Neural Process Models of Intentionality

Jan Tekülve

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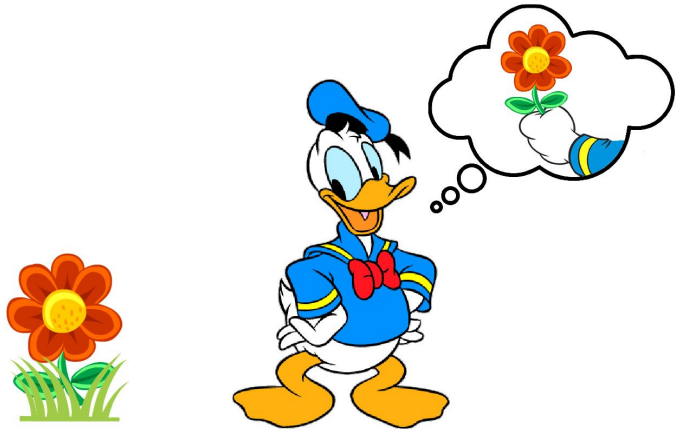
Spectrums of DFT

- Models capturing psychophysical data
- Models capturing behavioral competences
- Models capturing intentional agents?



Intentionality

> *"The capacity of the nervous system to generate mental states that are 'about' things in the world."*

- How may intentional states emerge from neural processes?
- How are intentional states stabilized in time?
- Under which circumstances are intentional states destabilized?

Intentional States

- Defined through a **content** and a **psychological mode**

World-to-Mind Direction of Fit

- I am picking a *red flower* in front of me (Intention-in-Action)
- I will pick a *red flower* later in the park (Prior Intention)
- I want a *red flower* (Desire)

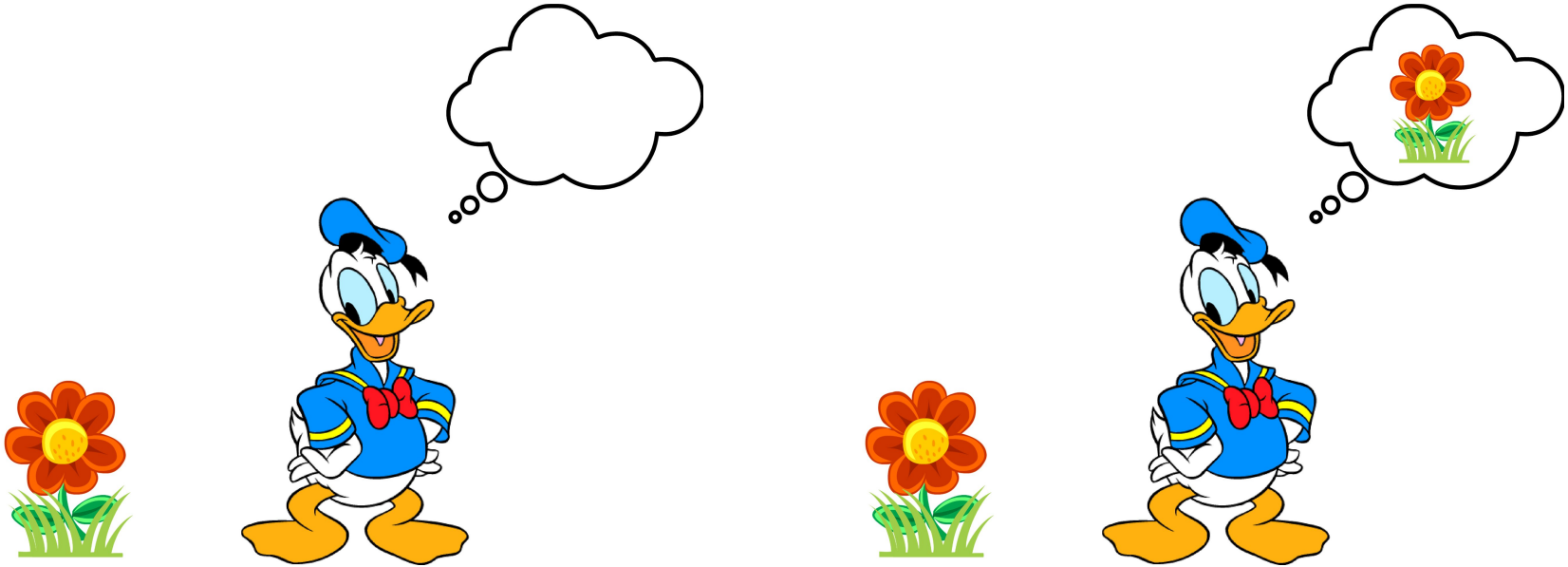
Mind-to-World Direction of Fit

- I am seeing a *red flower* in front of me (Perception)
- I recall a *red flower* growing in the park (Memory)
- I believe *red flowers* have a green stem (Belief)

content

[Searle,1983]

