

DFT Tutorial – Part 2

Building cognitive agents

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Challenges

- The less dependent the agent becomes from sensory input, the more autonomous and cognitive it is
 - Internal activation driven process organization
 - Abstract and invariant representation

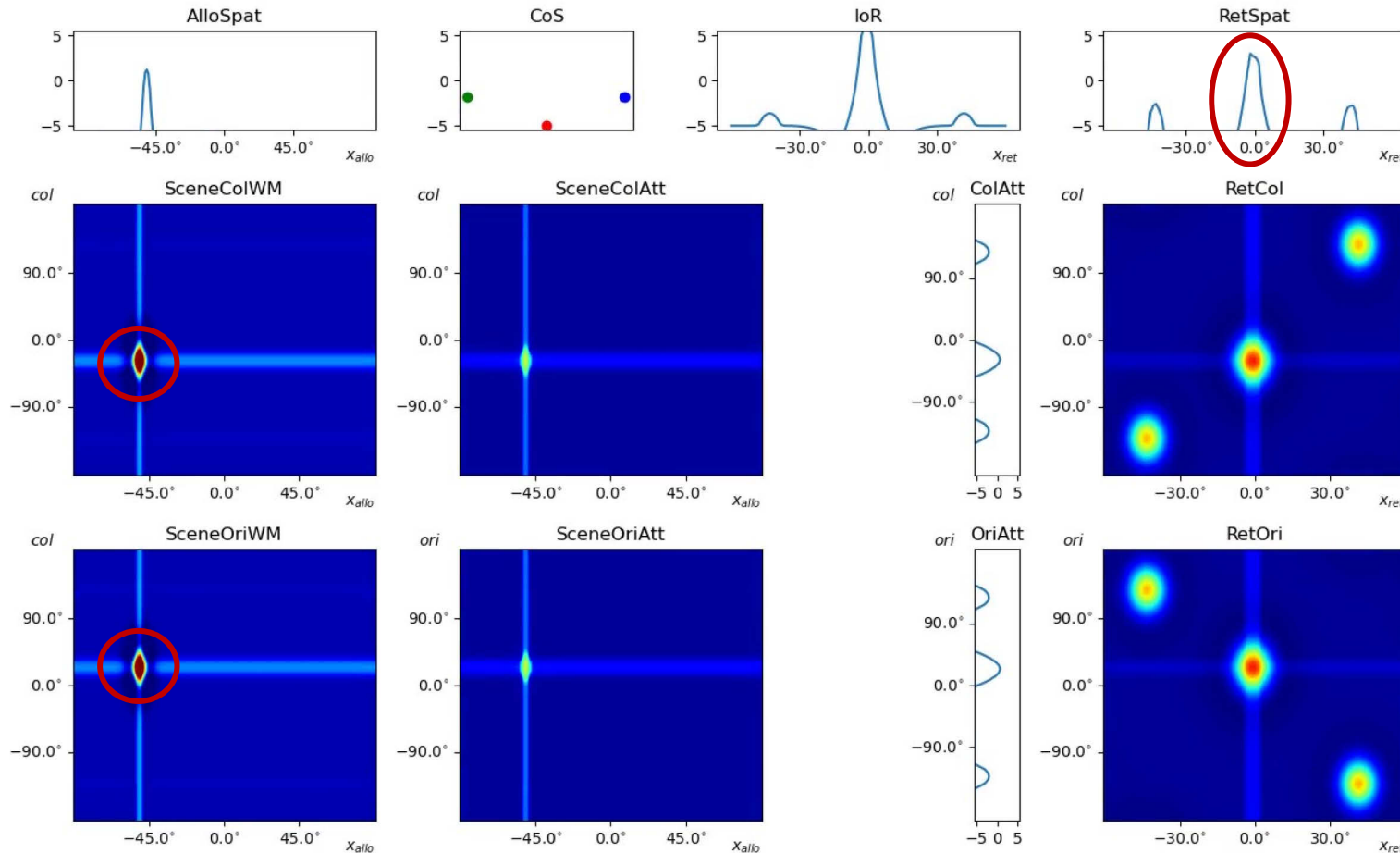


Autonomous sequence generation

- “all behavior and thinking consist of sequences of physical or mental acts”
- Two problems
 - When to start and end a process?
 - What is the next state?

Autonomous sequence generation

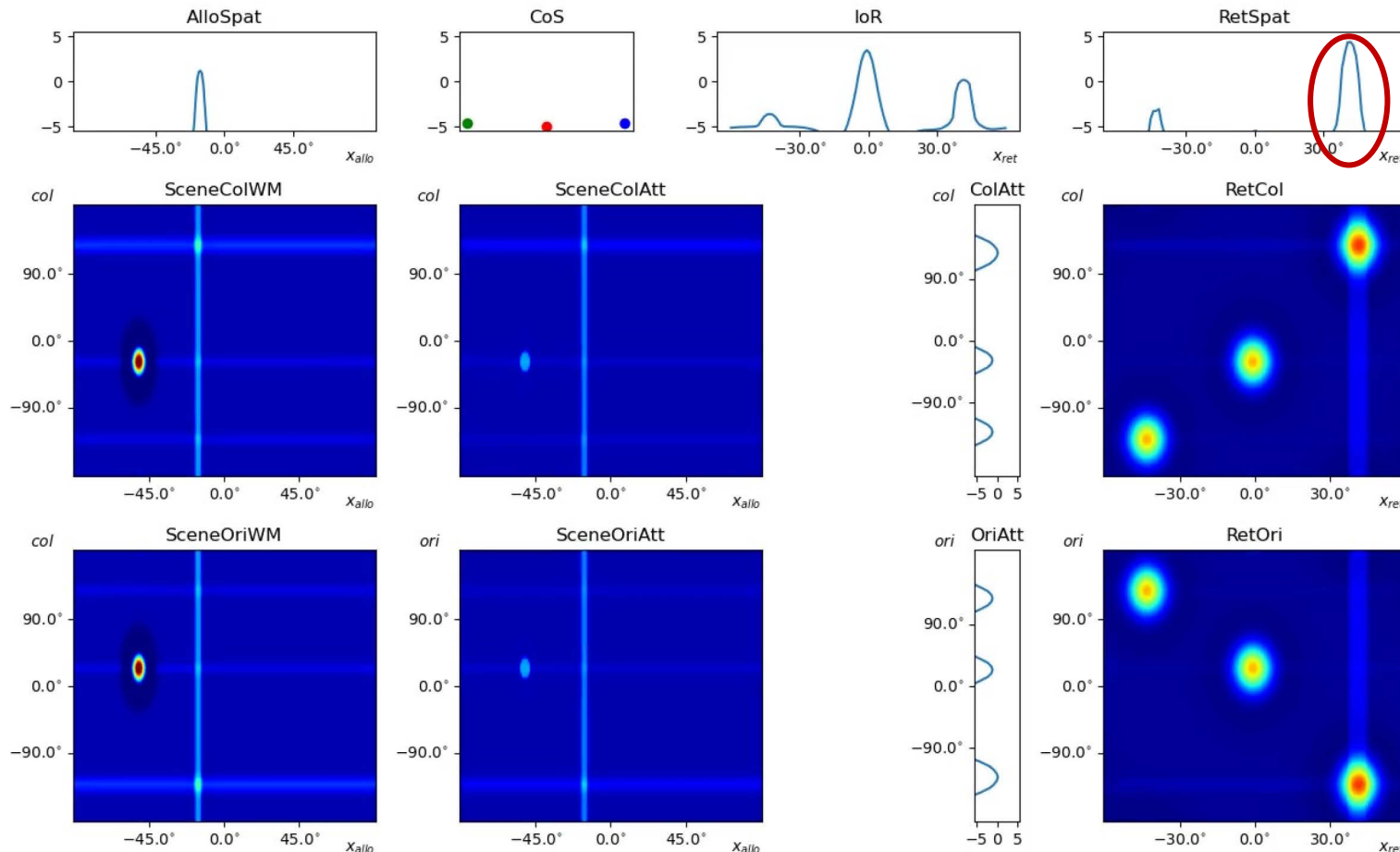
- When to start and end a process?



Initial selection and encoding of memory

Autonomous sequence generation

- When to start and end a process?

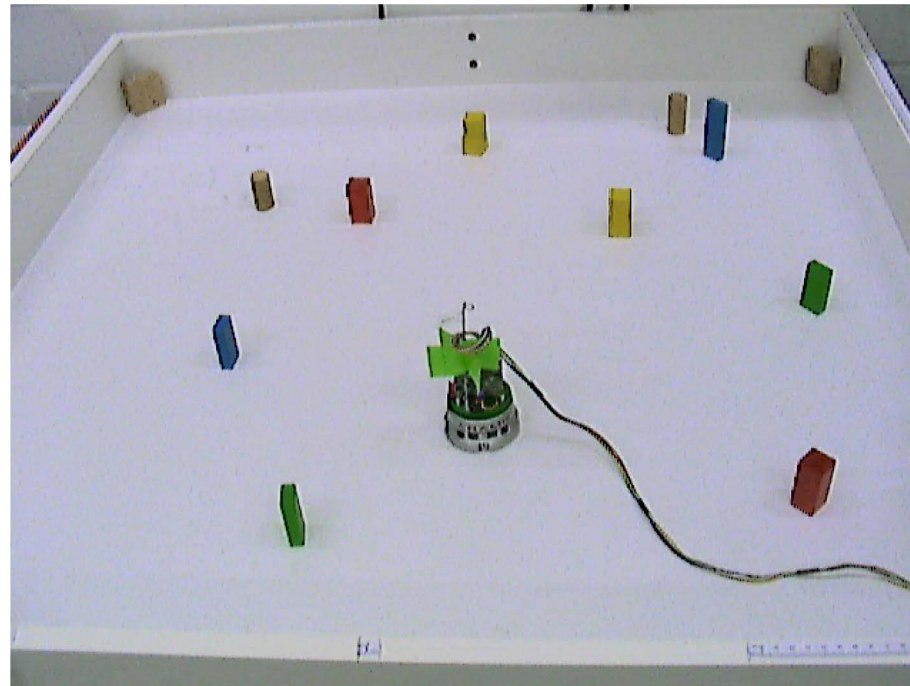


Selection of another object
-> Requires destabilization of the existing attractor!

Autonomous sequence generation

- When to start and end a process?

