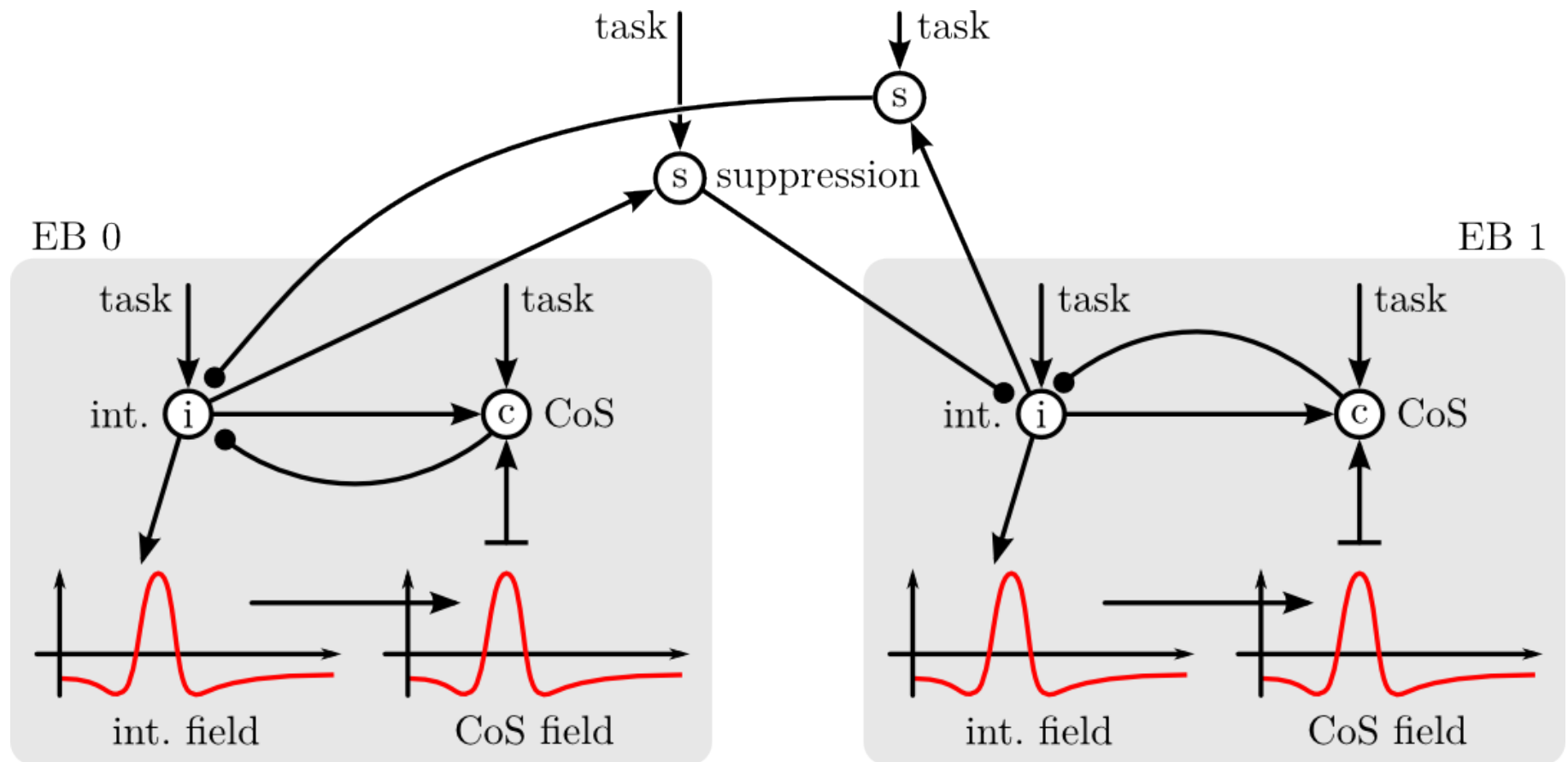
# *Elementary* **BEHAVIOR**