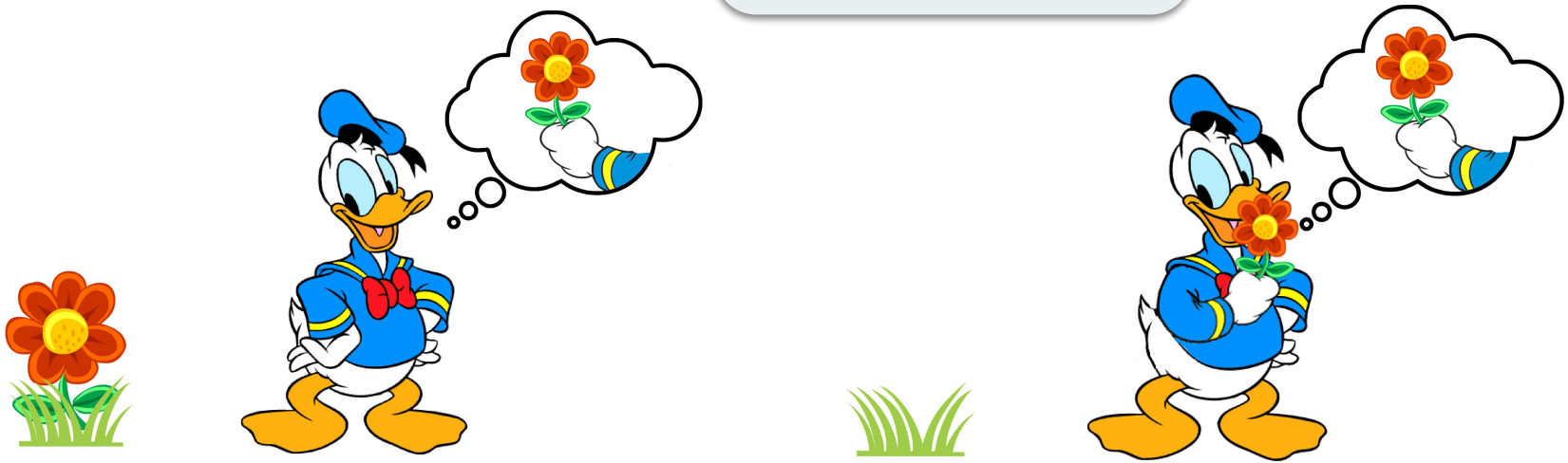
Directions of Fit: Mind-to-World



Example: Perception

Directions of Fit: World-to-Mind

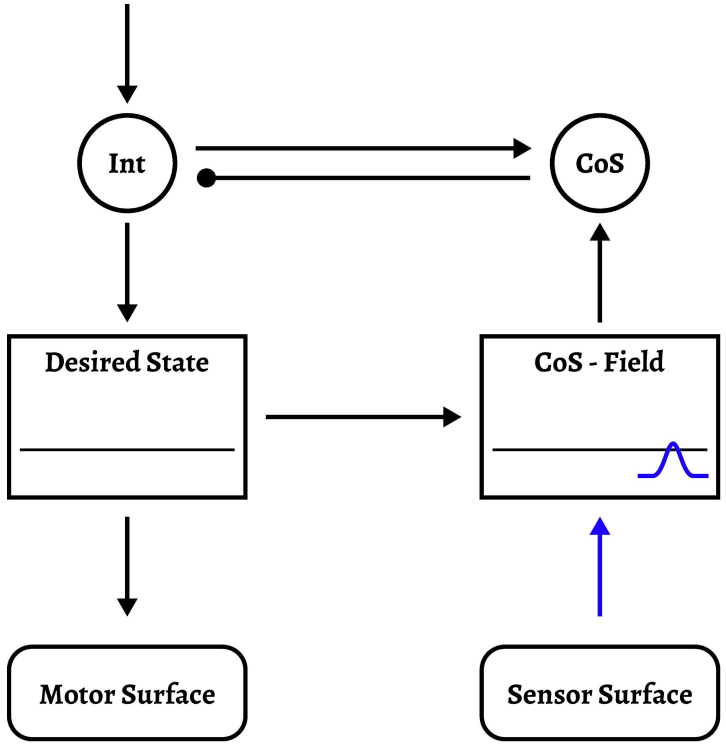
Condition of Satisfaction:
Is the fit achieved?



Example: Intention-In-Action

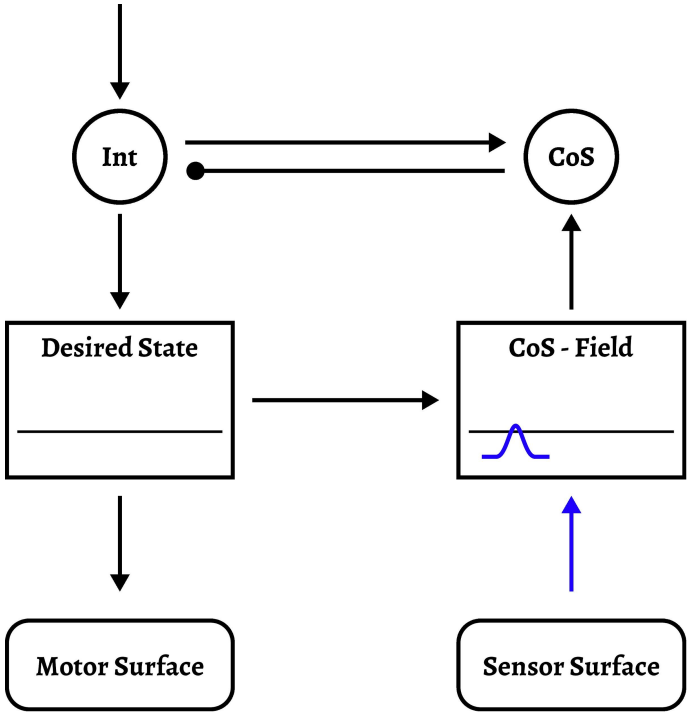
A neural Process Model

- Detects CoS based on sensor information
- Represents action initiation and termination
- Drives motor behavior



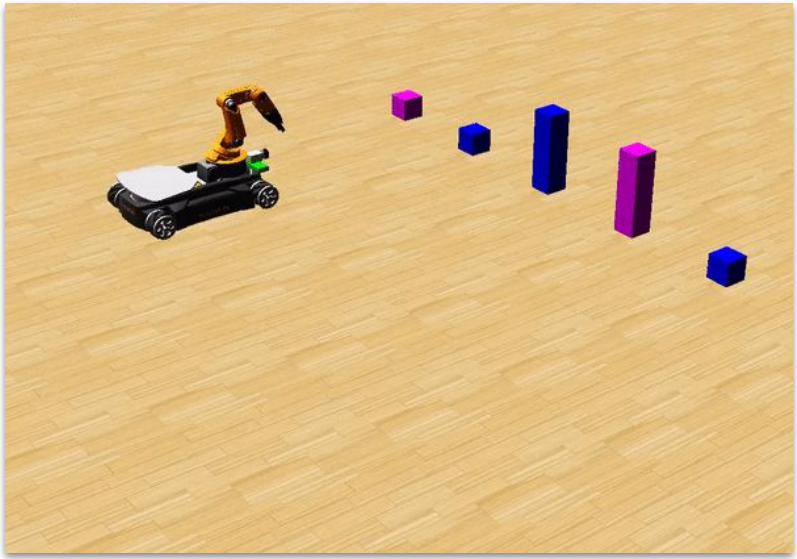
[Sandamirskaya and Schöner, 2010]

Condition of Satisfaction Network



A simple Toy Scenario

- Scenario includes six different psychological modes
- Behavior emerges from autonomous transitions between intentional states
- Stabilized intentional states make up experience
- Experience allows the formation of categorical beliefs



[Tekülve and Schöner, 2019]