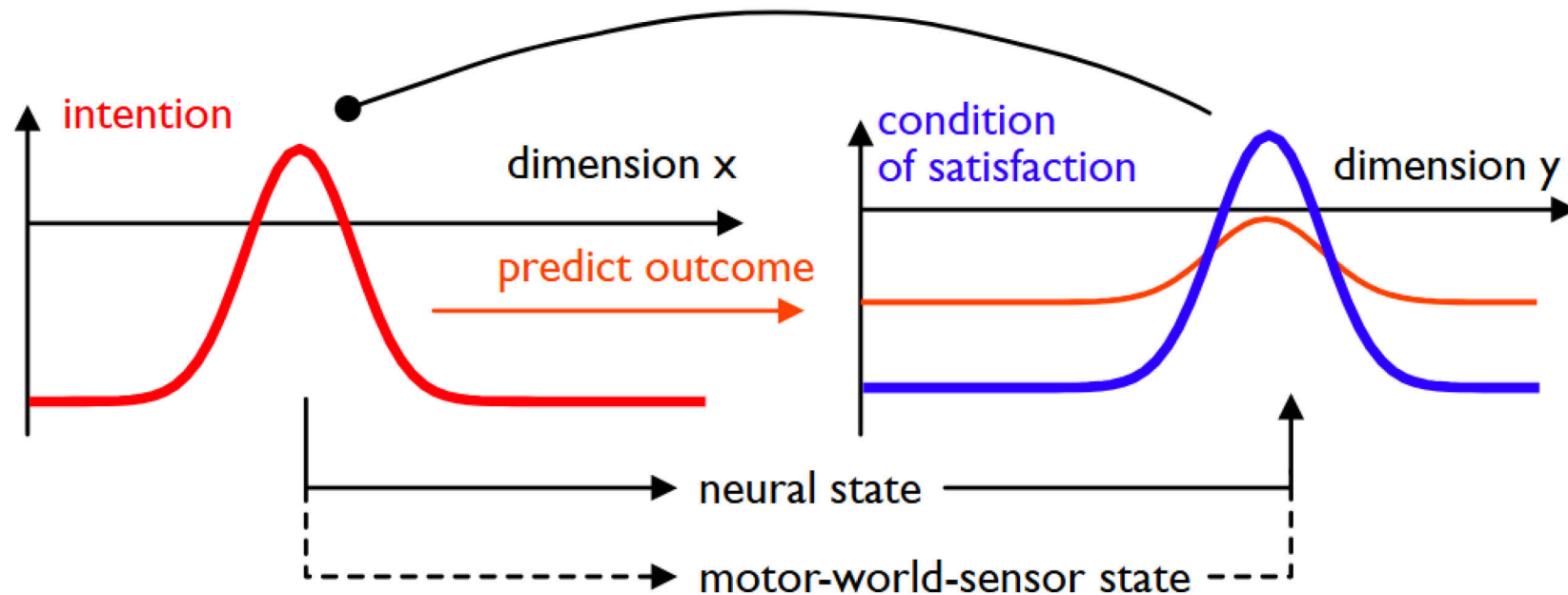
Variable termination timing -> requires event-based initiation and termination



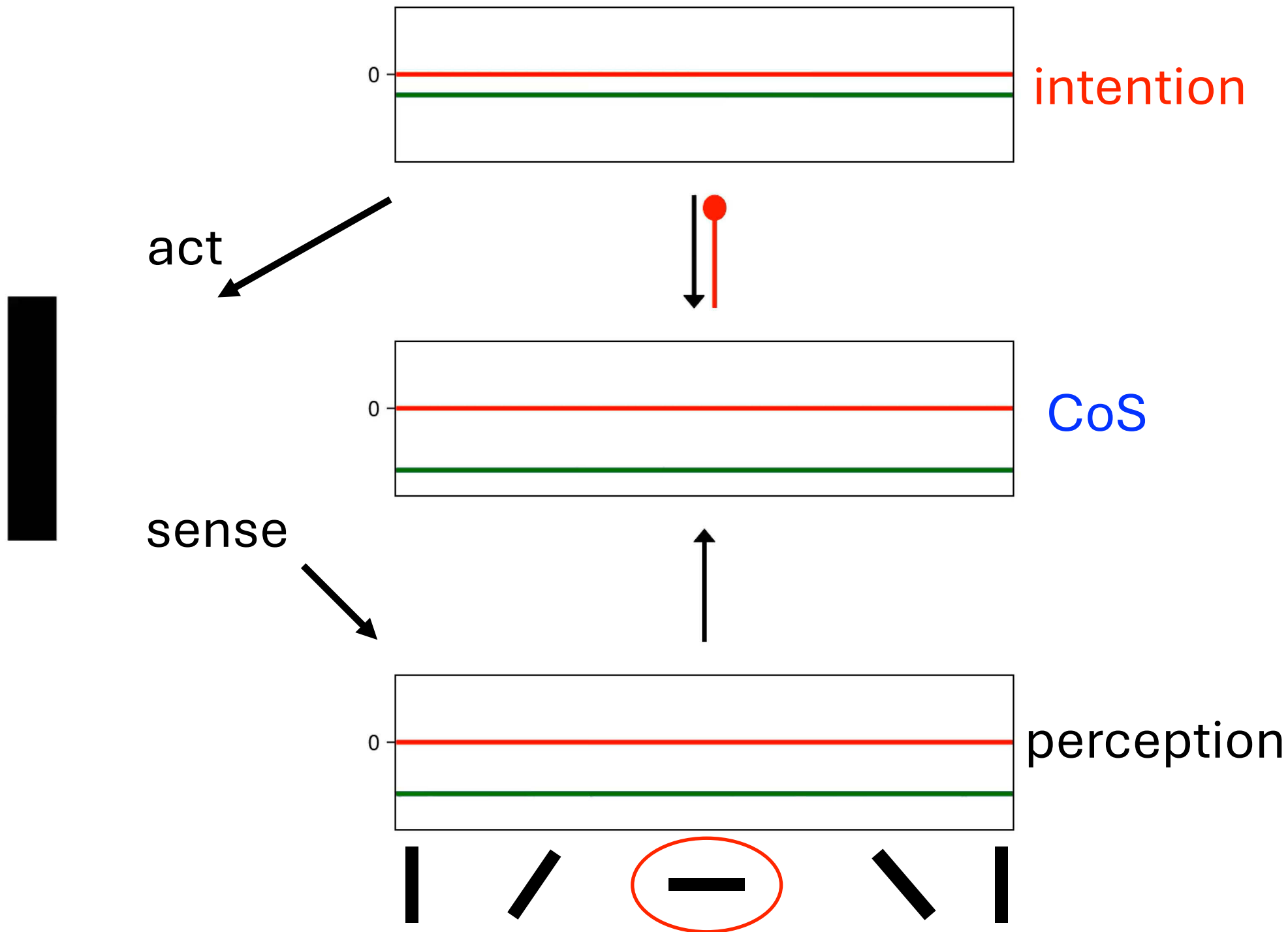
yellow -> red -> green

Intention and Condition of Satisfaction (CoS)

- When to start and end a process?



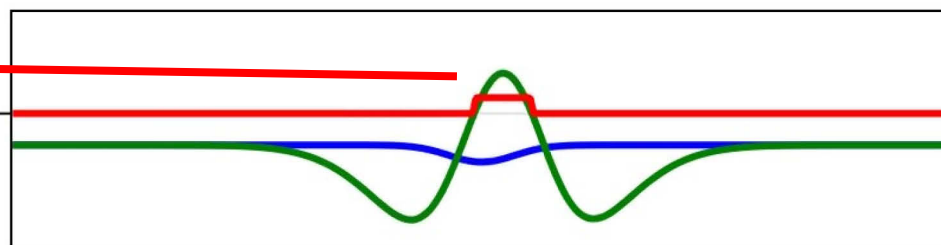
Autonomous detection of termination condition and destabilization



reverse detection

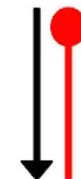
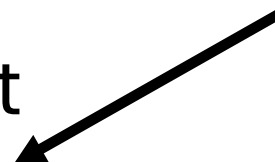


0



intention

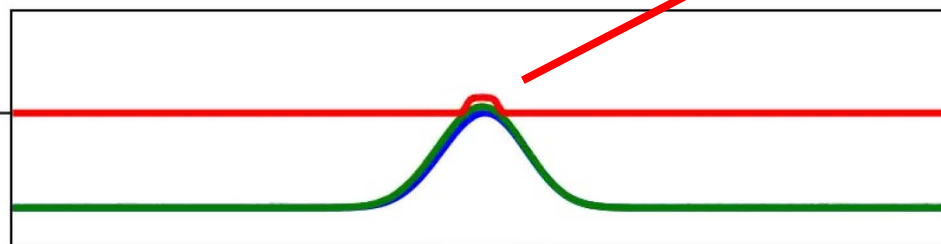
act



detection

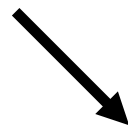


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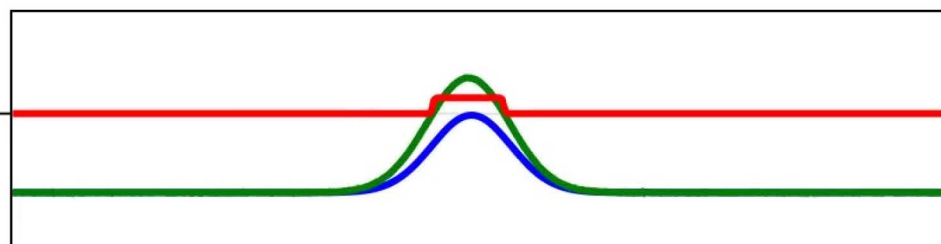


