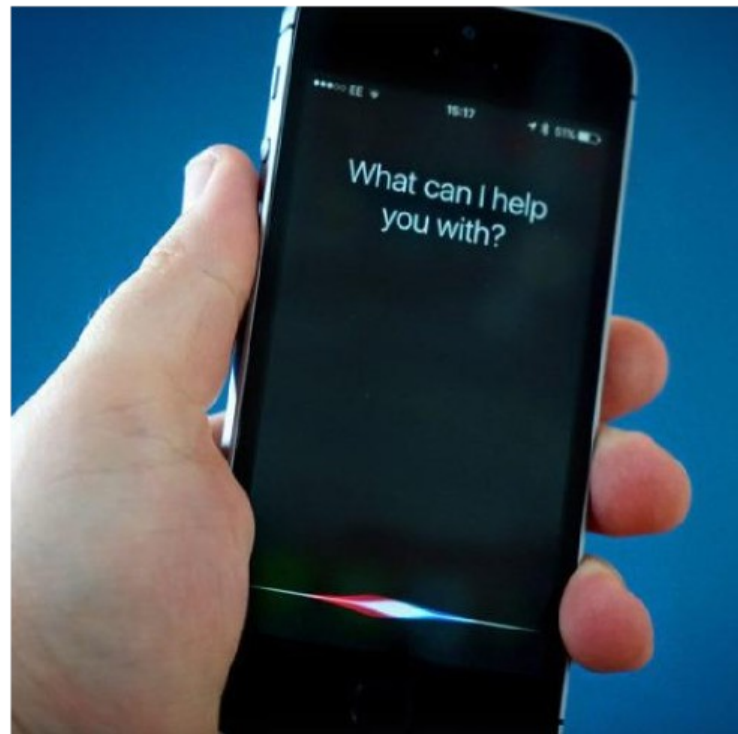
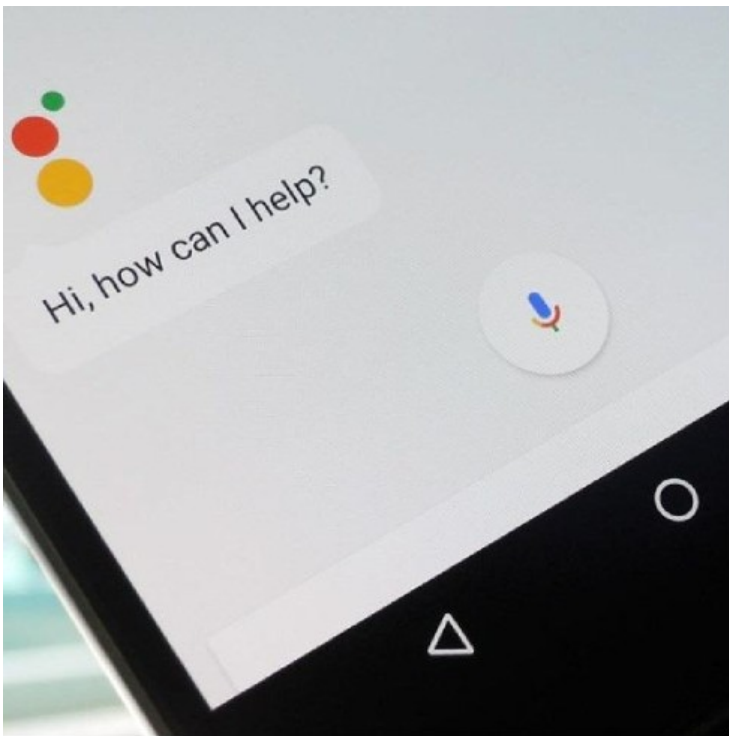


# Higher cognition in dynamic field theory

Mathis Richter





Hallo, wie kann ich dir helfen?

was ist ein Elefant



Einen Moment!

## Ele·fant

/ele'fant, Elefánt/

*Substantiv, maskulin*

1. großes, massiges (Säuge)tier von grauer Hautfarbe mit sehr großen Ohren, einem Rüssel und Stoßzähnen
2. sich [anderen Menschen gegenüber] ungeschickt, plump, taktlos verhalten

 Suche

Was essen Elefanten?


Was



Secure | <https://cloud.google.com/vision/>

Google Cloud

Products




Elephants And Mammoths	99%
Elephant	99%
Wildlife	98%
Grassland	97%
Terrestrial Animal	96%
Ecosystem	95%


Secure | <https://www.captionbot.ai>

Microsoft

## CaptionBot



I think it's a elephant that is standing in the dirt.