Mind-To-World States

Perception

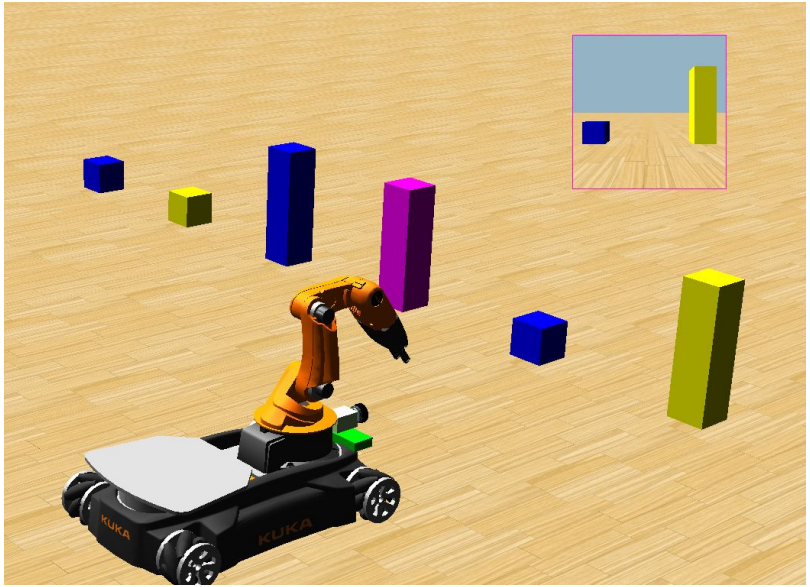
- See Objects (Position, Height, Color)
- Observe Color Change
- Sense Location, Arm , Paint-Device Status

Memory

- Objects in World Space

Belief

- Paint Rules:
  Coat Color + Canvas Color = Result Color



World-to-Mind States

Intention-in-Action

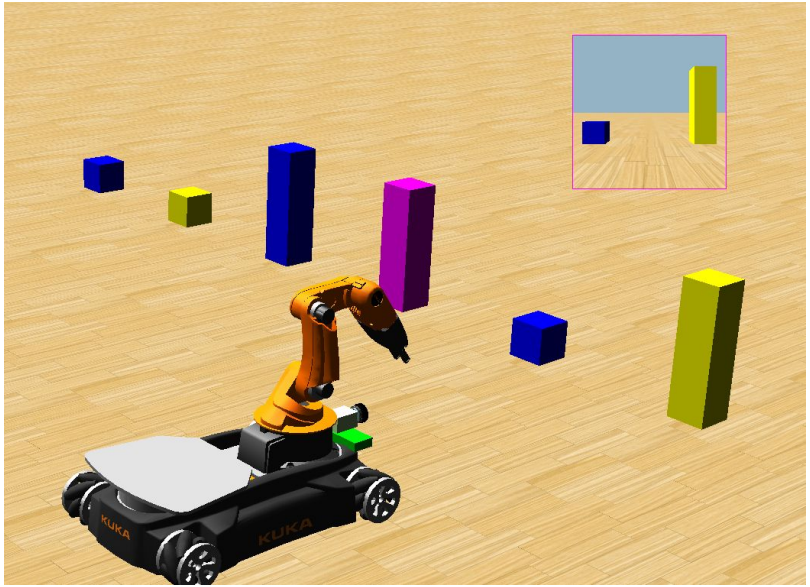
- Move in 1-D Space
- Reach for Objects
- Pick-Up/Dispense Color
- Invoke certain Mind-to-World States

Prior Intention

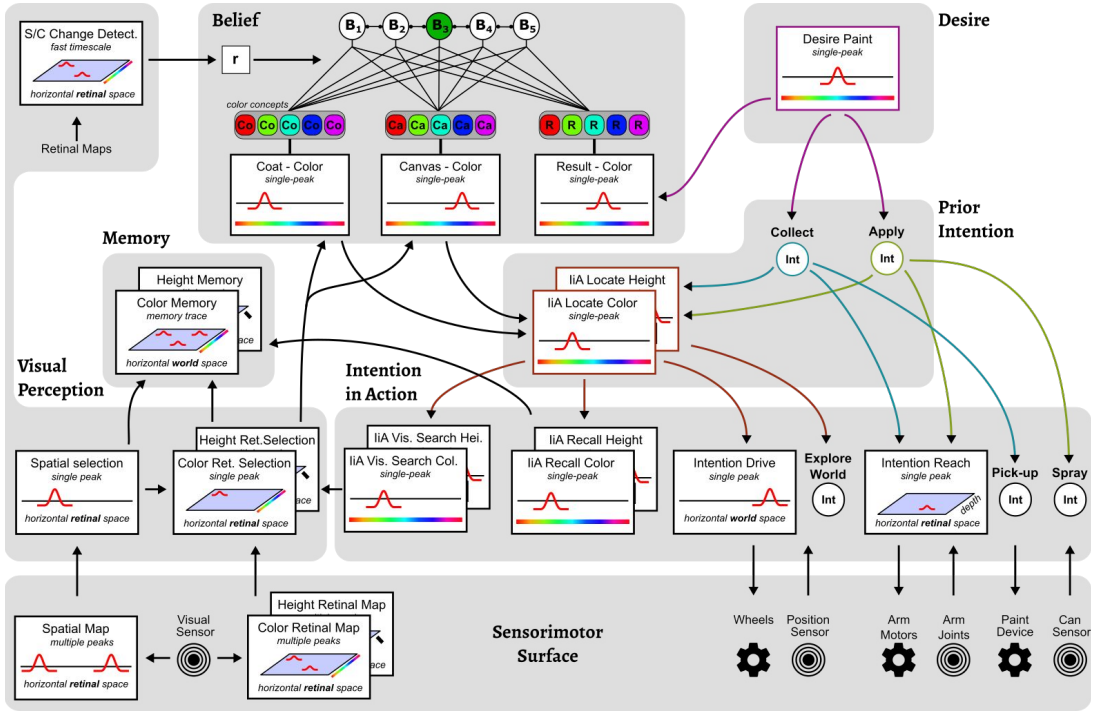
- Locate an Object
- Collect a certain Coat
- Apply Coat on a certain Canvas