CoS

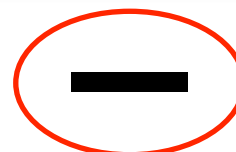
sense

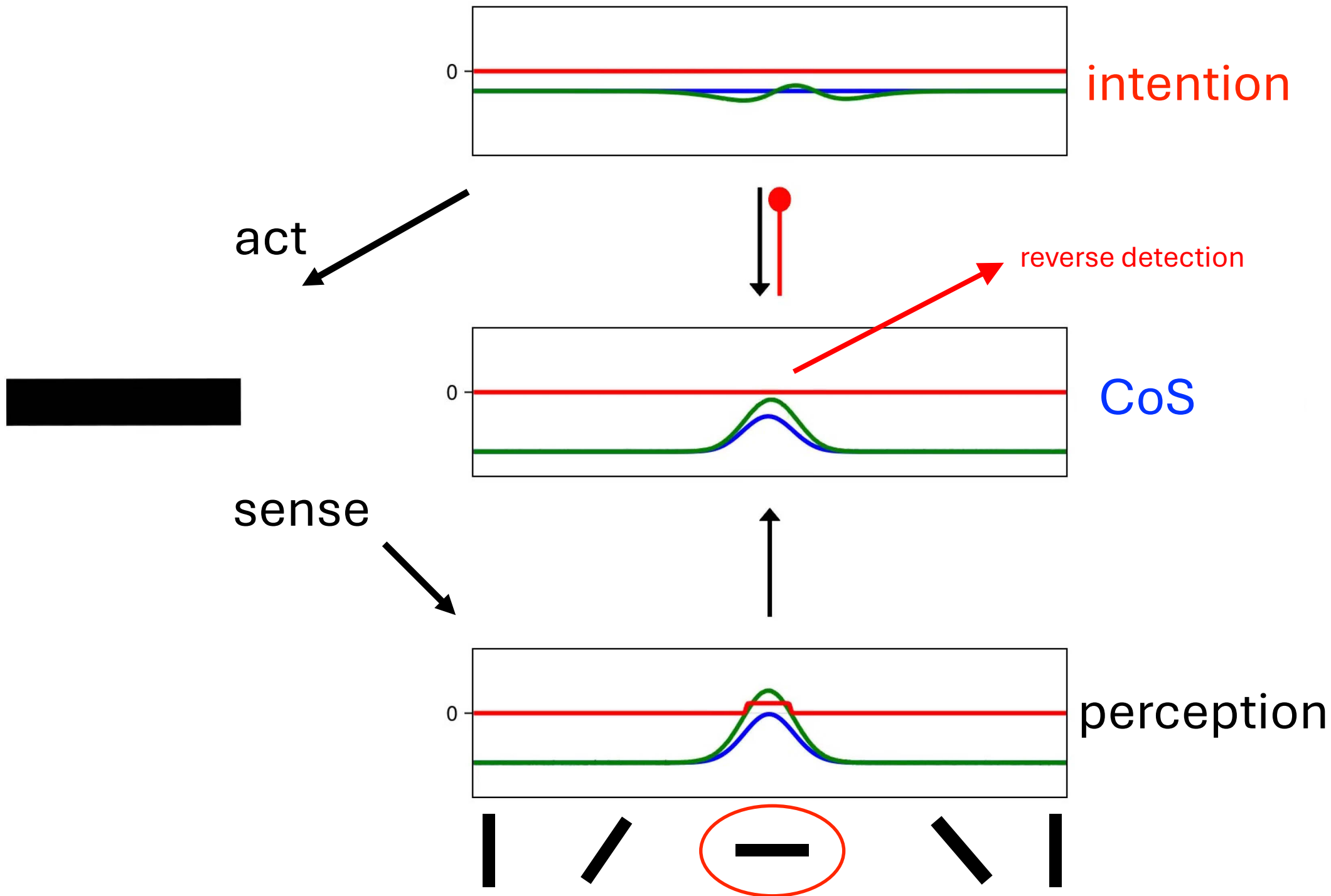


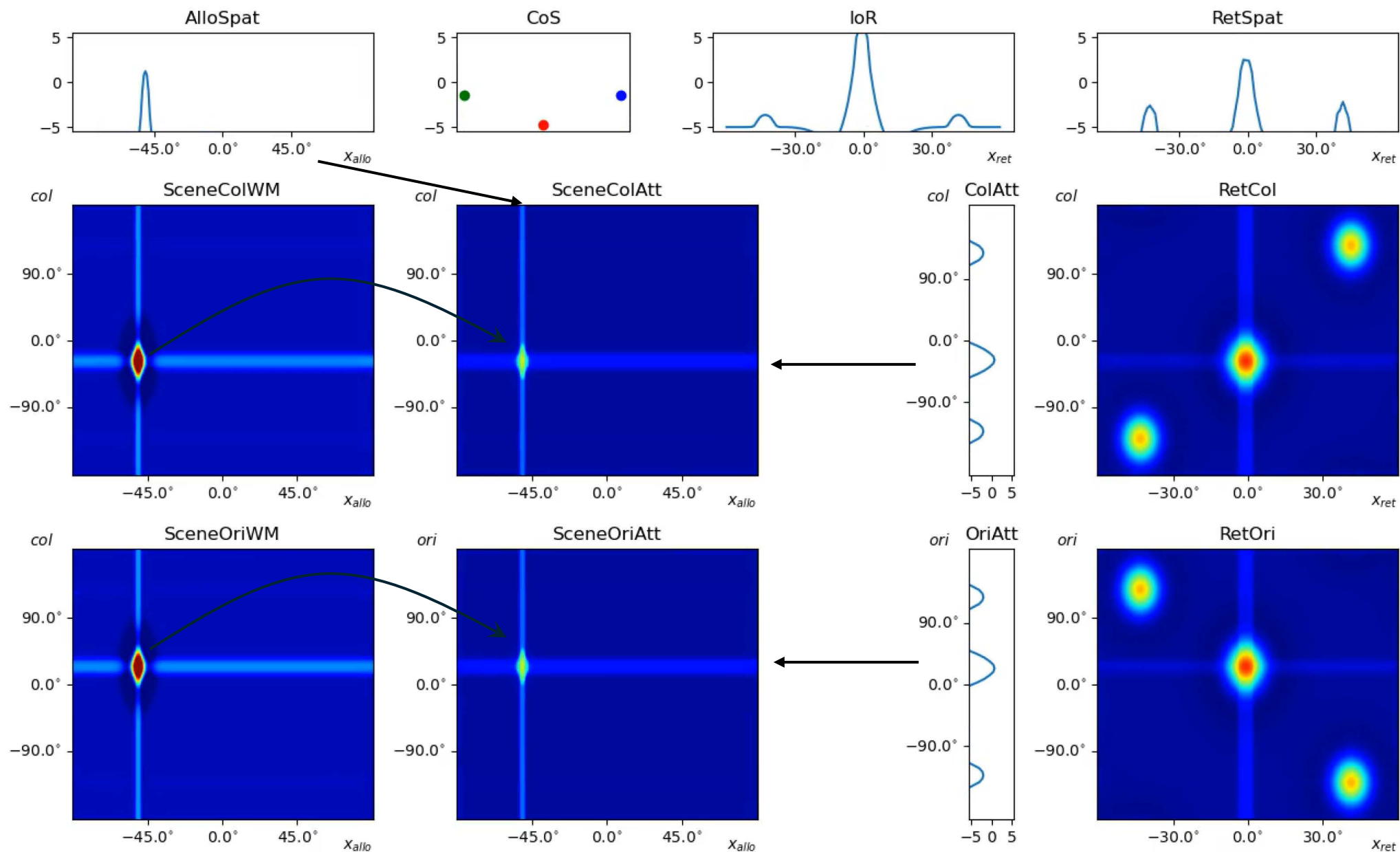
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perception



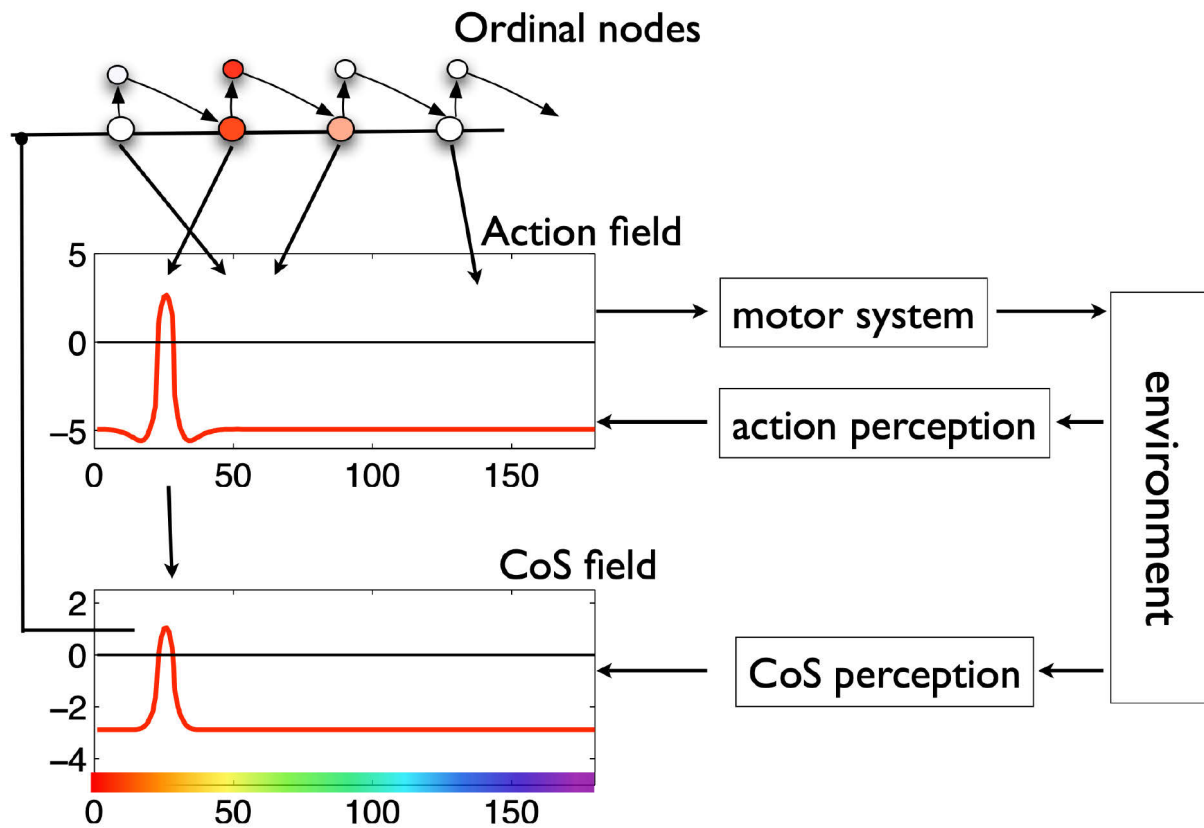




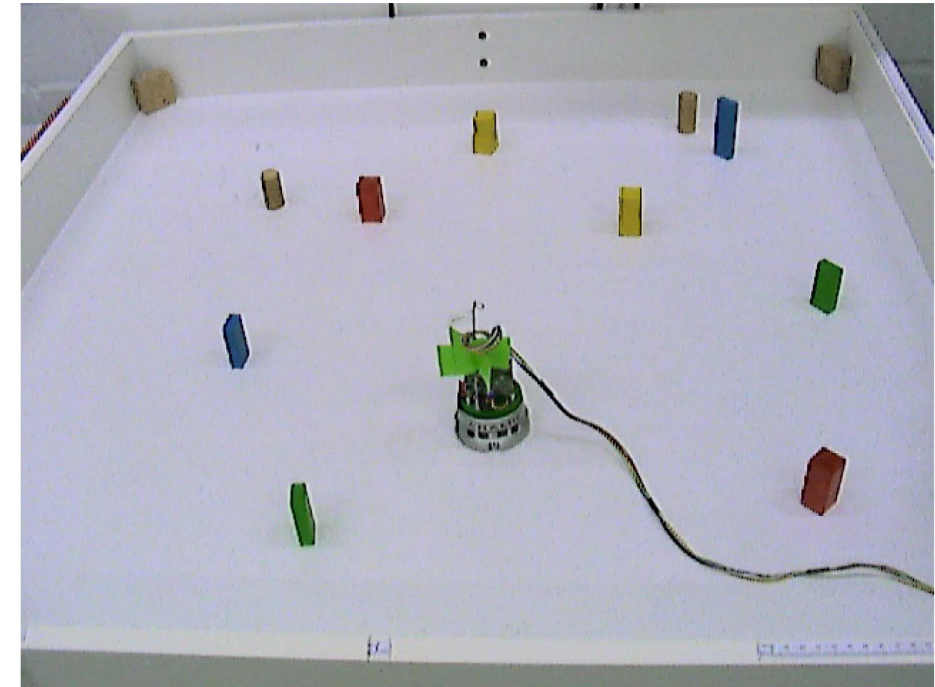
Building a new memory representation -> CoS -> destabilize intention -> destabilize CoS