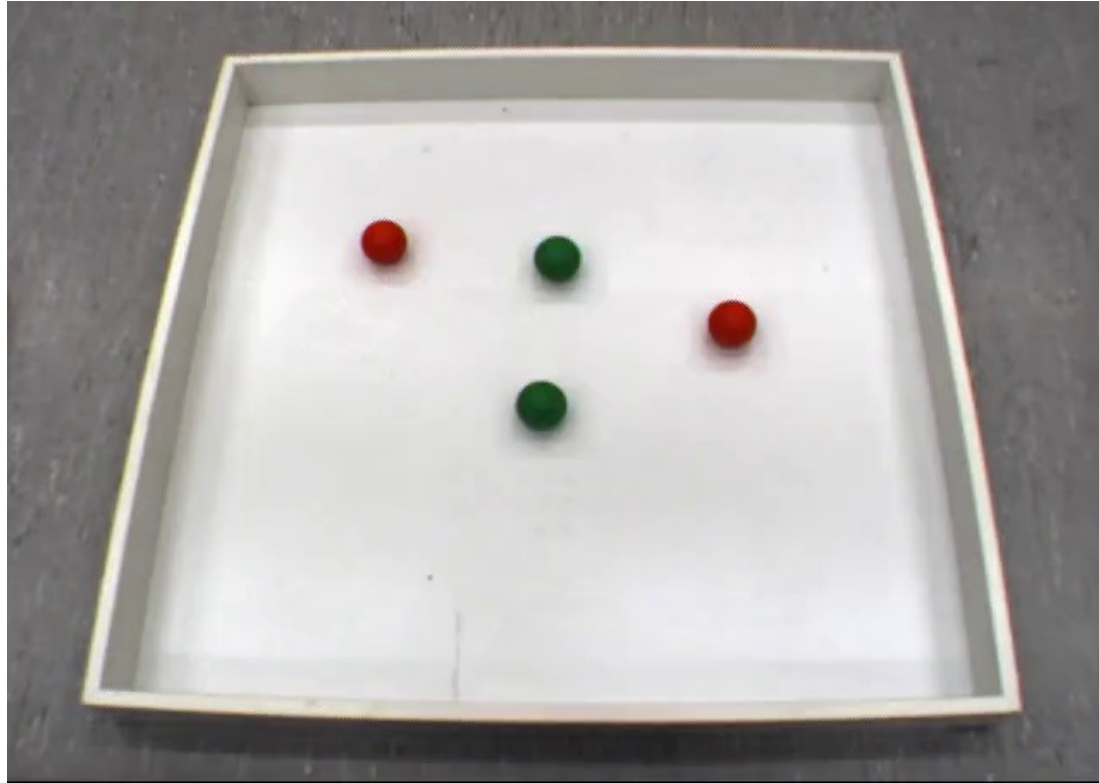


Describing

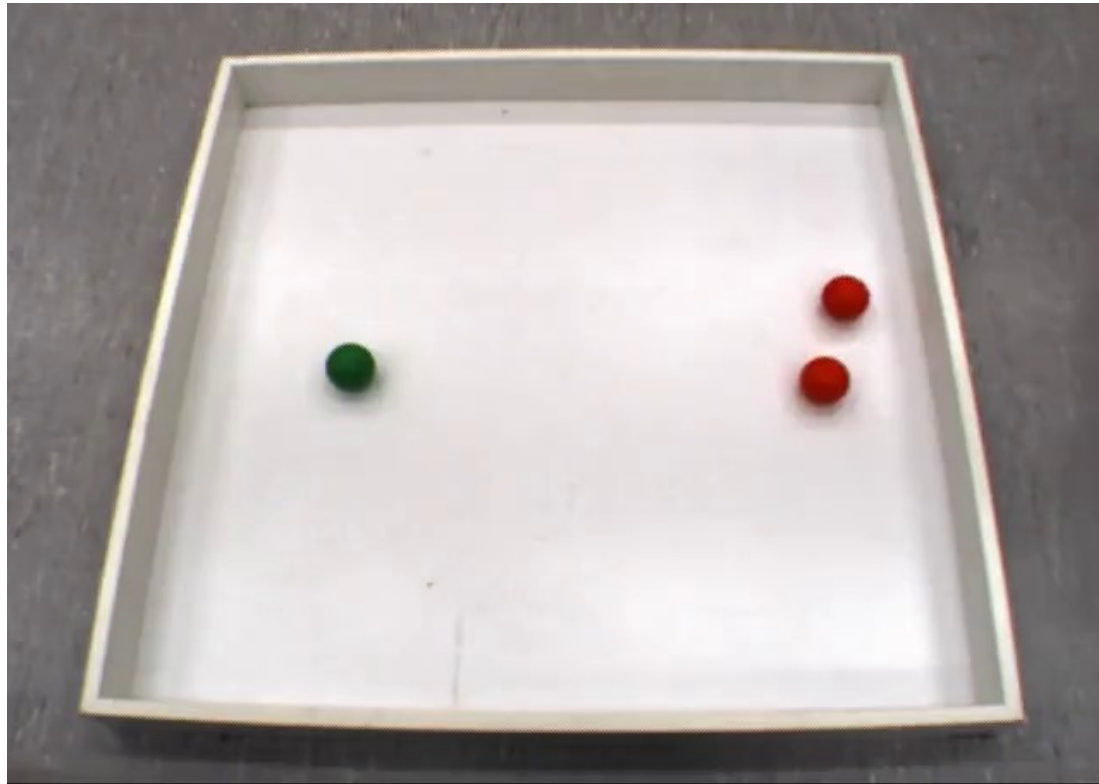


Grounding

A baby elephant is walking toward its mother

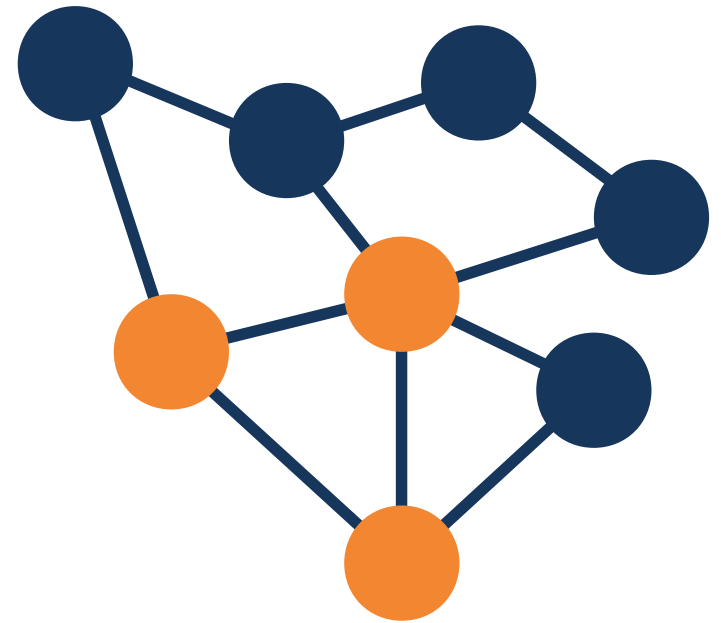


The red object to the left of the green object.



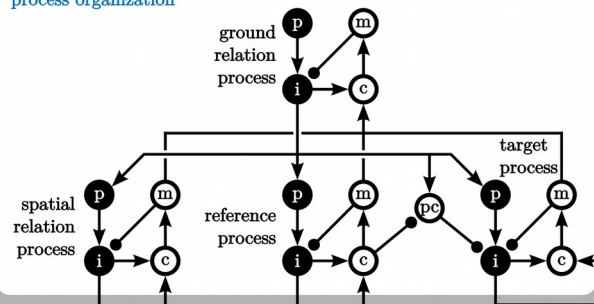
The red object moving toward the green object.

How can neural networks solve such problems?