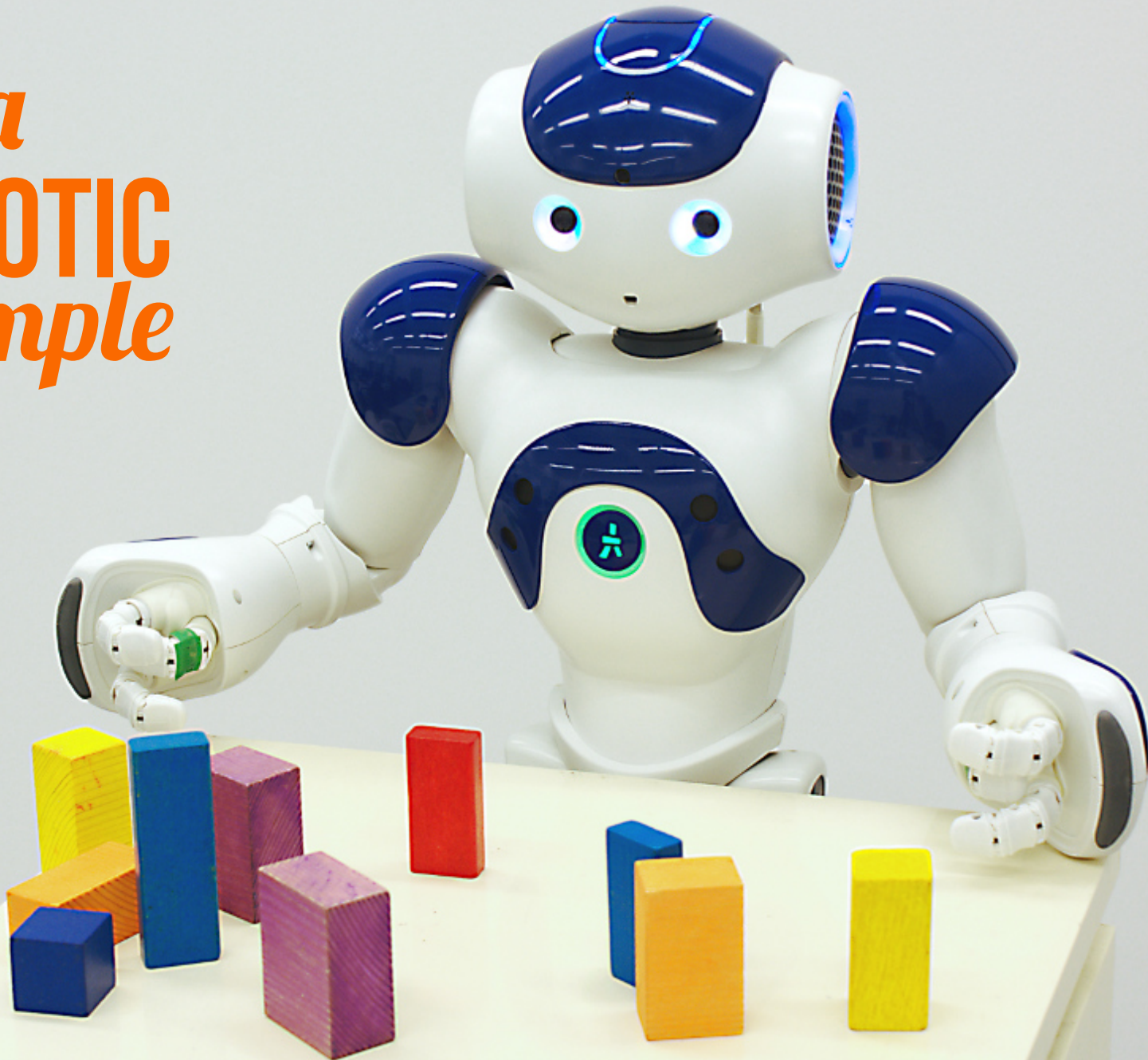
# PRECONDITION *constraint*



# COMPETITION *constraint*