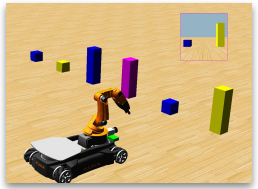
Desire

- Create a certain color

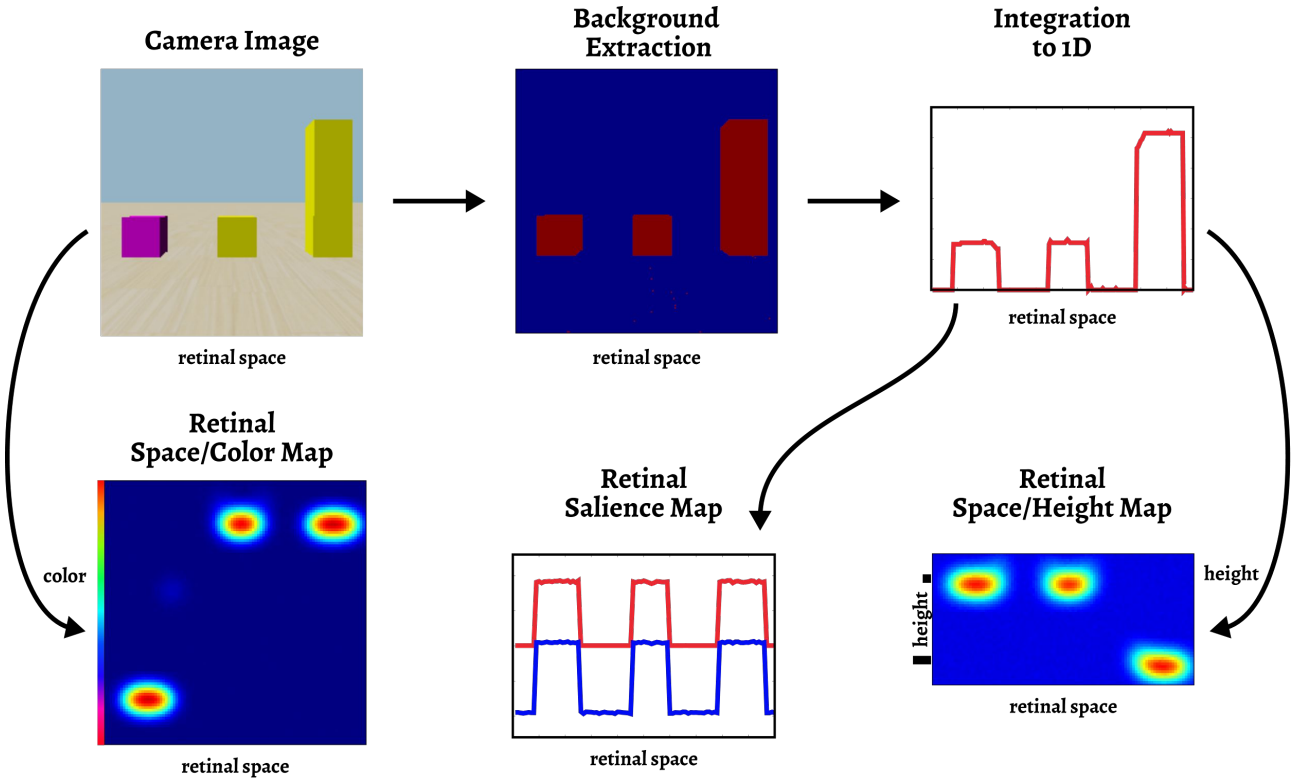


Architecture Overview

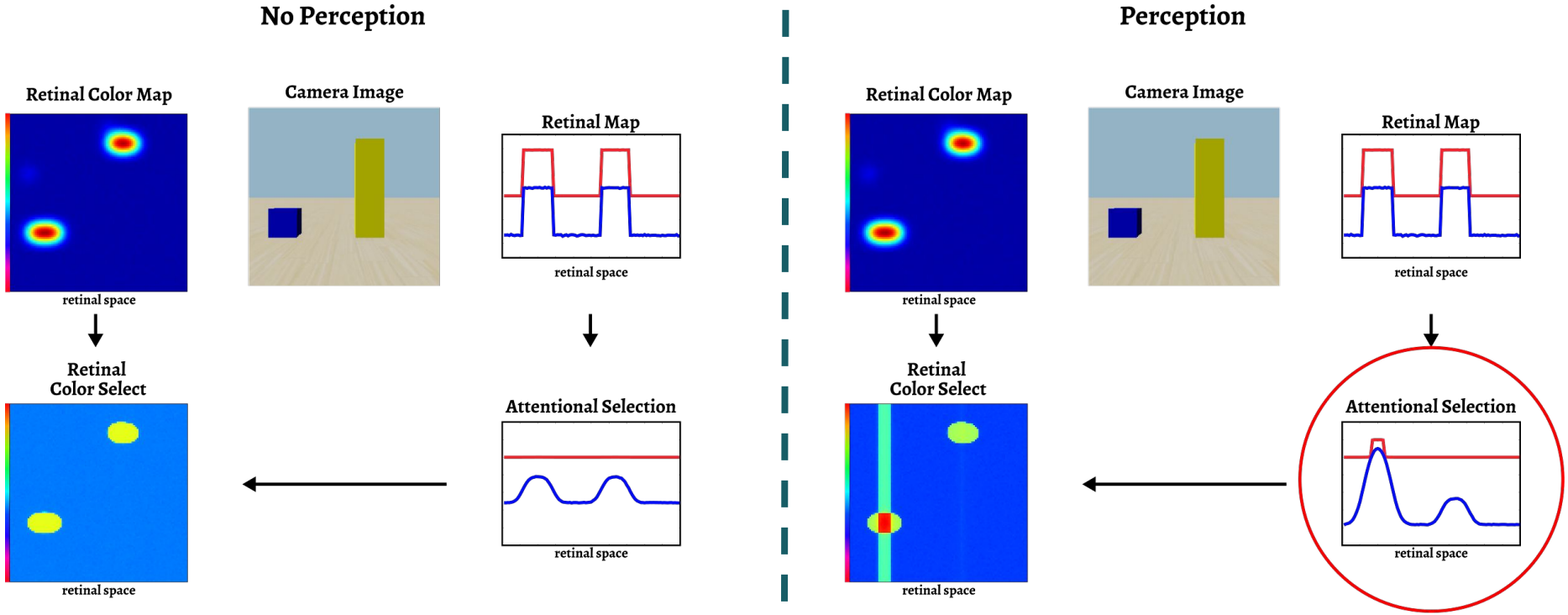