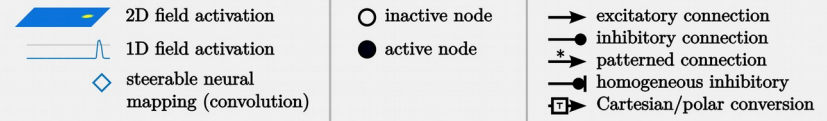




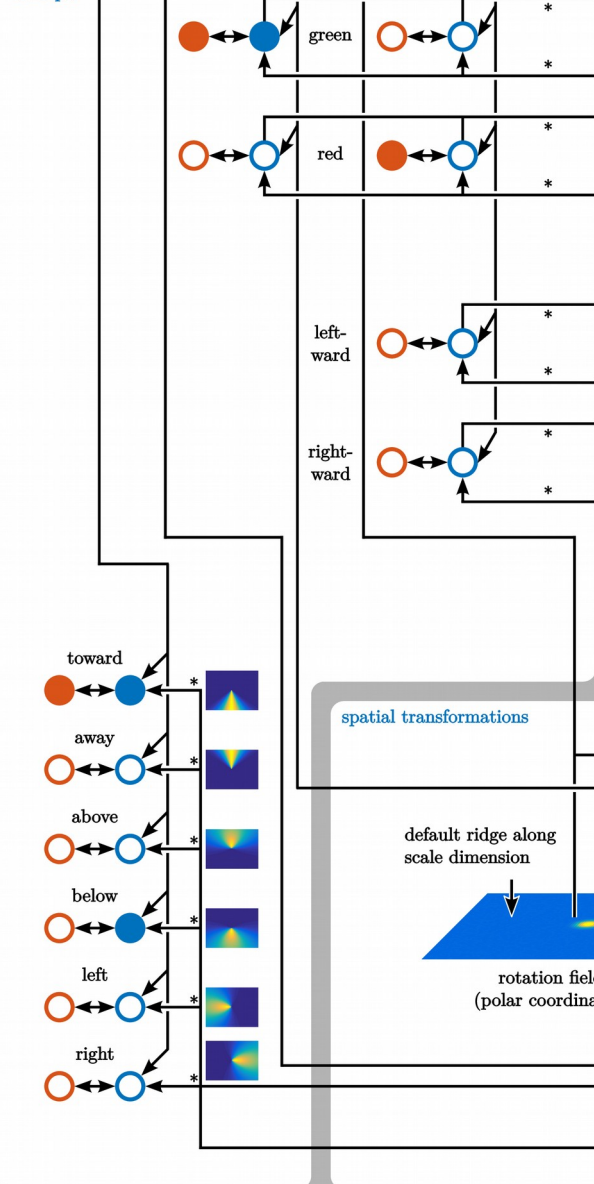
process organization



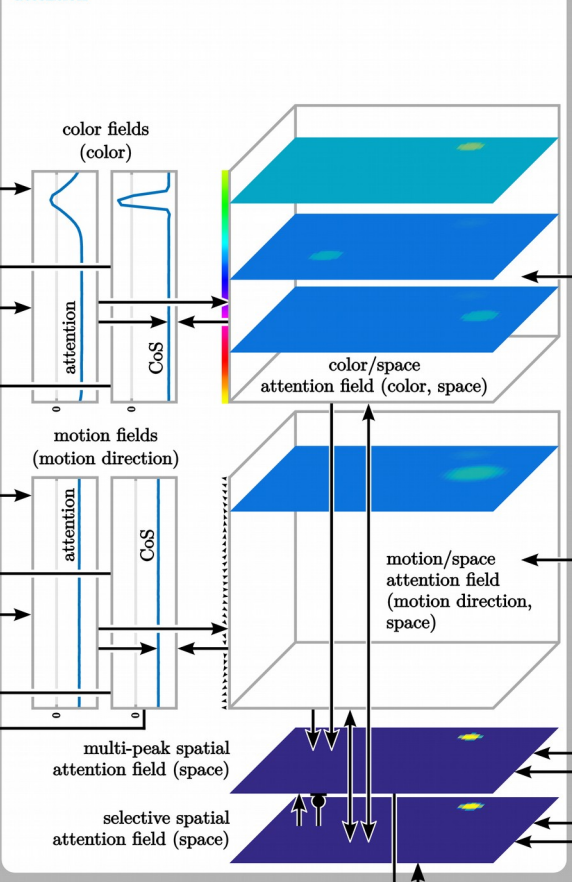
notation



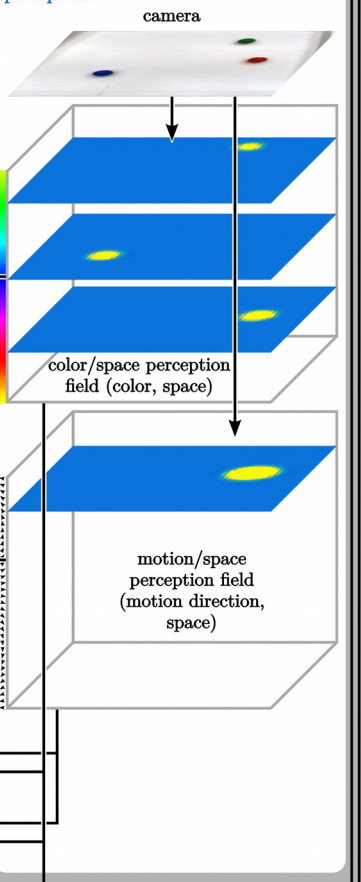
concepts



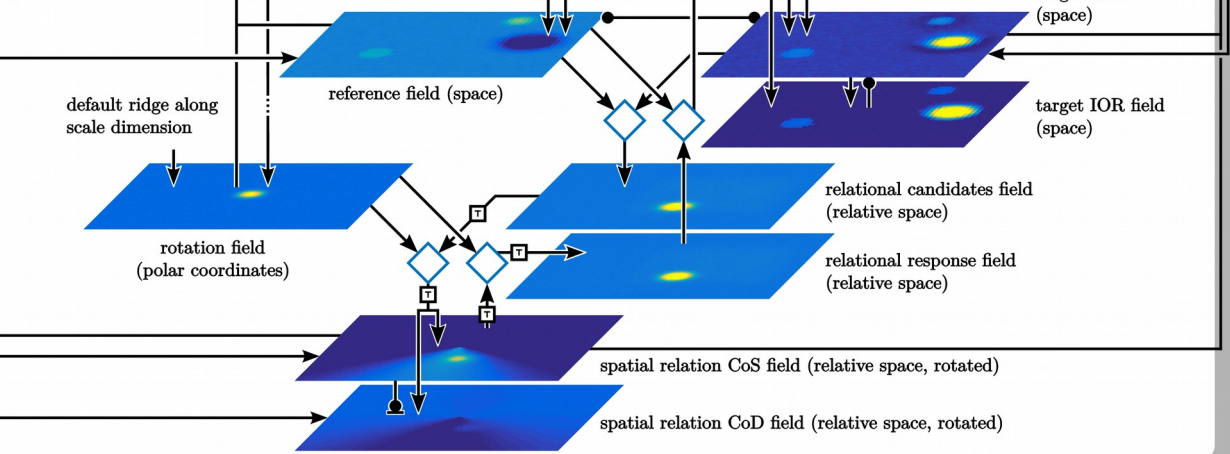