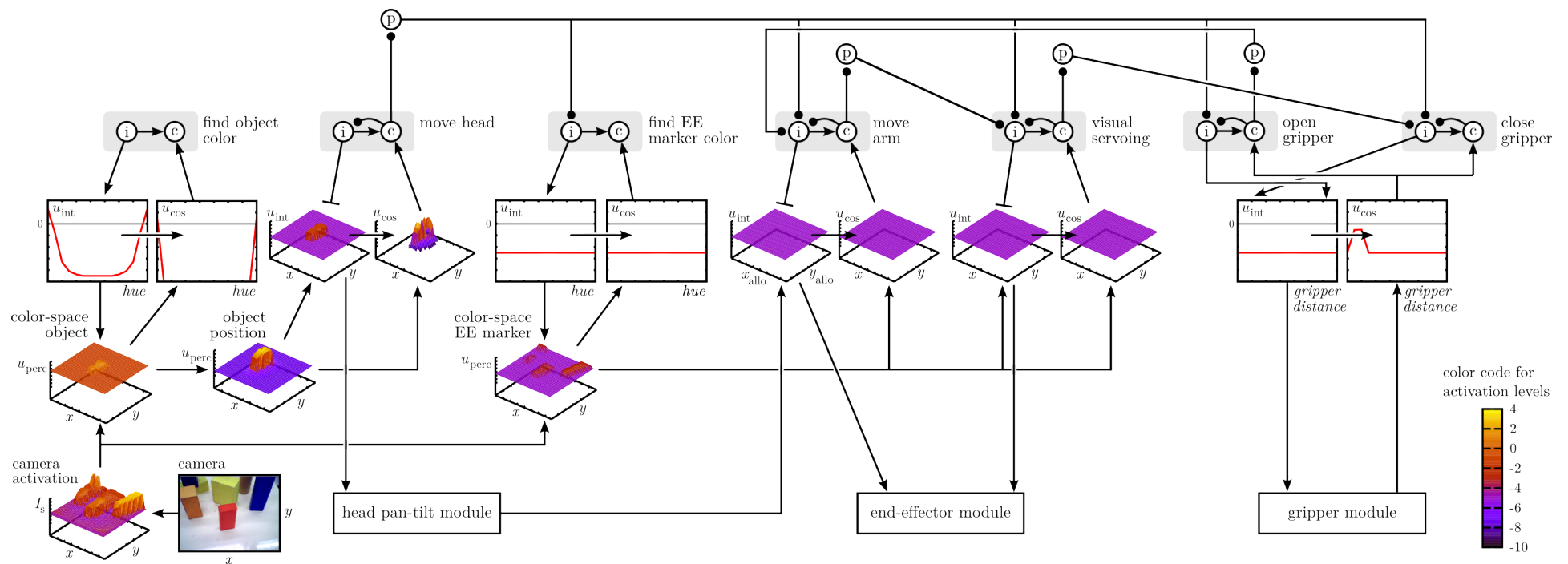


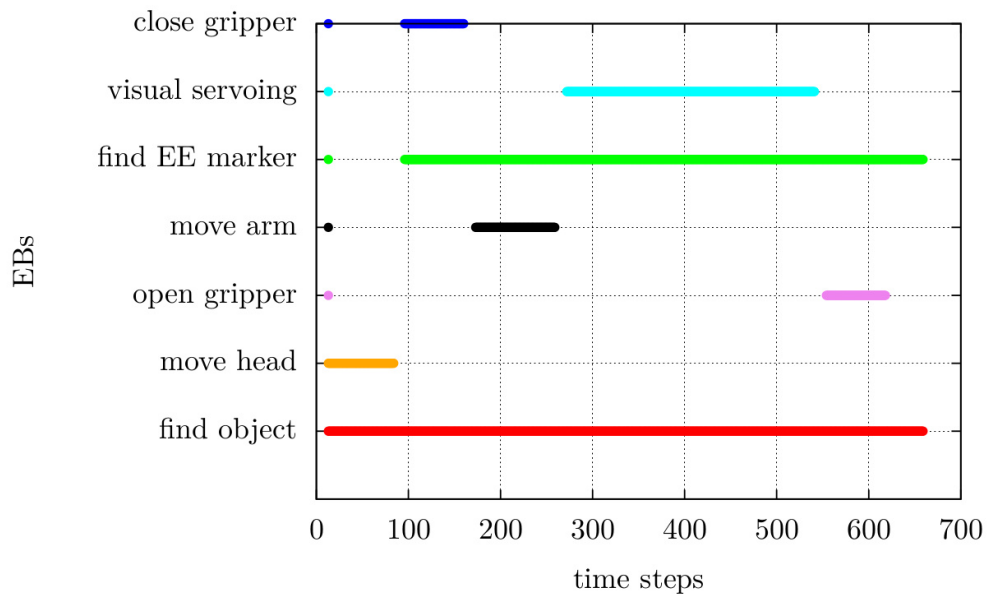