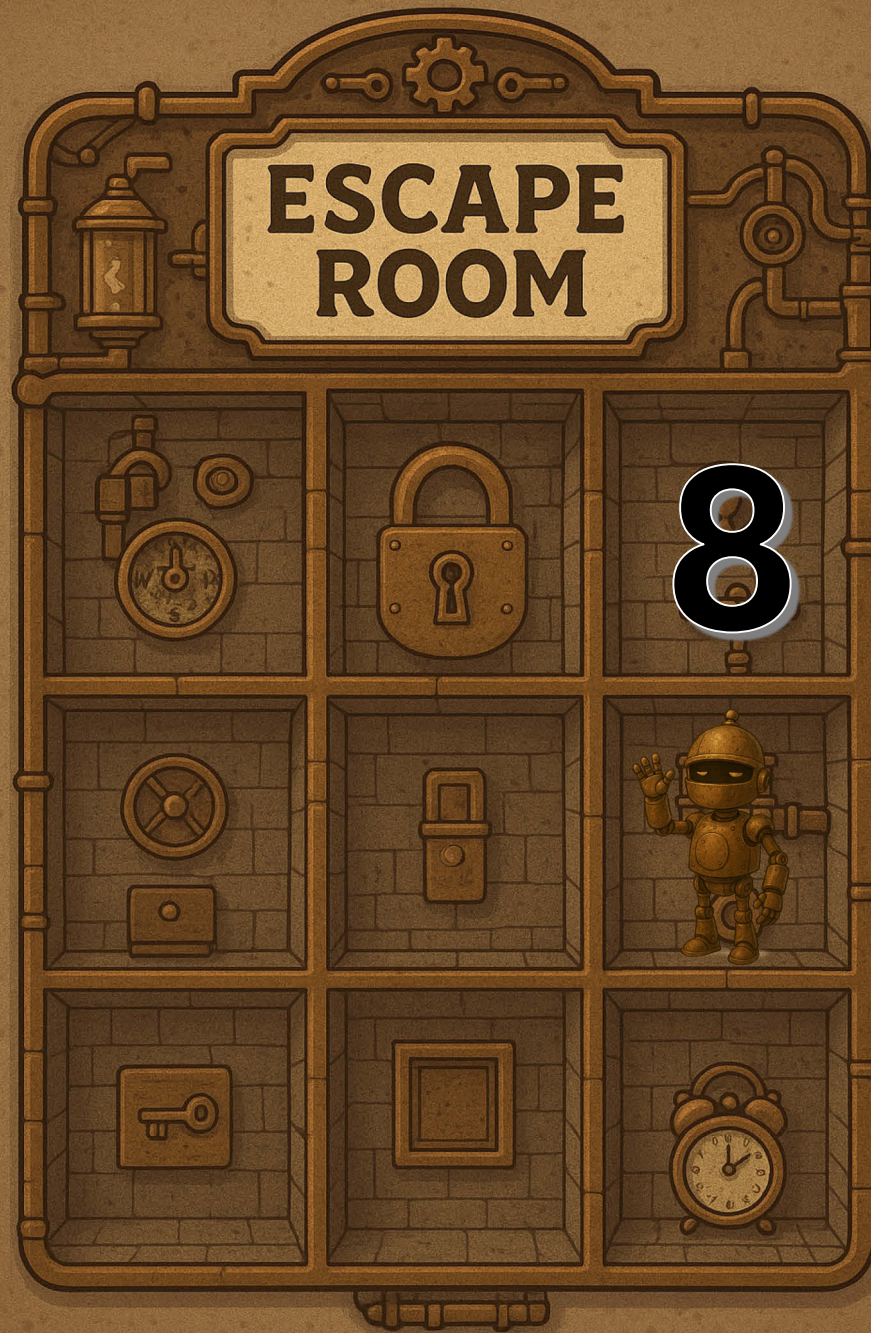
Serial order

- What is the next state?



yellow -> red -> green





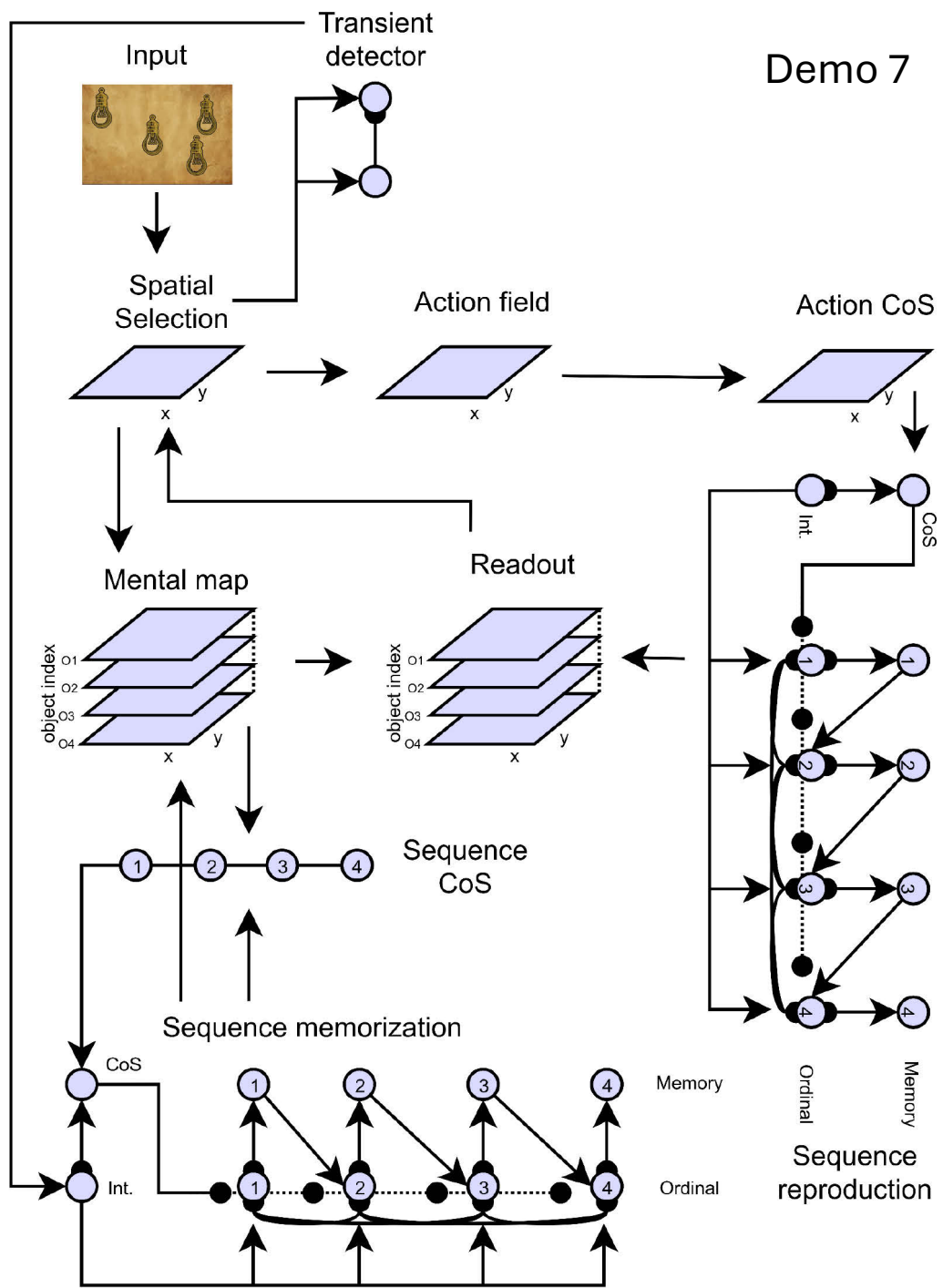
ESCAPE ROOM

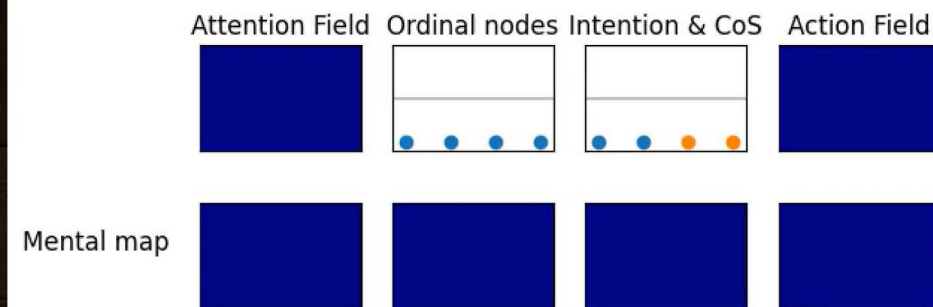
8





Demo 7





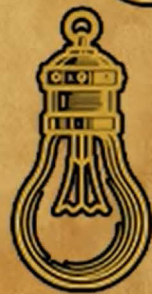
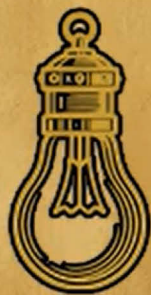
https://github.com/cedar/juniper/blob/main/demo7_Corsi_sequence.ipynb