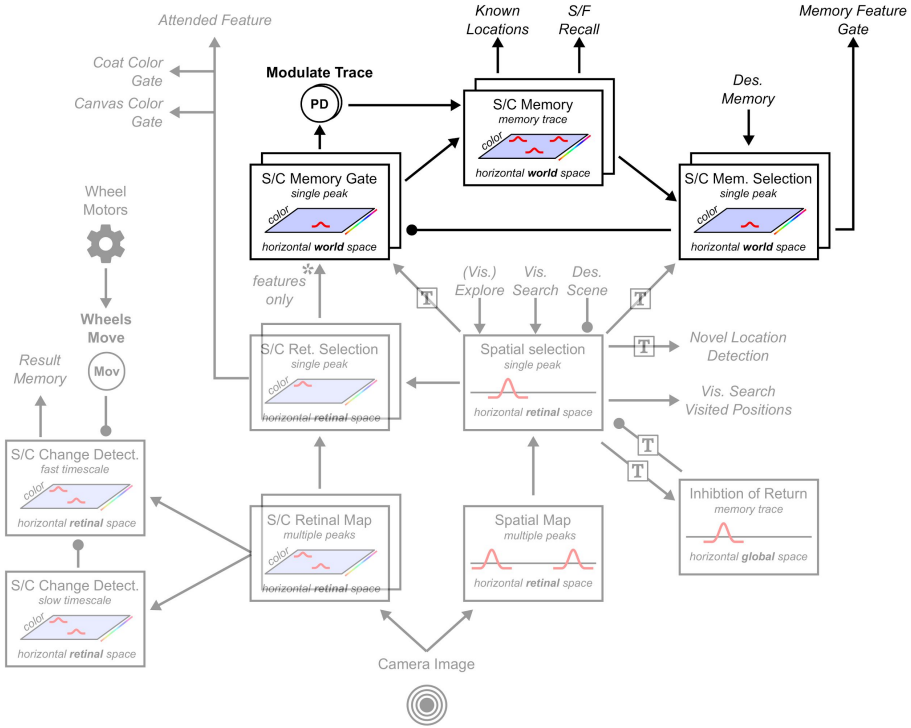
From Sensor to Field



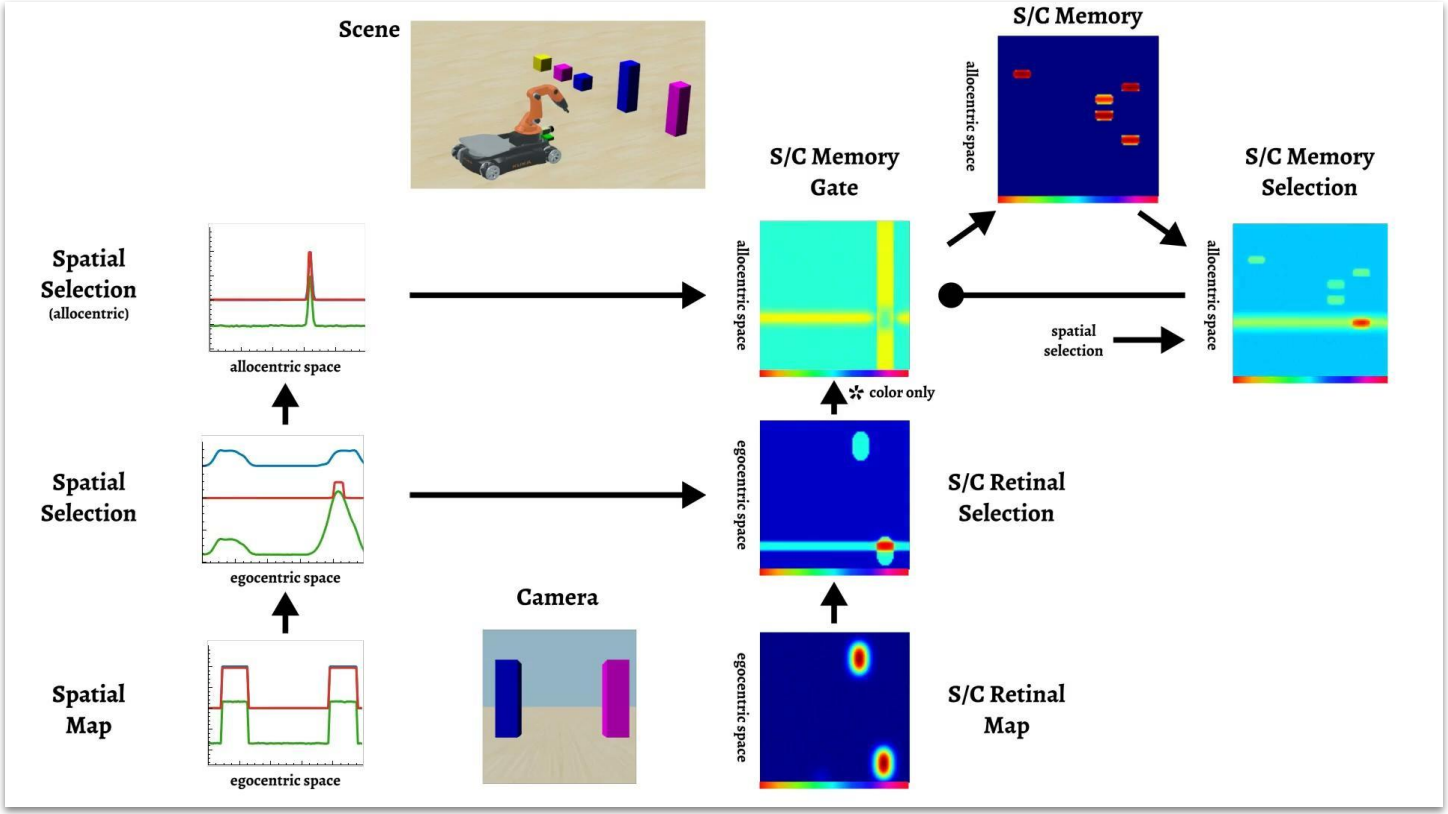
Process Model: Perception



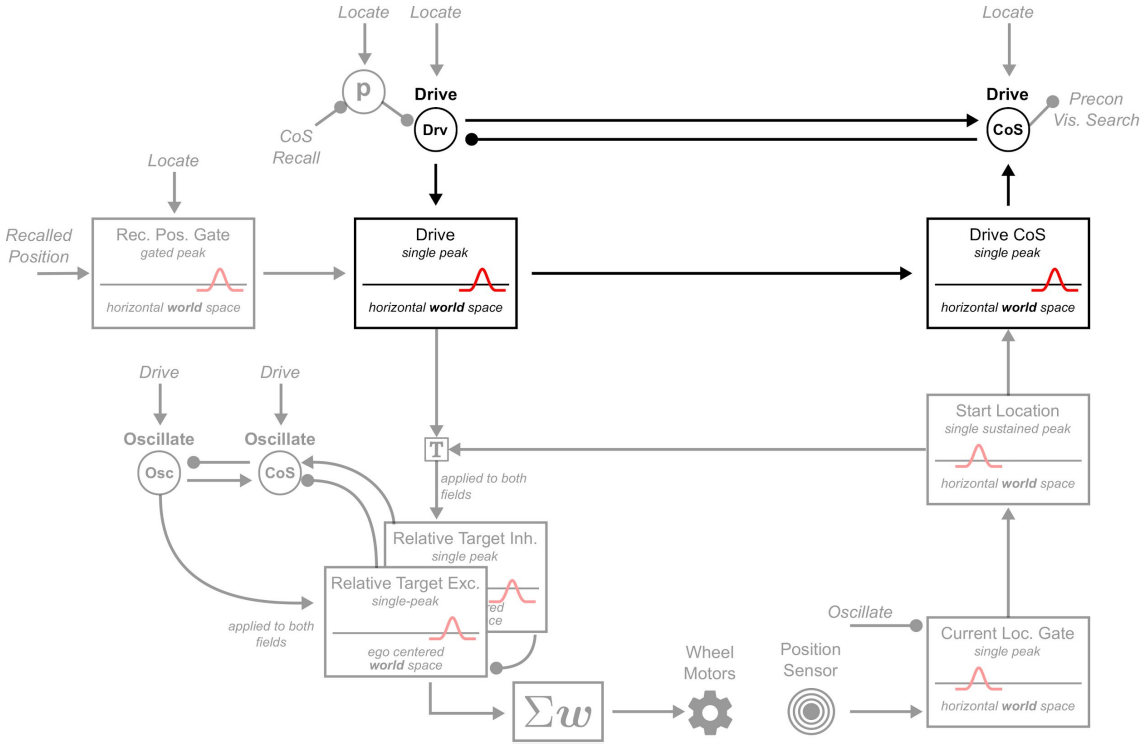
Scene Representation: Perception and Memory