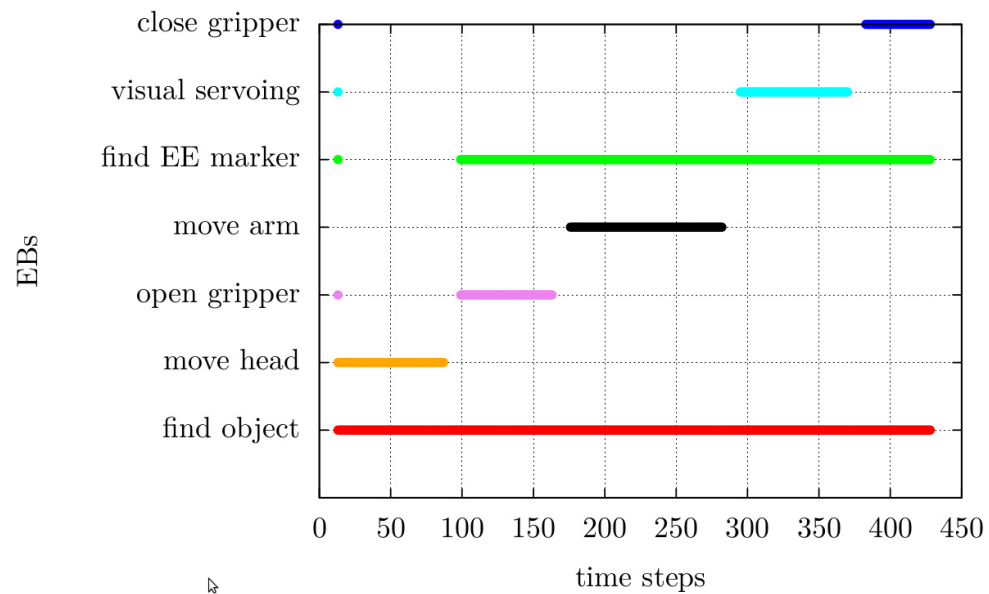
*a*  
**ROBOTIC**  
*example*