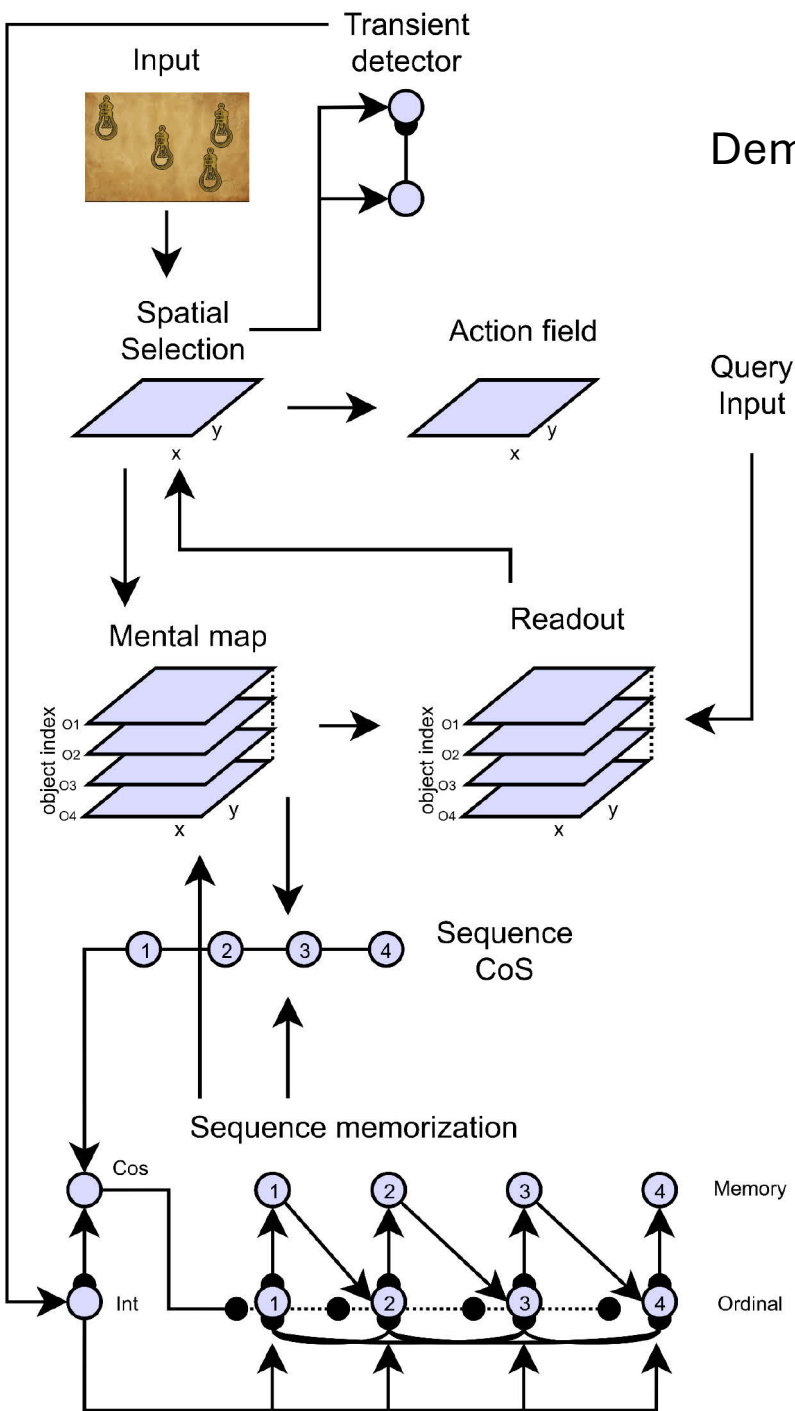
ESCAPE ROOM

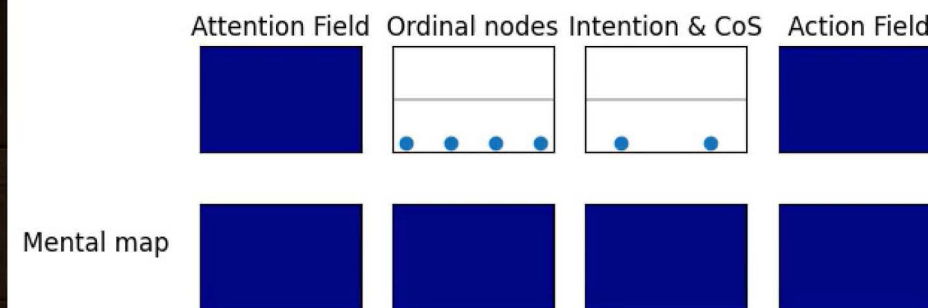


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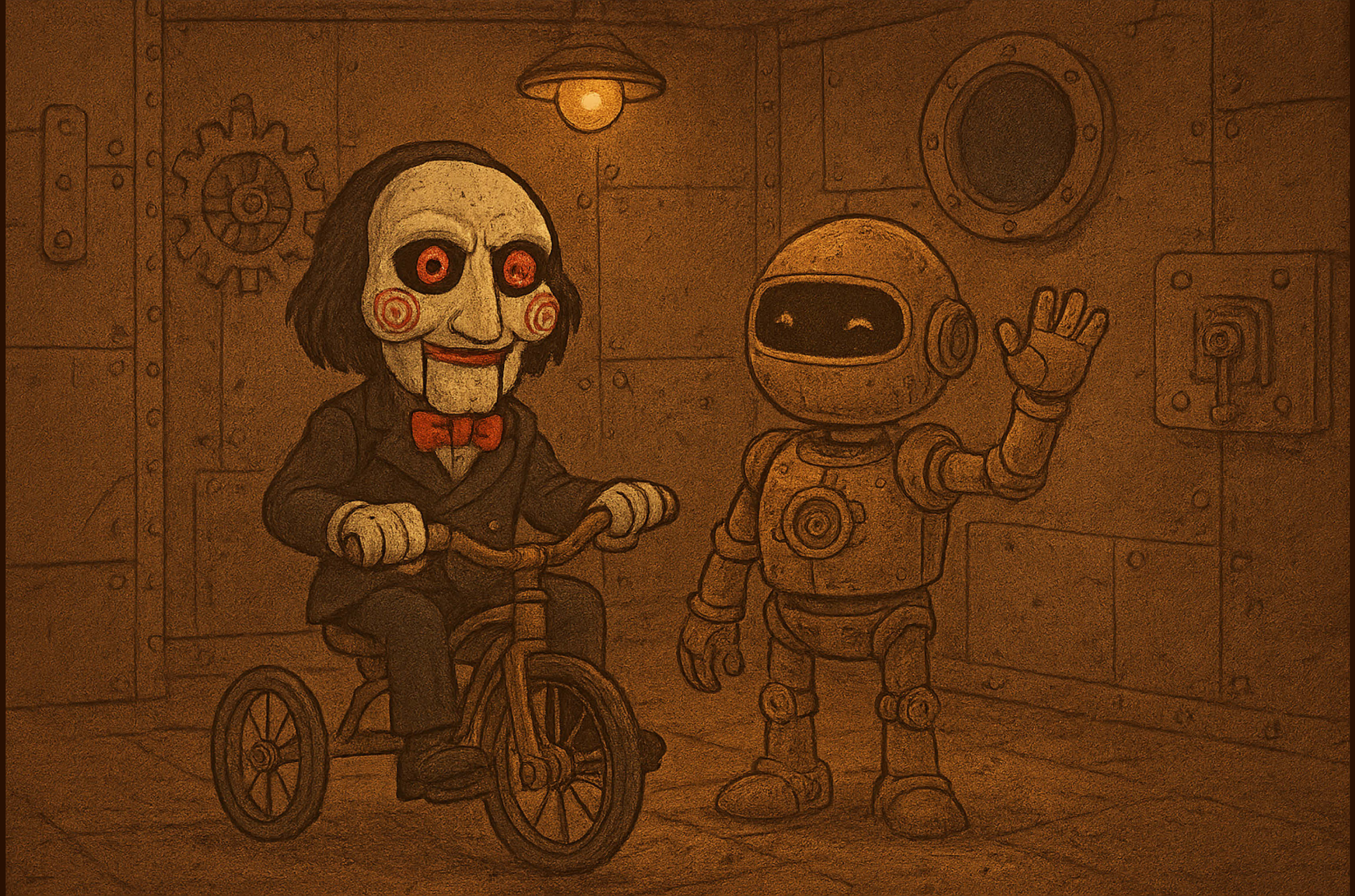