attention



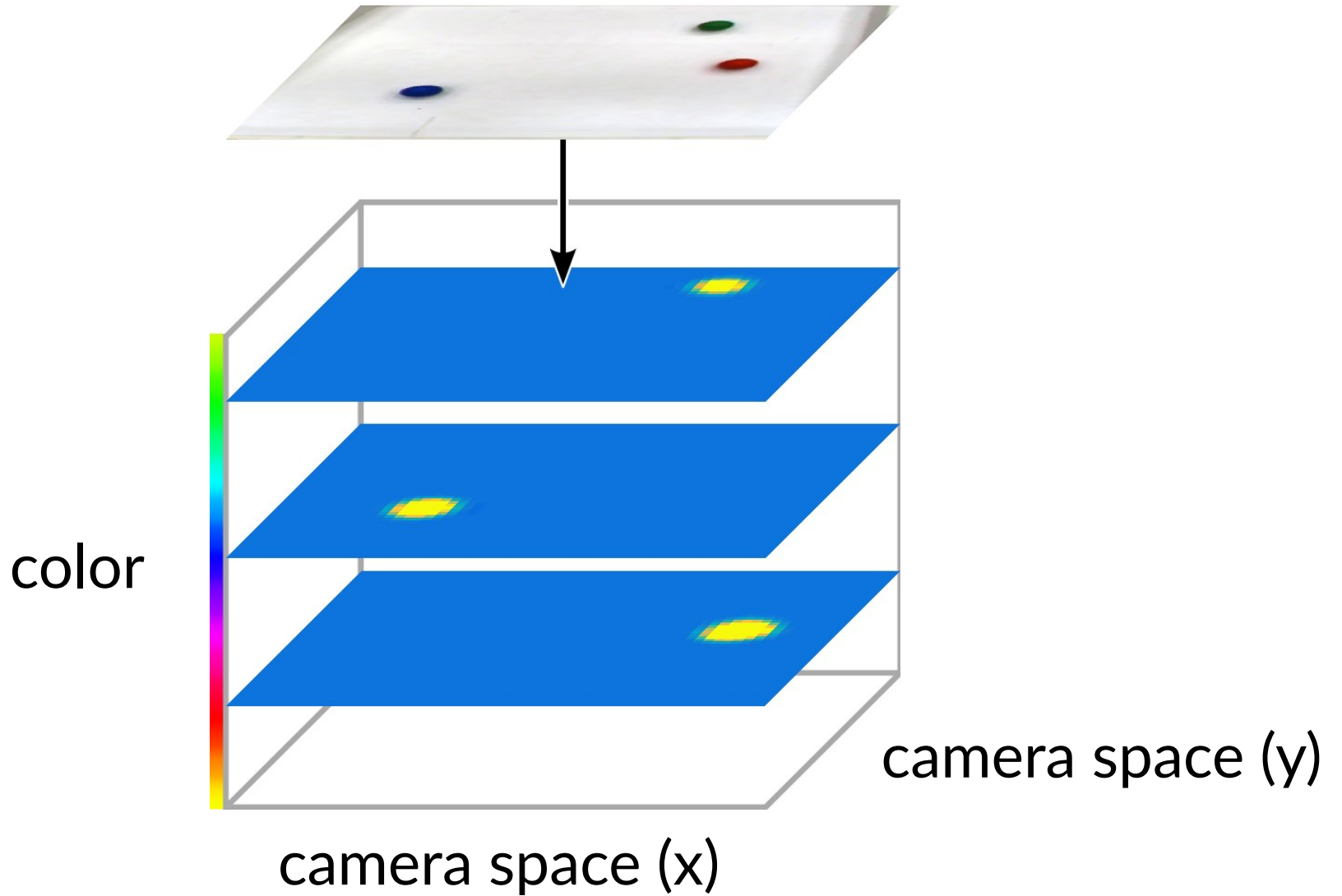
perception



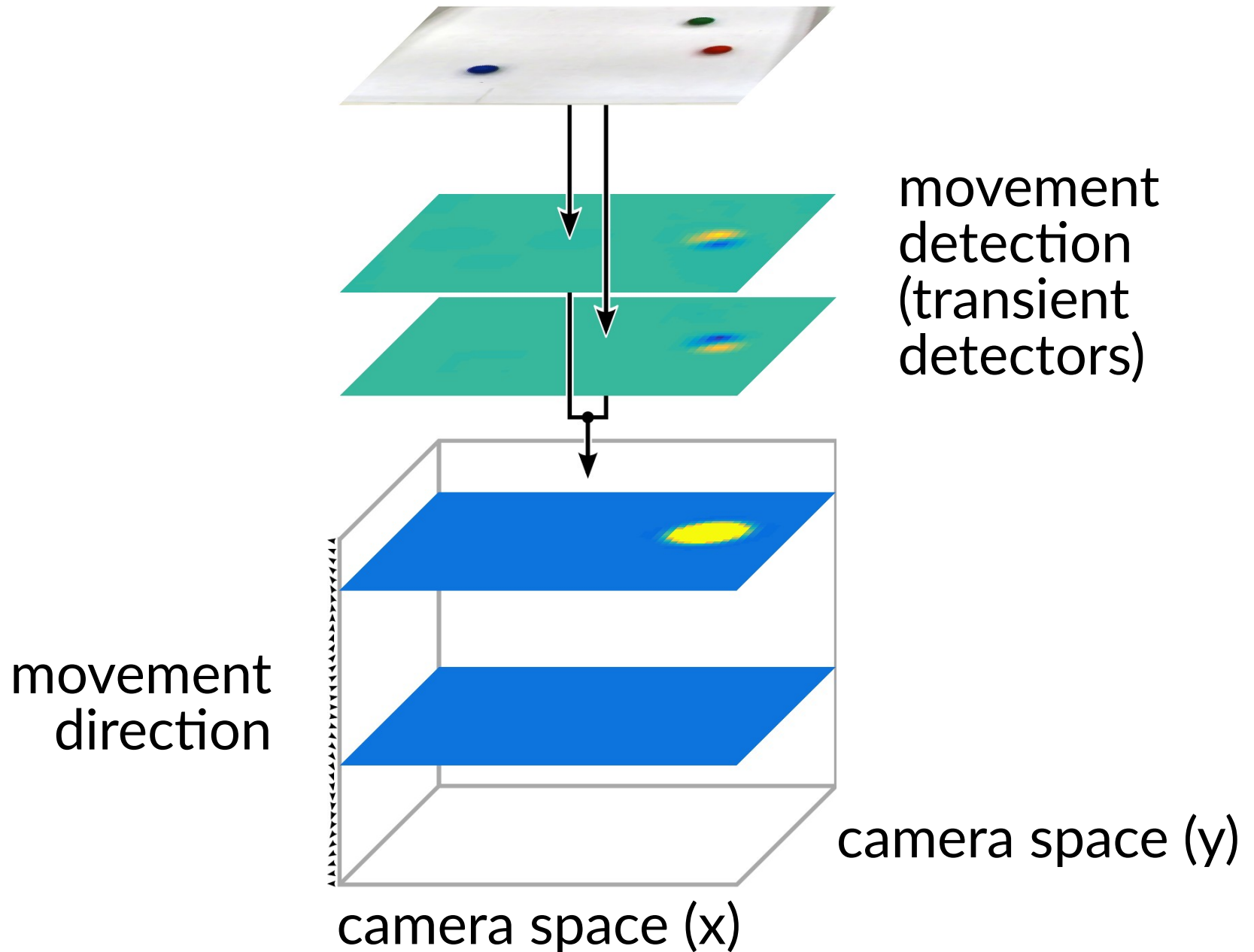
spatial transformations



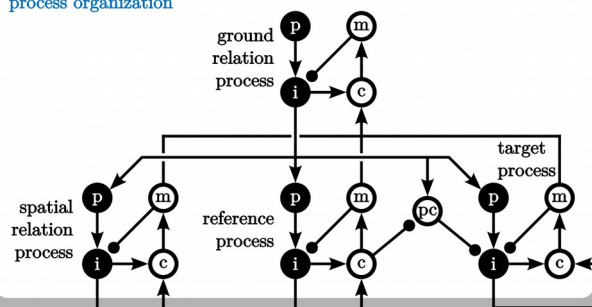
# Perception



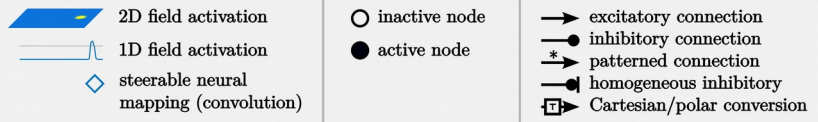