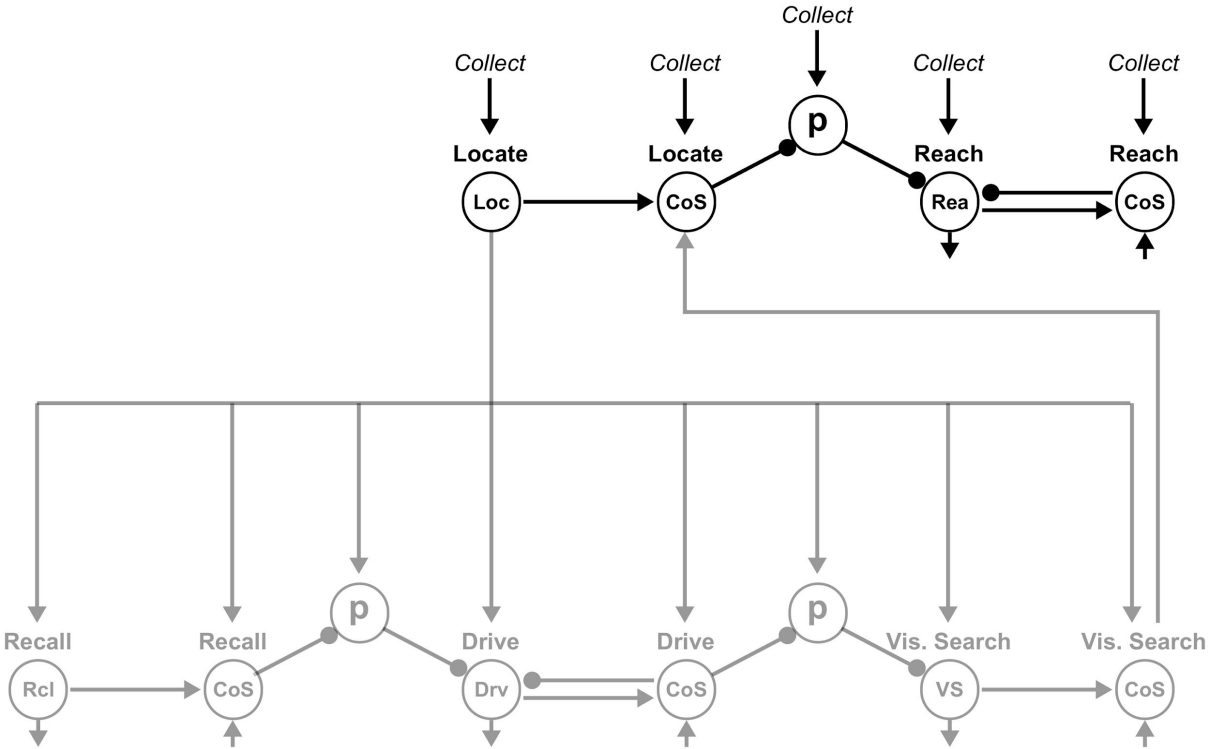
Memory Buildup



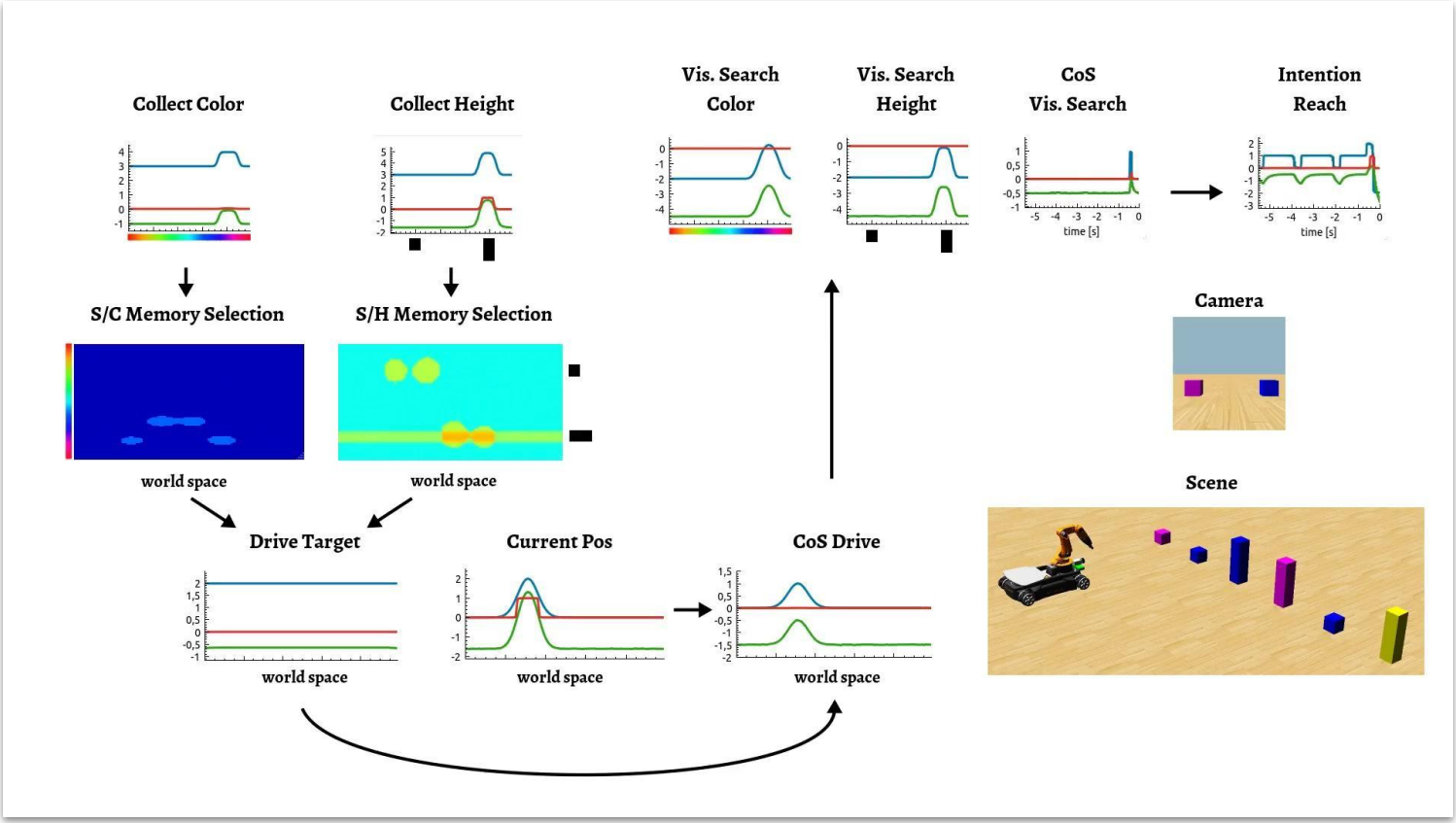
Example: Goal-Directed Driving



Prior Intentions



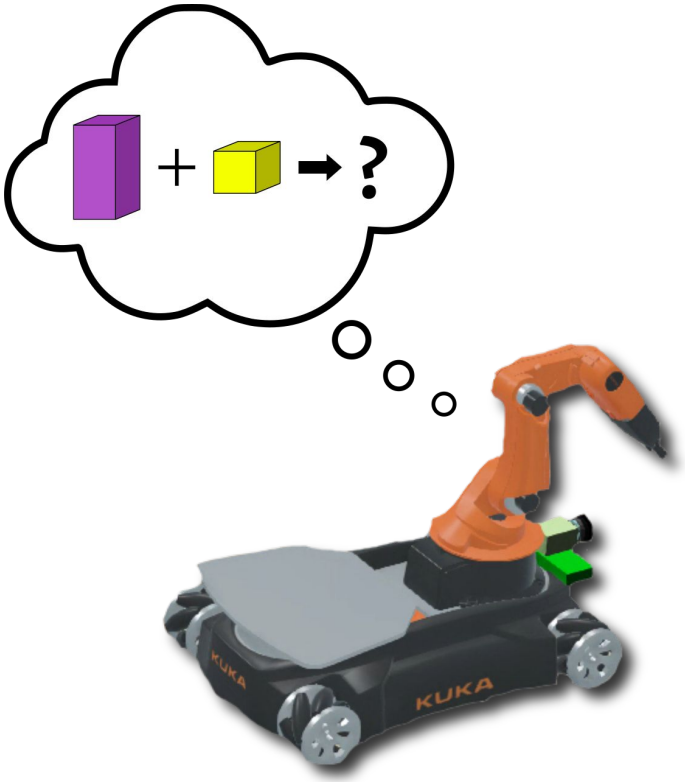
Collecting Sequence



Autonomous Learning

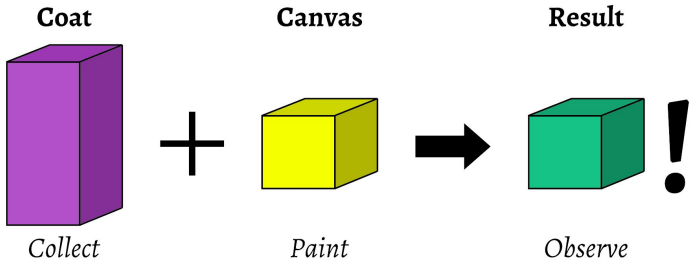
- **Requirements**
  - Autonomous Action
  - Meaningful Experience