Demo 8

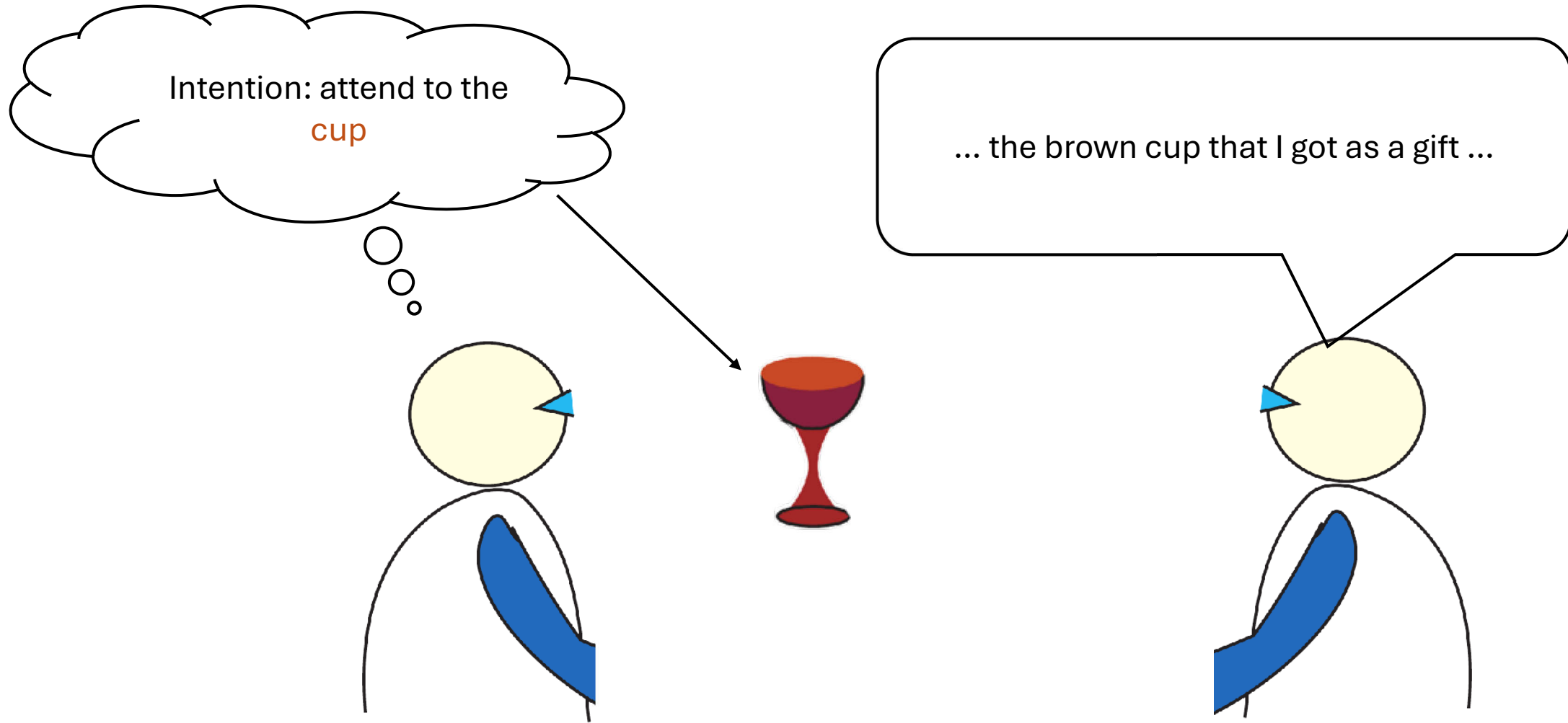




https://github.com/cedar/juniper/blob/main/demo8_Corsi_query.ipynb

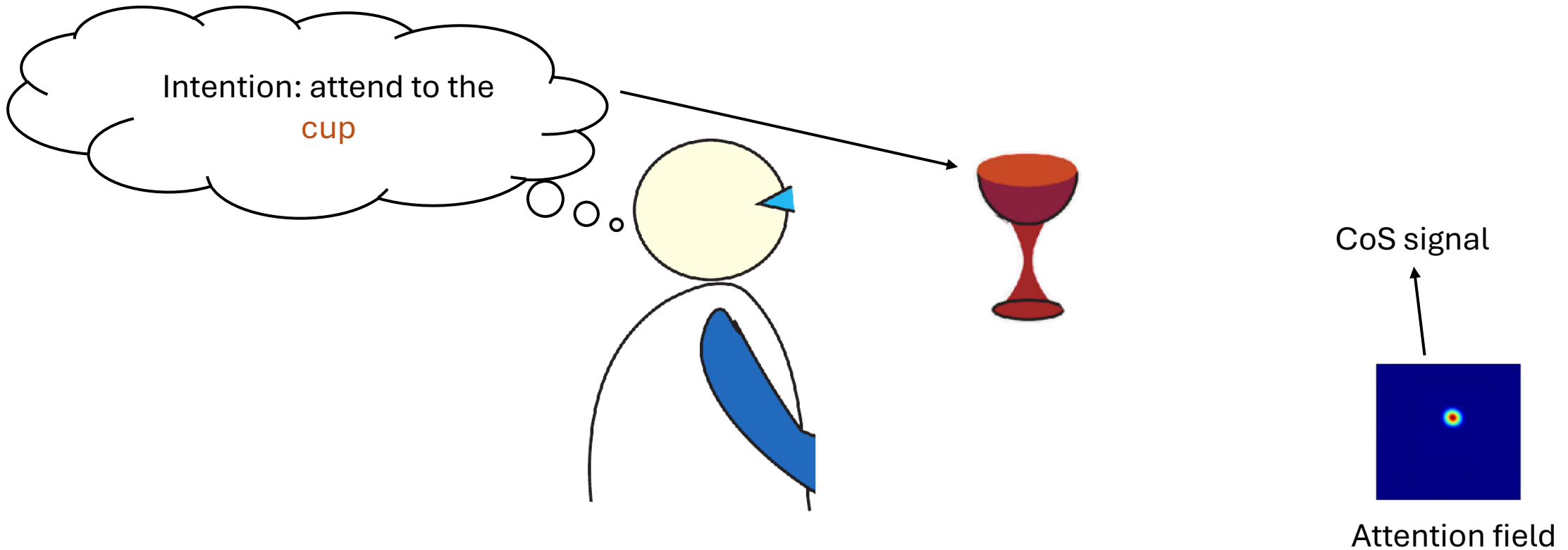


Grounding



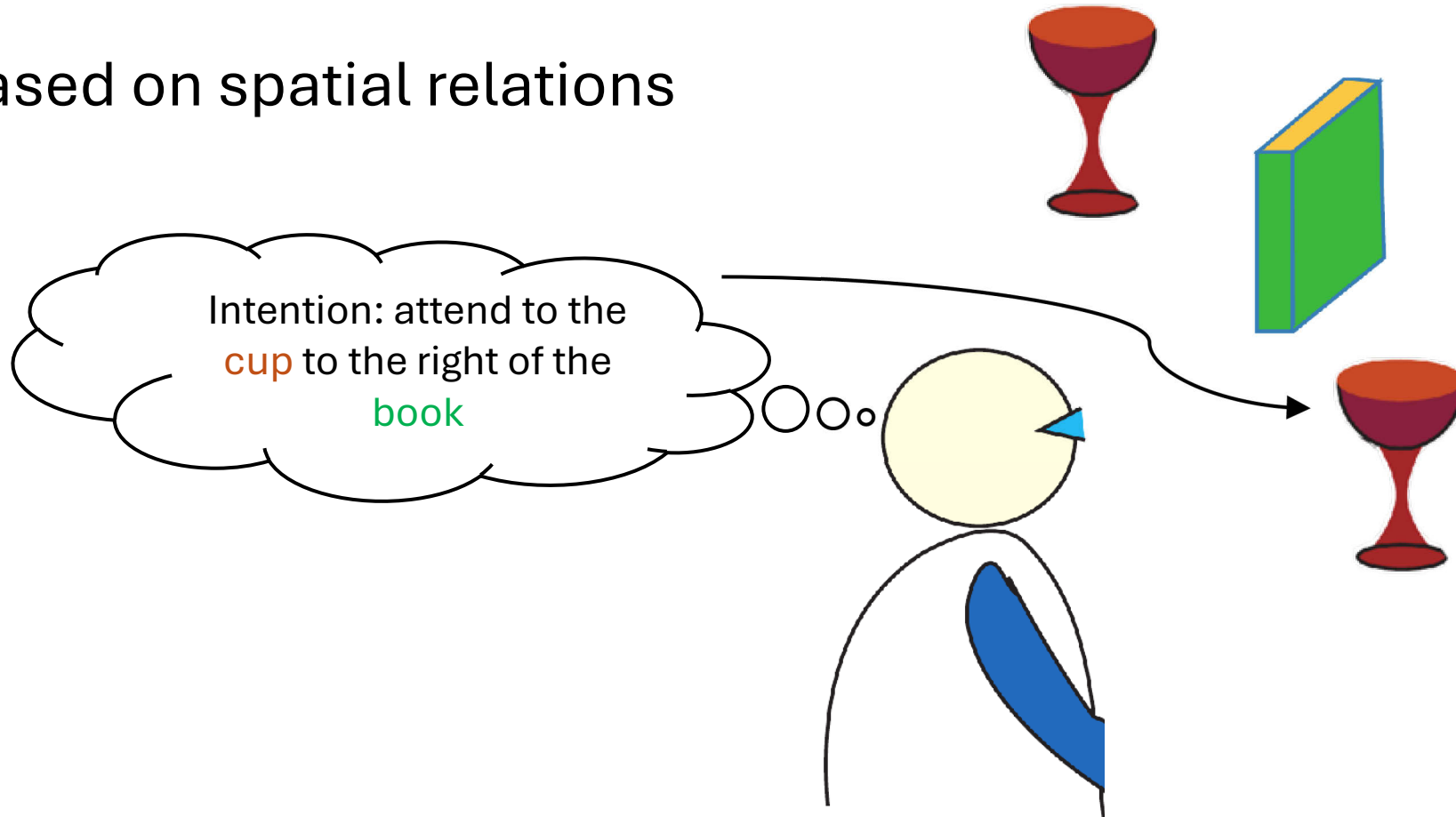
Perceptual grounding

- Directing **attention** to objects/events in the **world** based on language / **internally** generated thoughts