# Perception



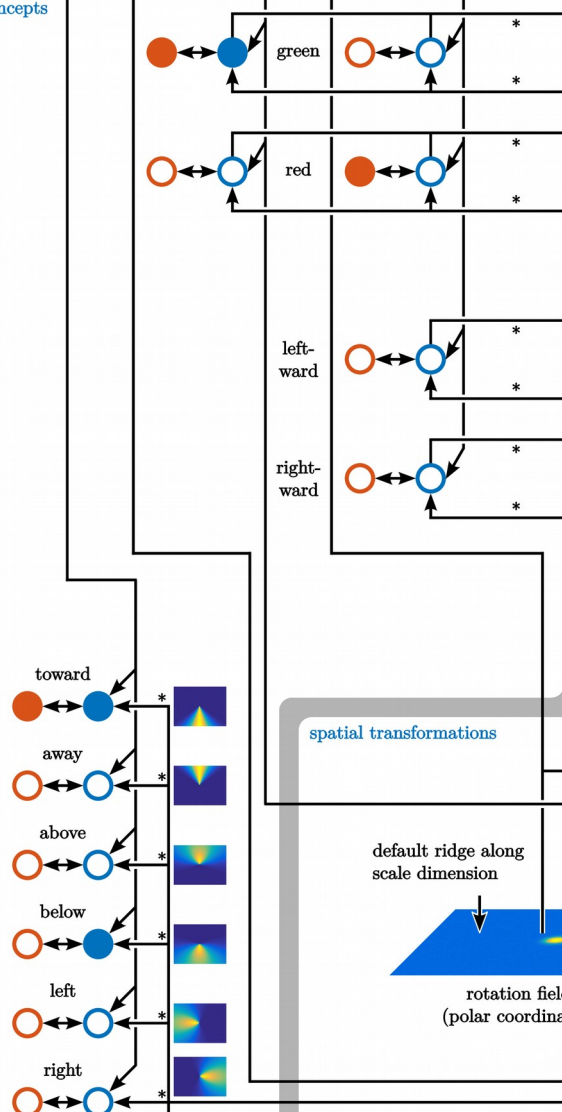
process organization



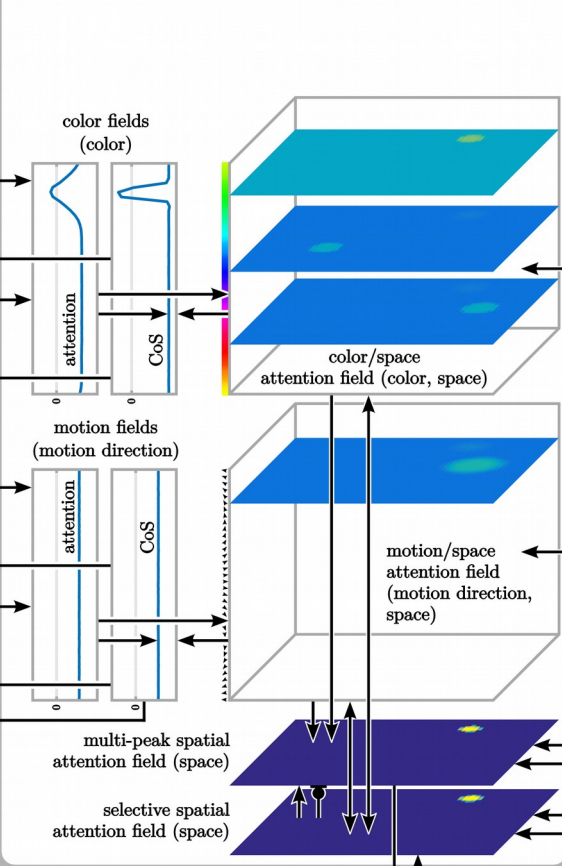
notation



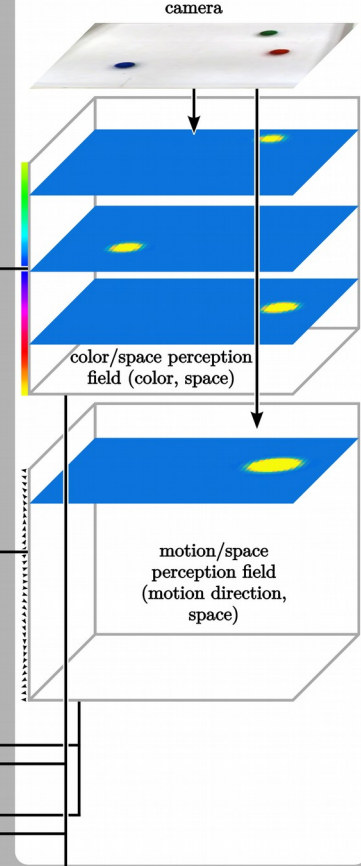
concepts



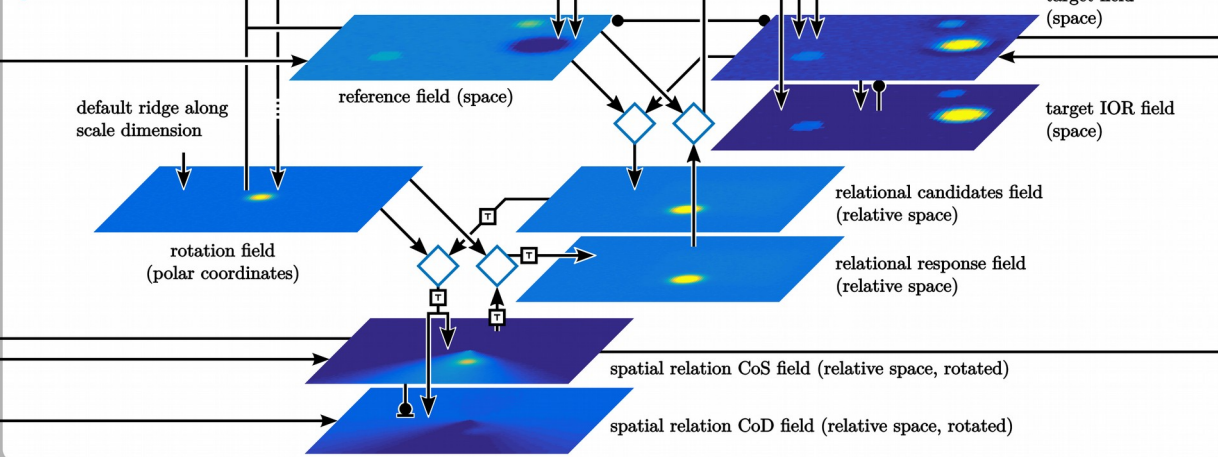
attention