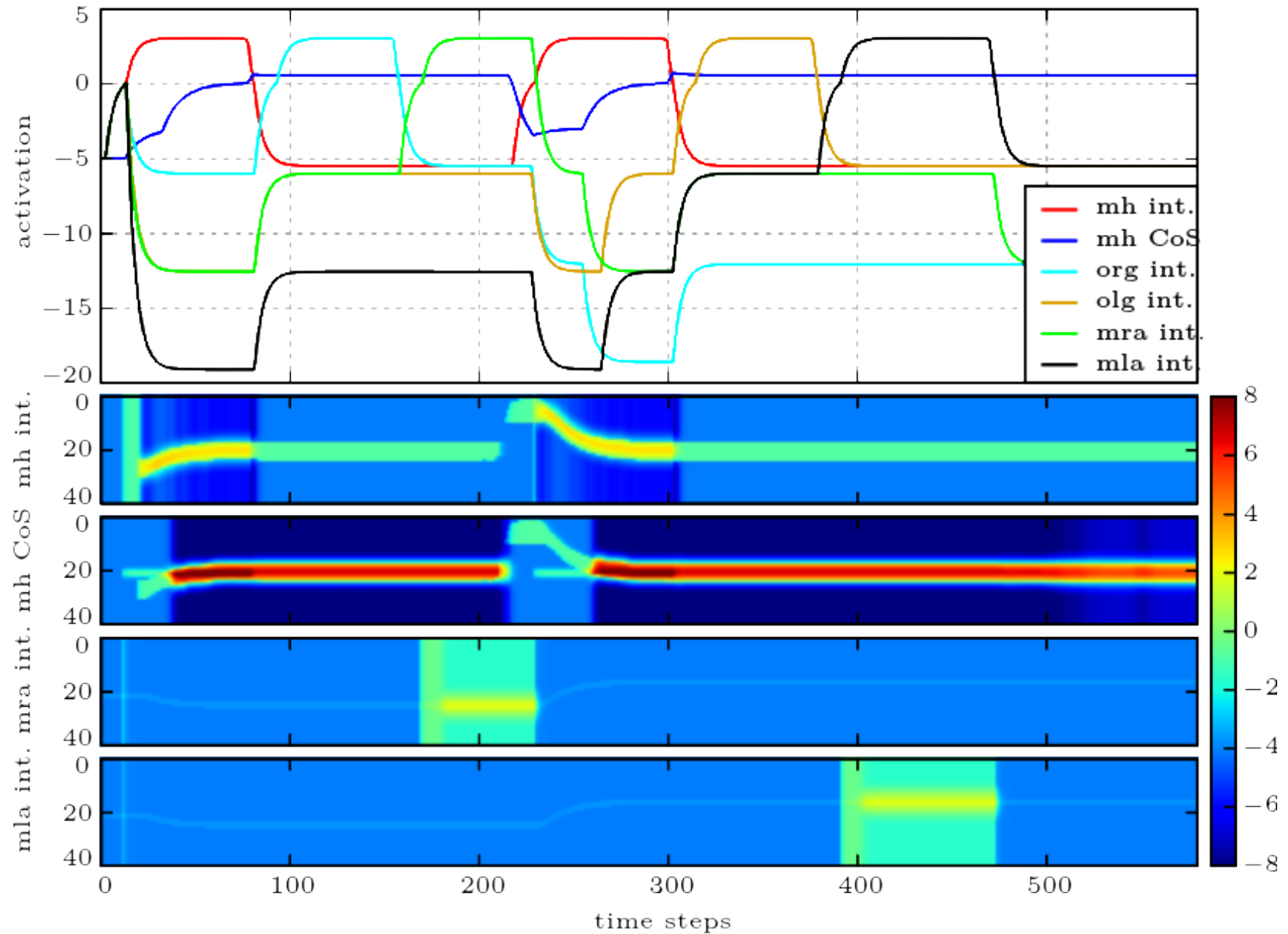
# *(almost) the whole* ARCHITECTURE





**GRASPING** *and* **POINTING**

# ACTIVATION *over time*

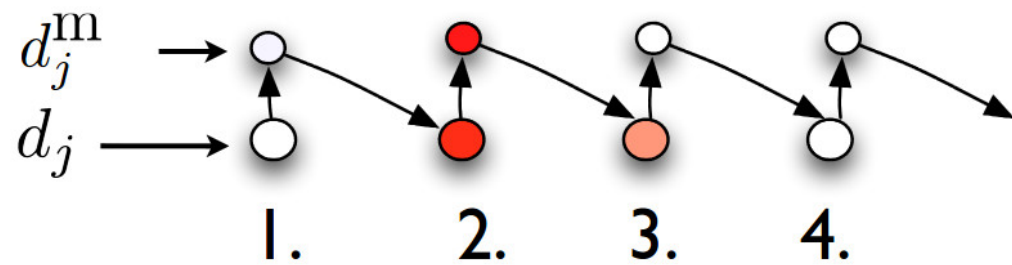


# 3 TYPES

*of organization*

- 1 Serial order
- 2 Behavioral organization
- 3 Goal-oriented sequences

# *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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