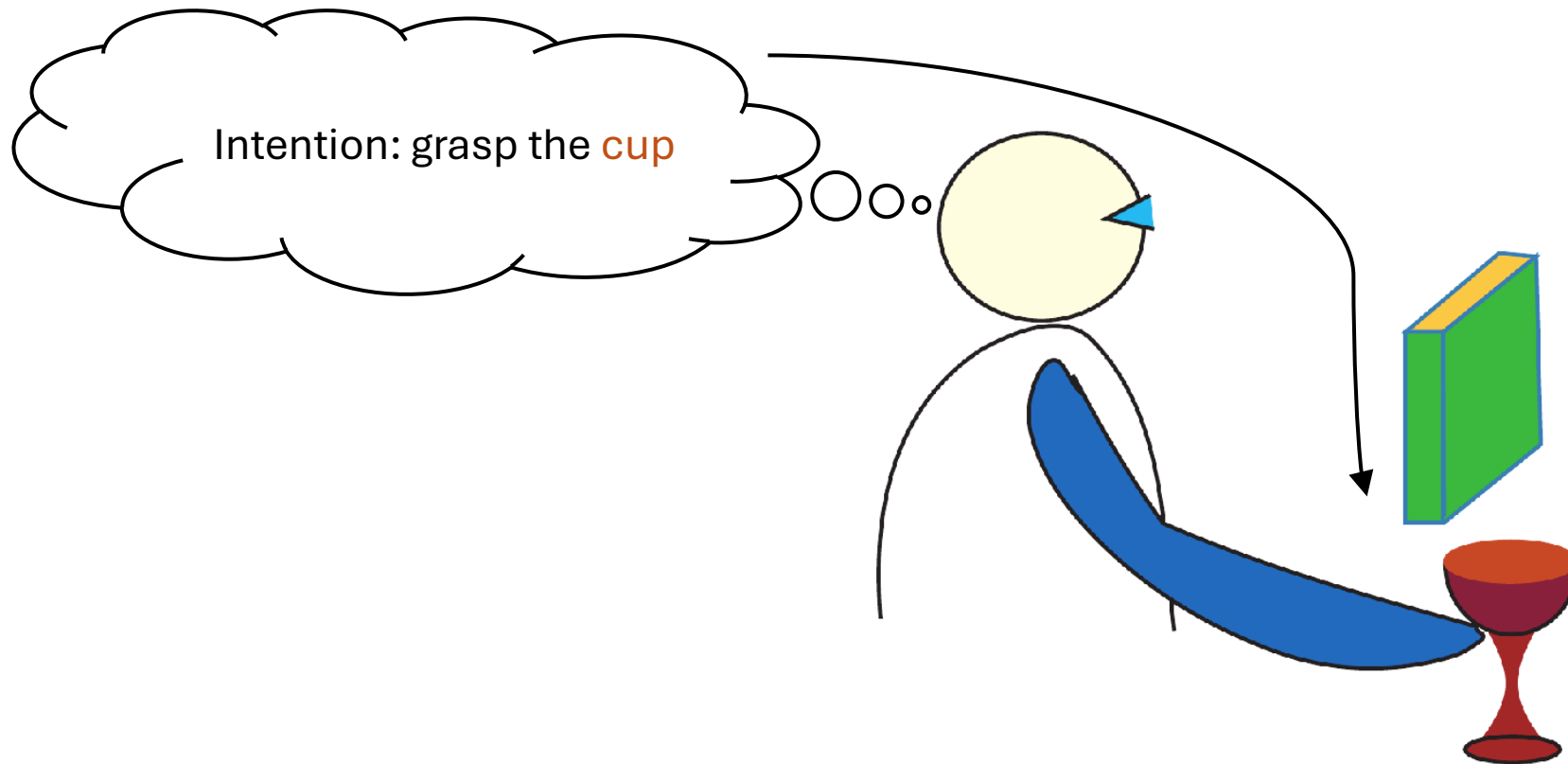
Perceptual grounding

- Based on spatial relations



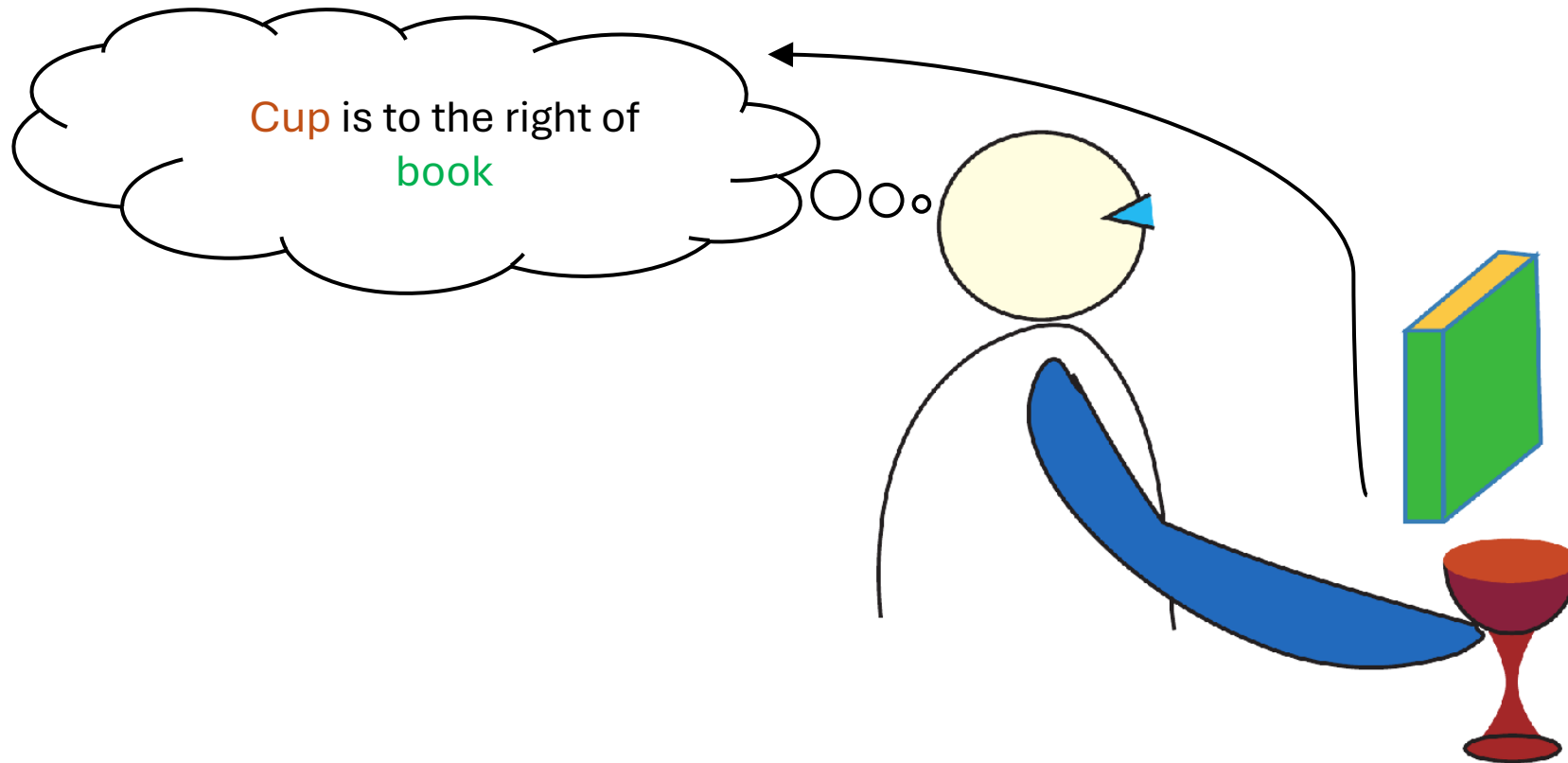
Action grounding

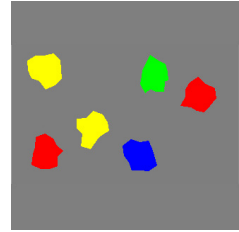
- Grounding is fulfilled by executing the intended action and getting the expected outcome



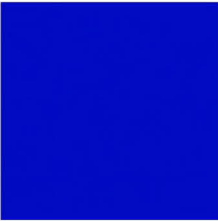
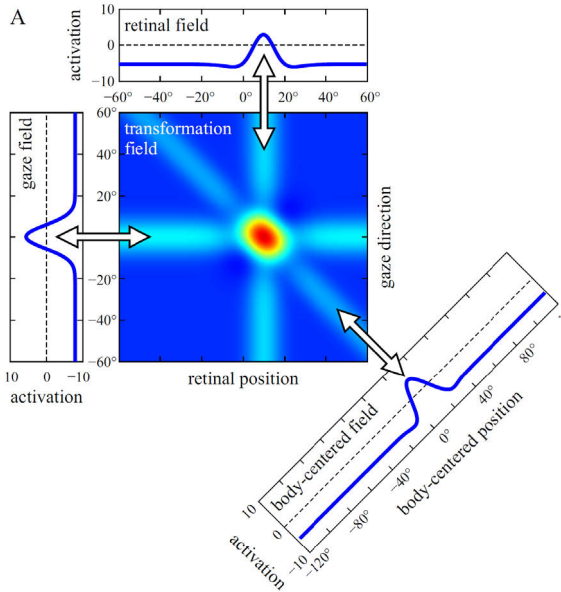
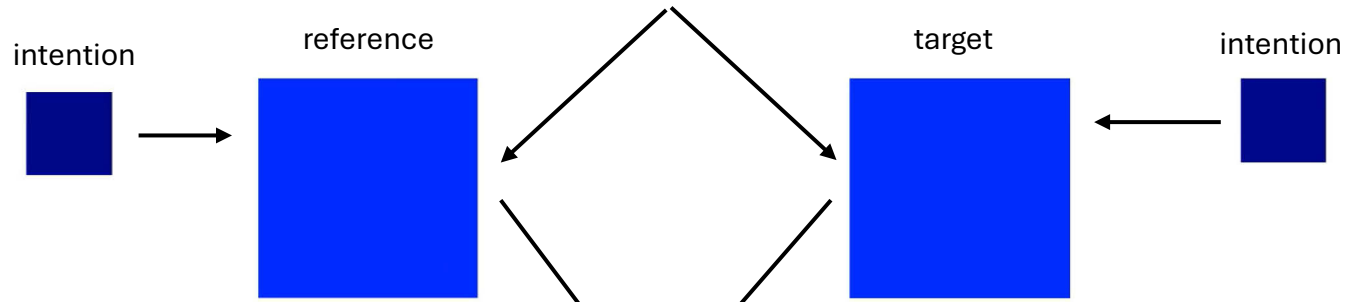
Description

- Generating conceptual/internal representation of the world



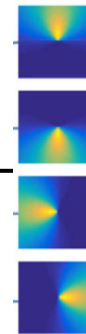


Green is ____ to blue



Spatial relation

Coordinate transformation



ABOVE

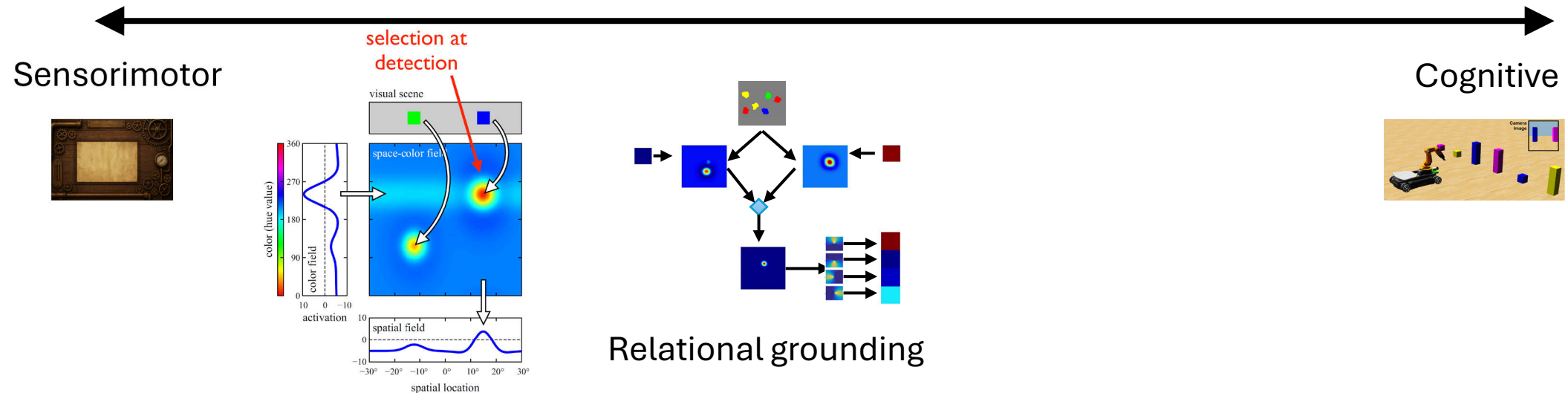
BELOW

LEFT

RIGHT

Challenges

- The less dependent the agent becomes from sensory input, the more autonomous and cognitive it is

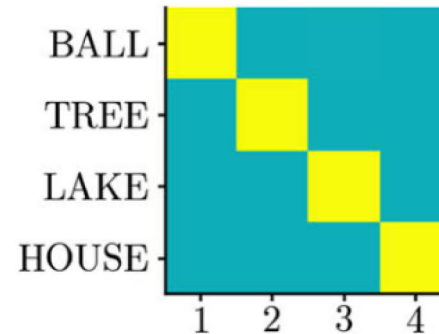


Binding through ordinal dimension

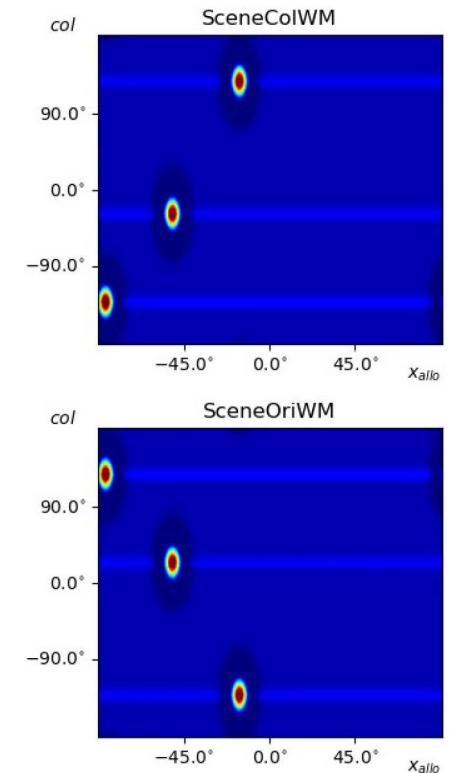
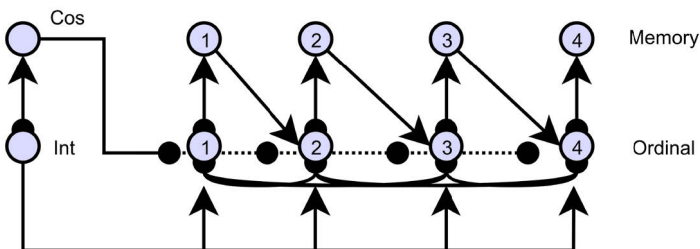
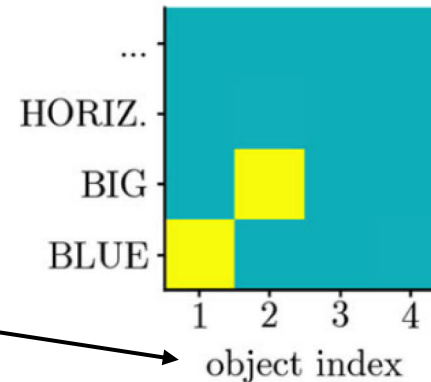
- Autonomously generated ordinal dimension binds concepts