perception

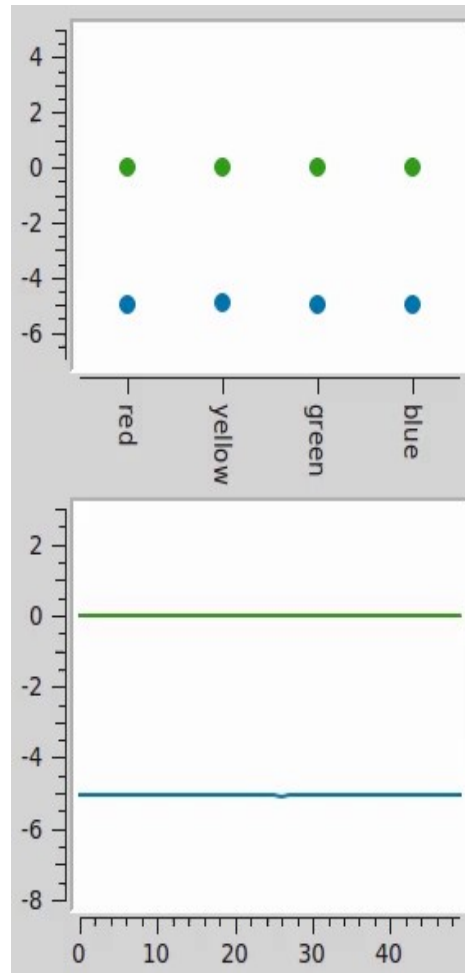


spatial transformations



# Categorical color concepts

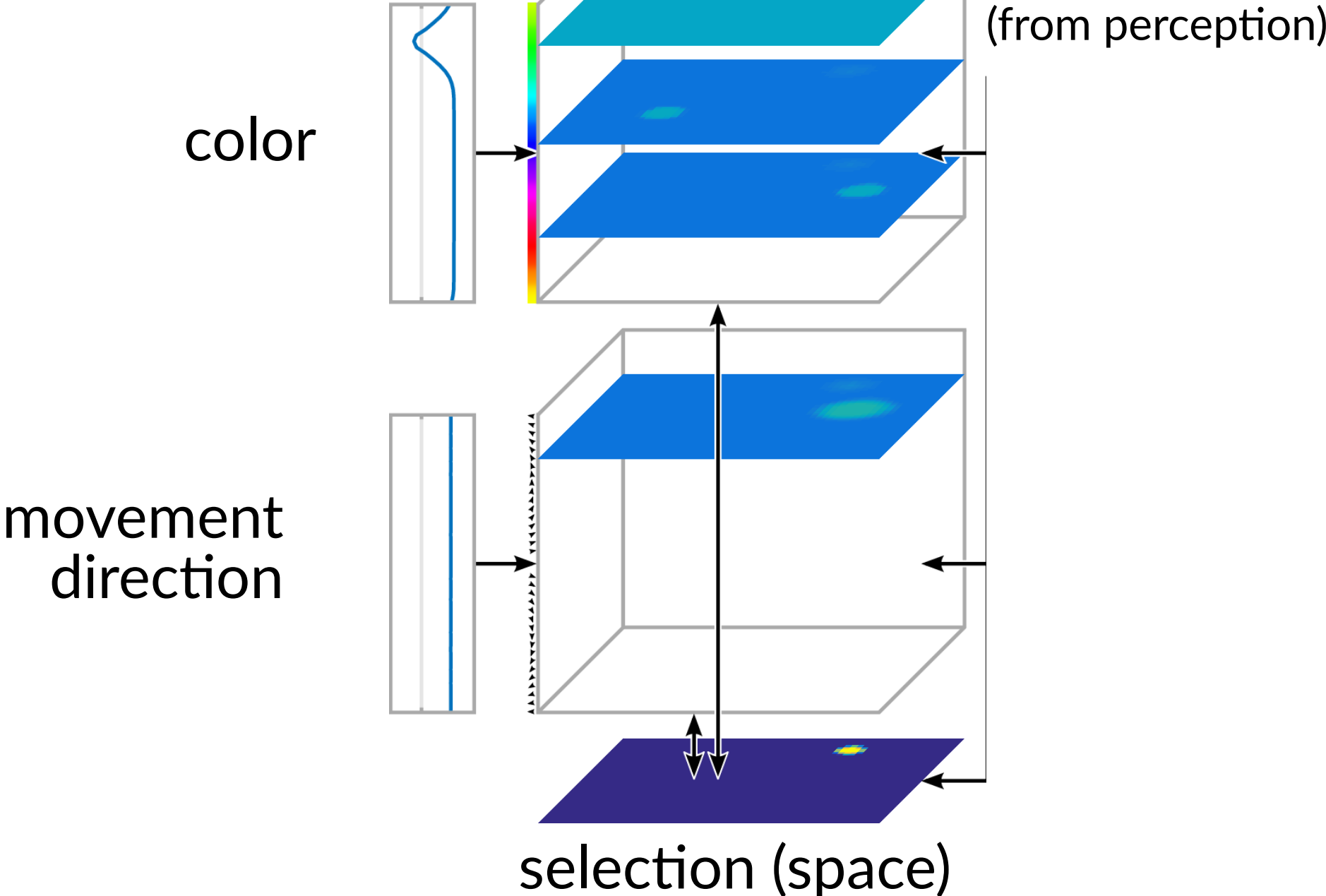
color categories



color field

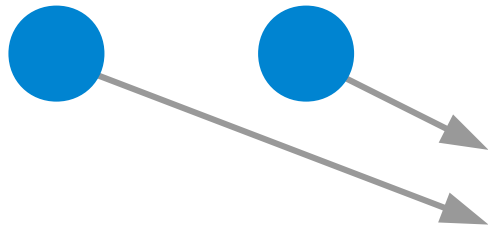
● output  