- **Problems:**
  - Content Abstraction
  - Temporal Organization

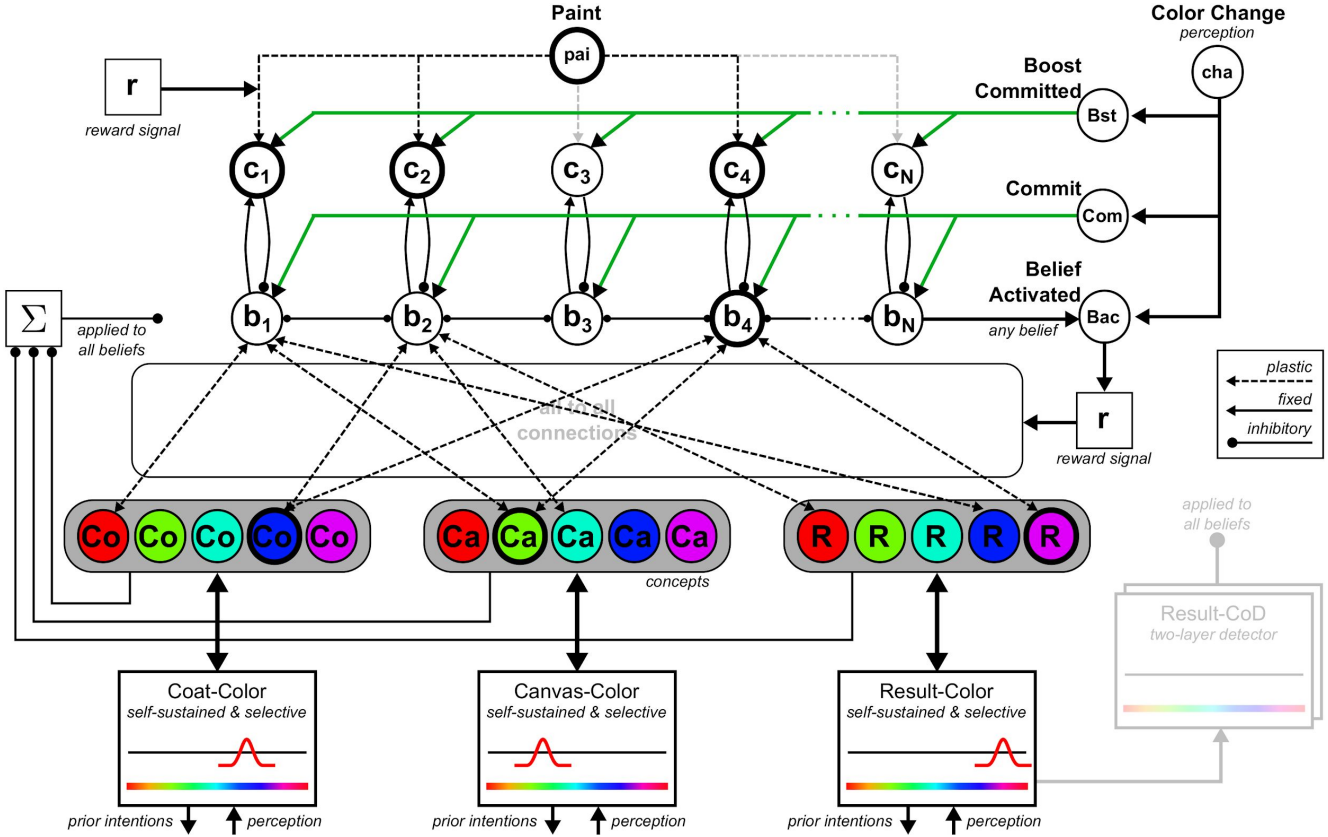


Beliefs

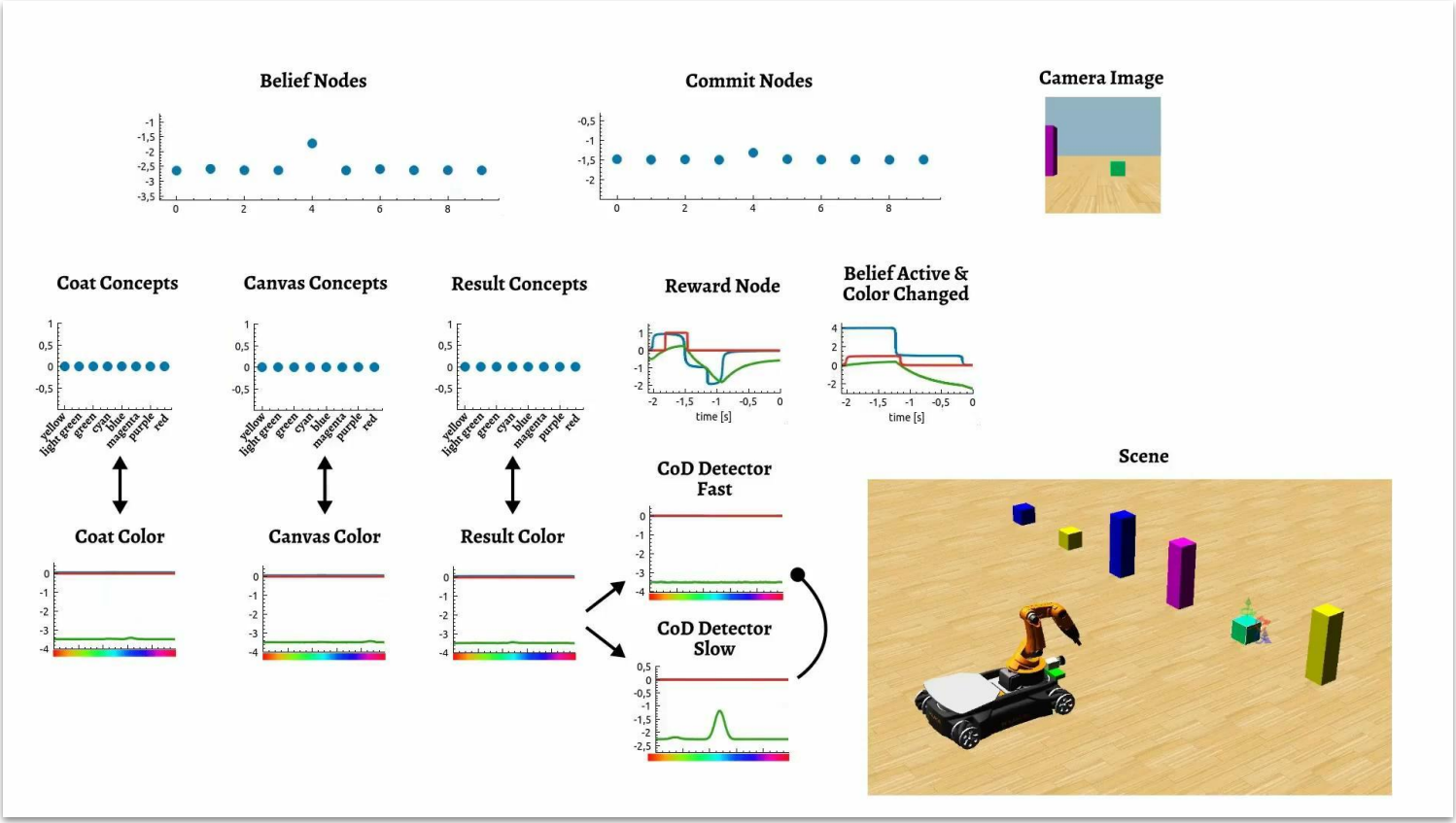
- Learning from a single episode
- Cued activation to guide behavior
- Rejection in the face of conflicting evidence