object / object concept

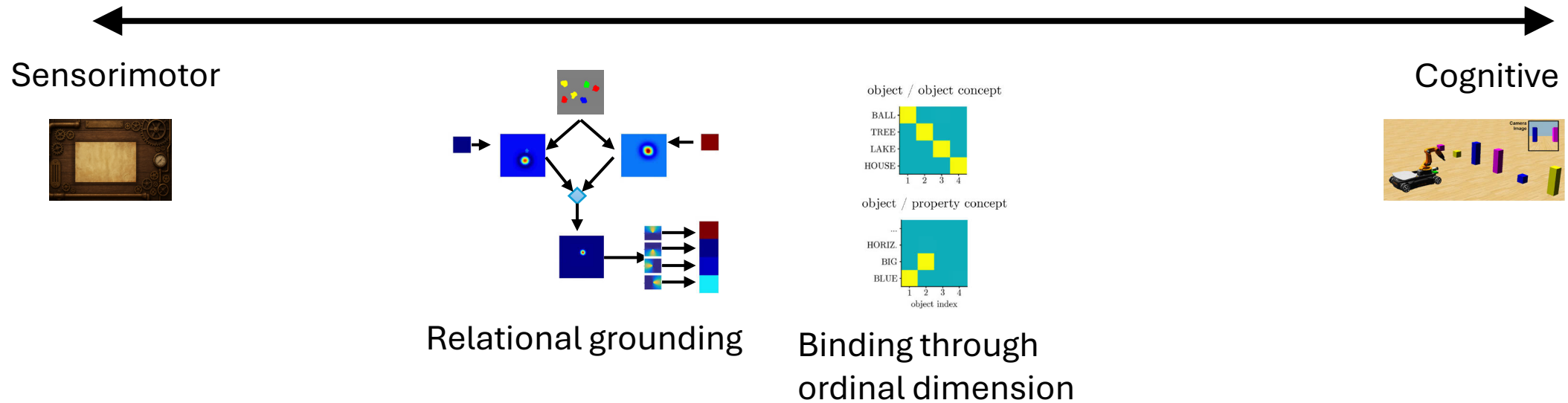


object / property concept



Challenges

- The less dependent the agent becomes from sensory input, the more autonomous and cognitive it is



Conceptual structure

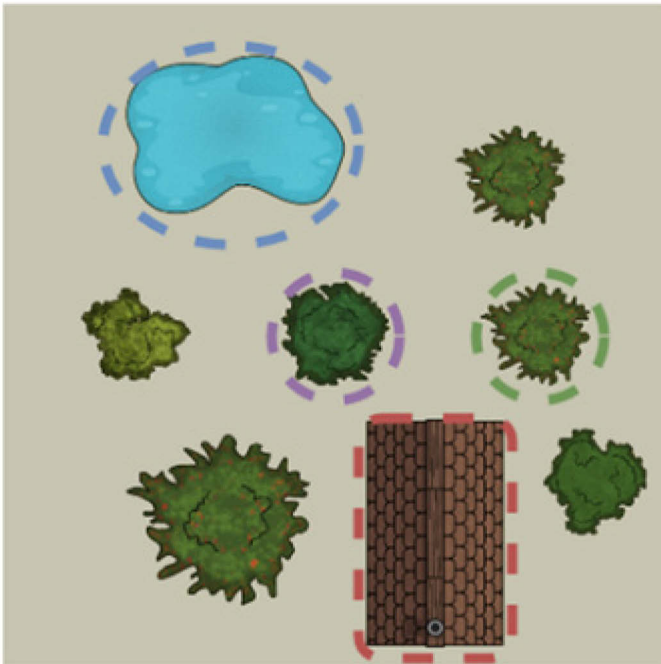
- Expressing identity of instances given multiple relations

Intention: find the **tree** that is:

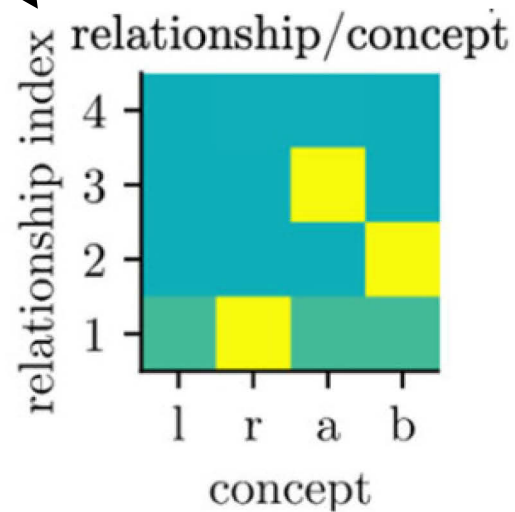
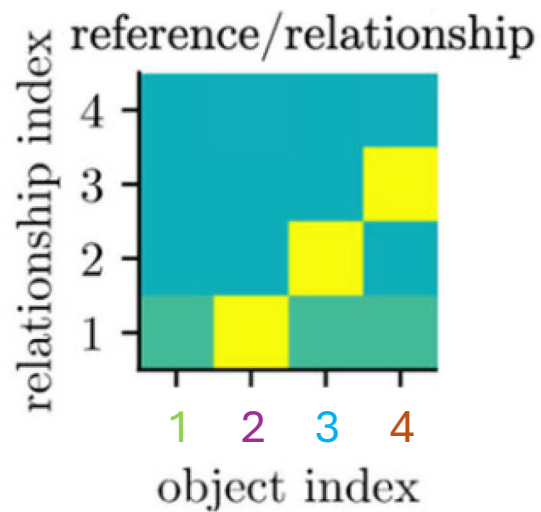
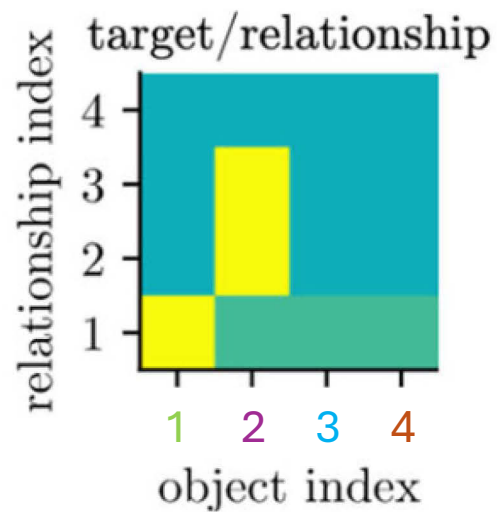
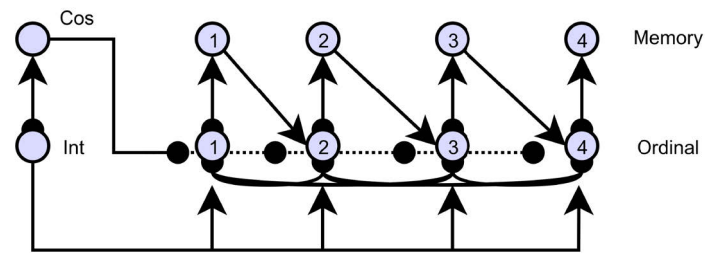
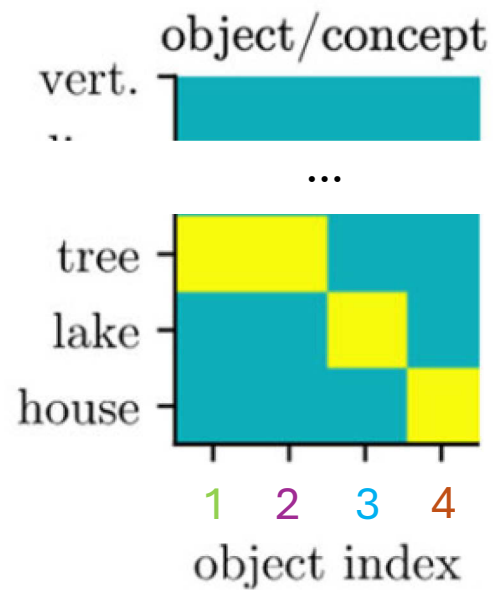
Right-of(**tree**, **tree**)

Below(**lake**, **tree**)

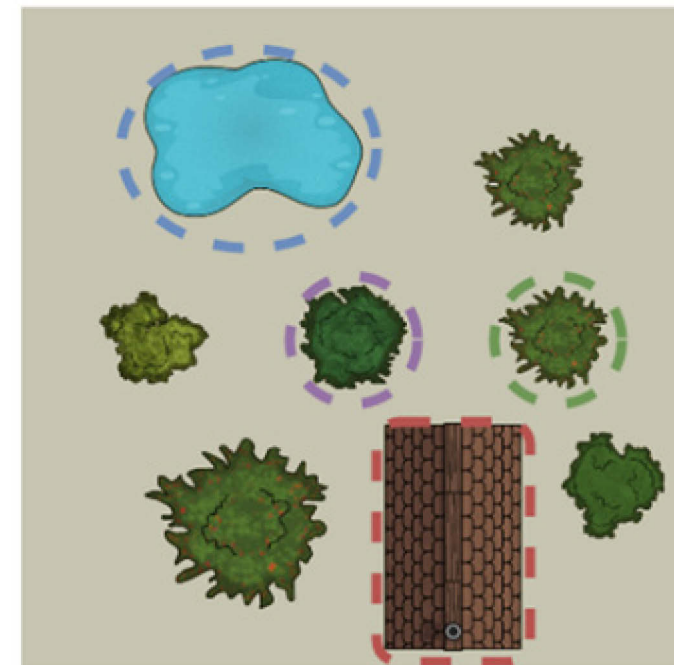
Above(**house**, **tree**)



- Representation of **two** distinct **trees**
- Binding the same **tree** to different roles in different relations



Intention: find the **tree** that is:
 Right-of(**tree**, **tree**)
 Below(**lake**, **tree**)
 Above(**house**, **tree**)

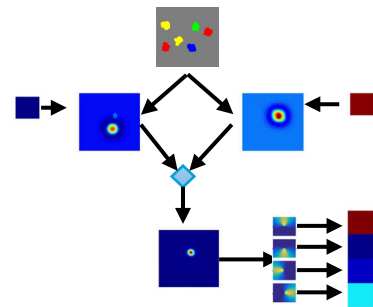


Challenges

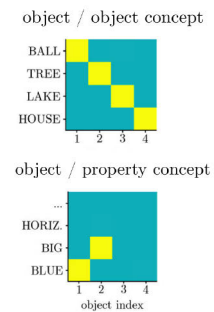
Sensorimotor



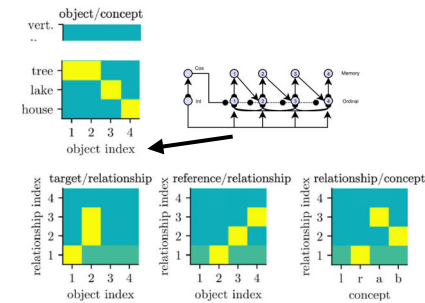
Relational grounding



Binding through
ordinal dimension



Conceptual structure



Cognitive