● activation

# Selection

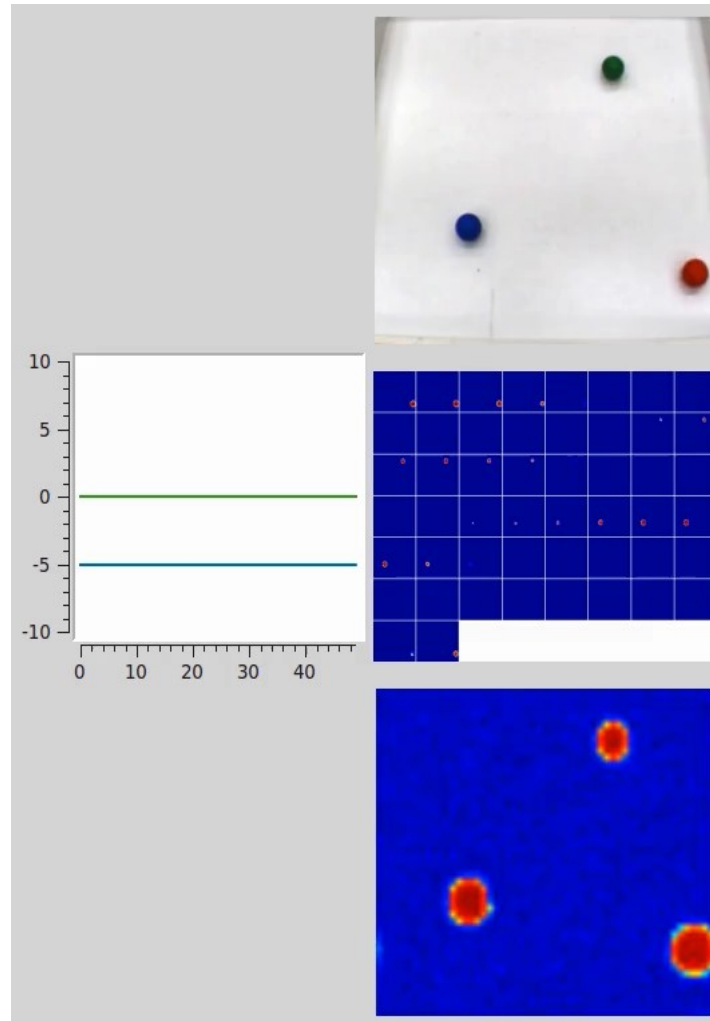


# Selection

“green” “blue”



color field

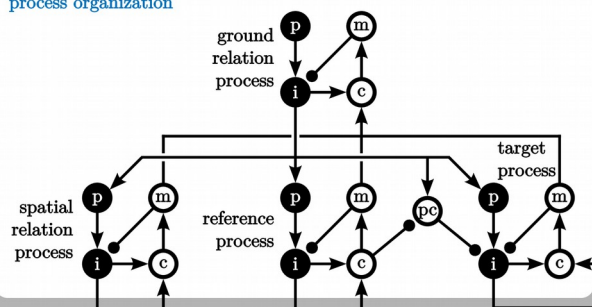


video

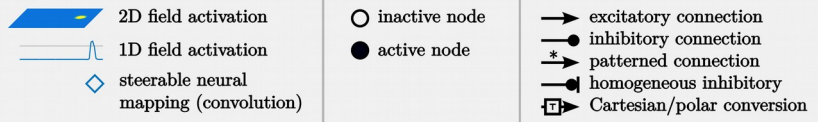
selection (color space)

selection (space)