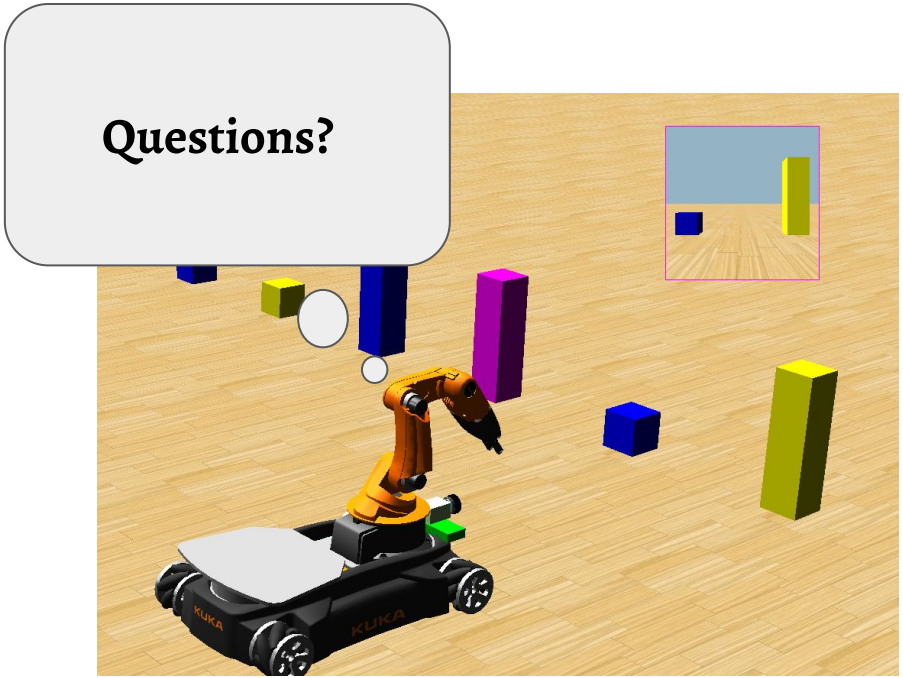


Belief Architecture



Belief Recall and Rejection



Conclusion

- From the sensorimotor surface to abstract representations
- Process models of different psychological modes
- Autonomous learning requires infrastructure