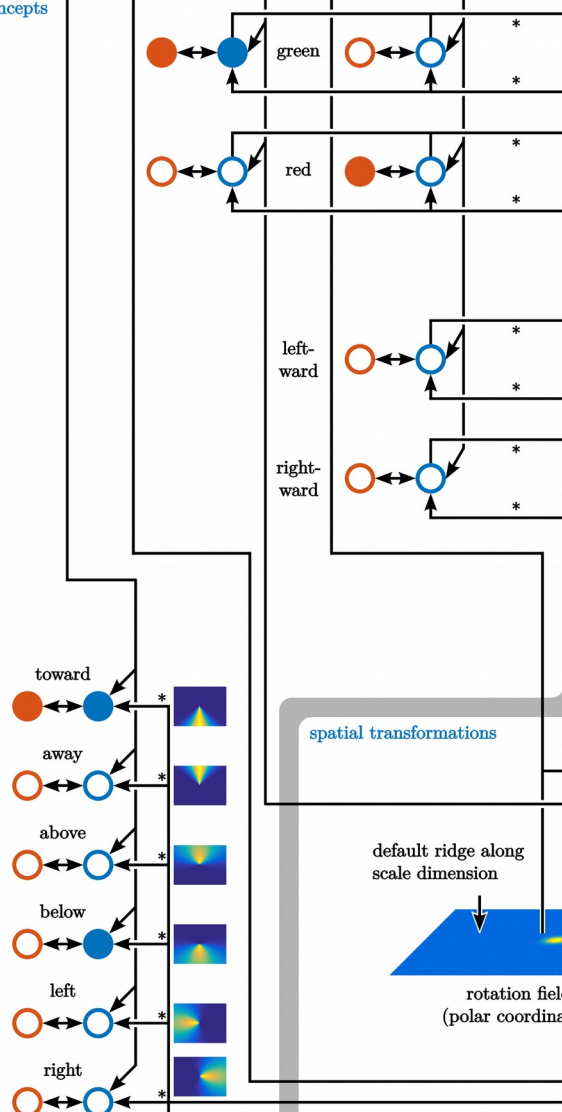
process organization



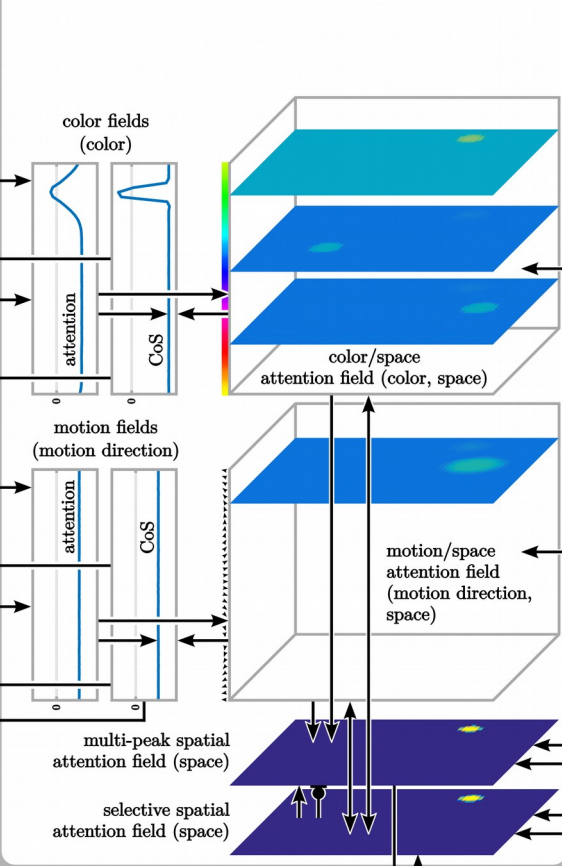
notation



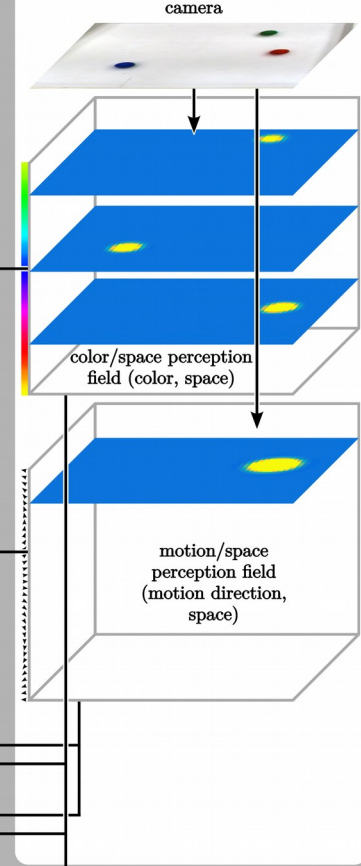
concepts



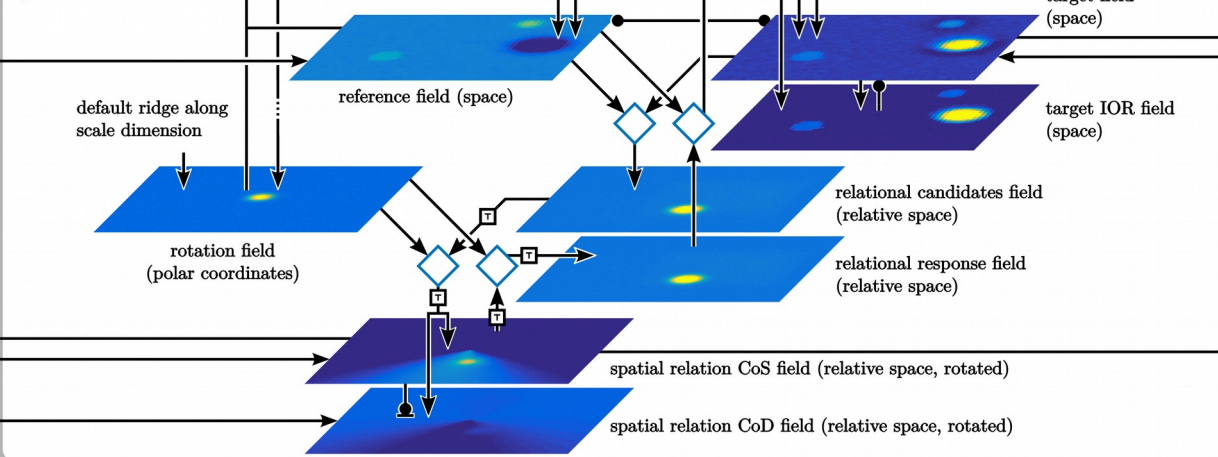
attention



perception



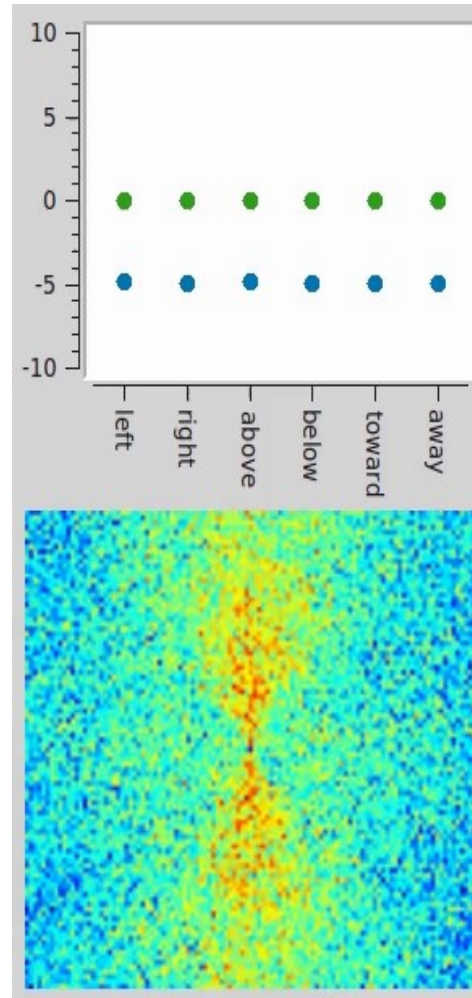
spatial transformations





# Operators

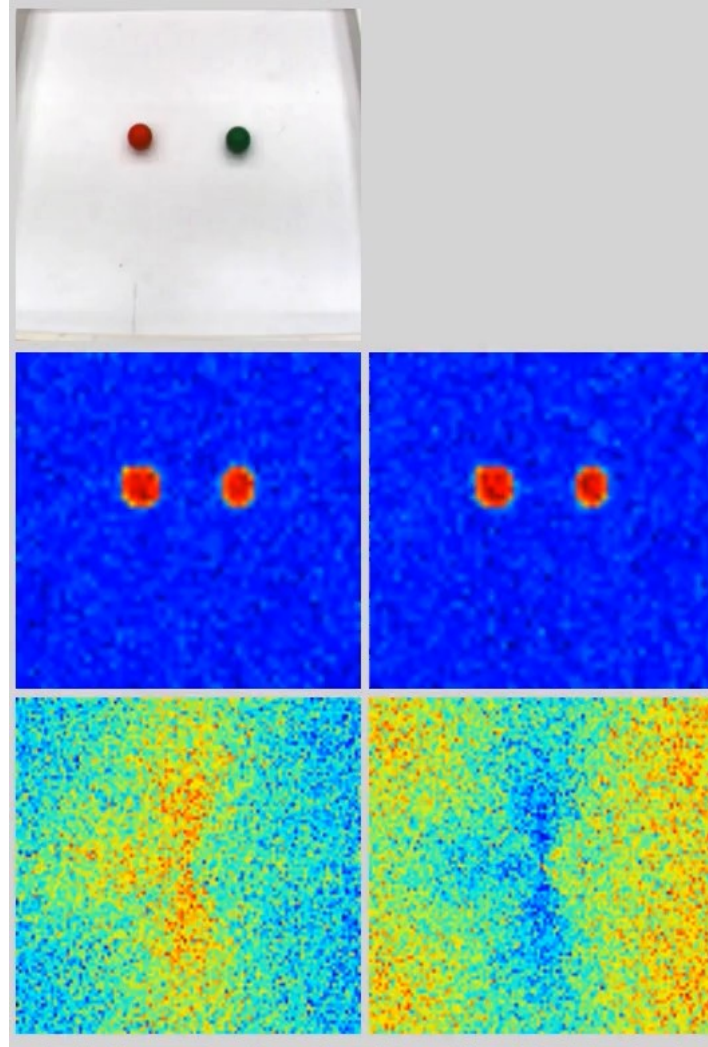
categorical  
relation  
concepts



relation  
field

# Operators (coordinate transformation)

video



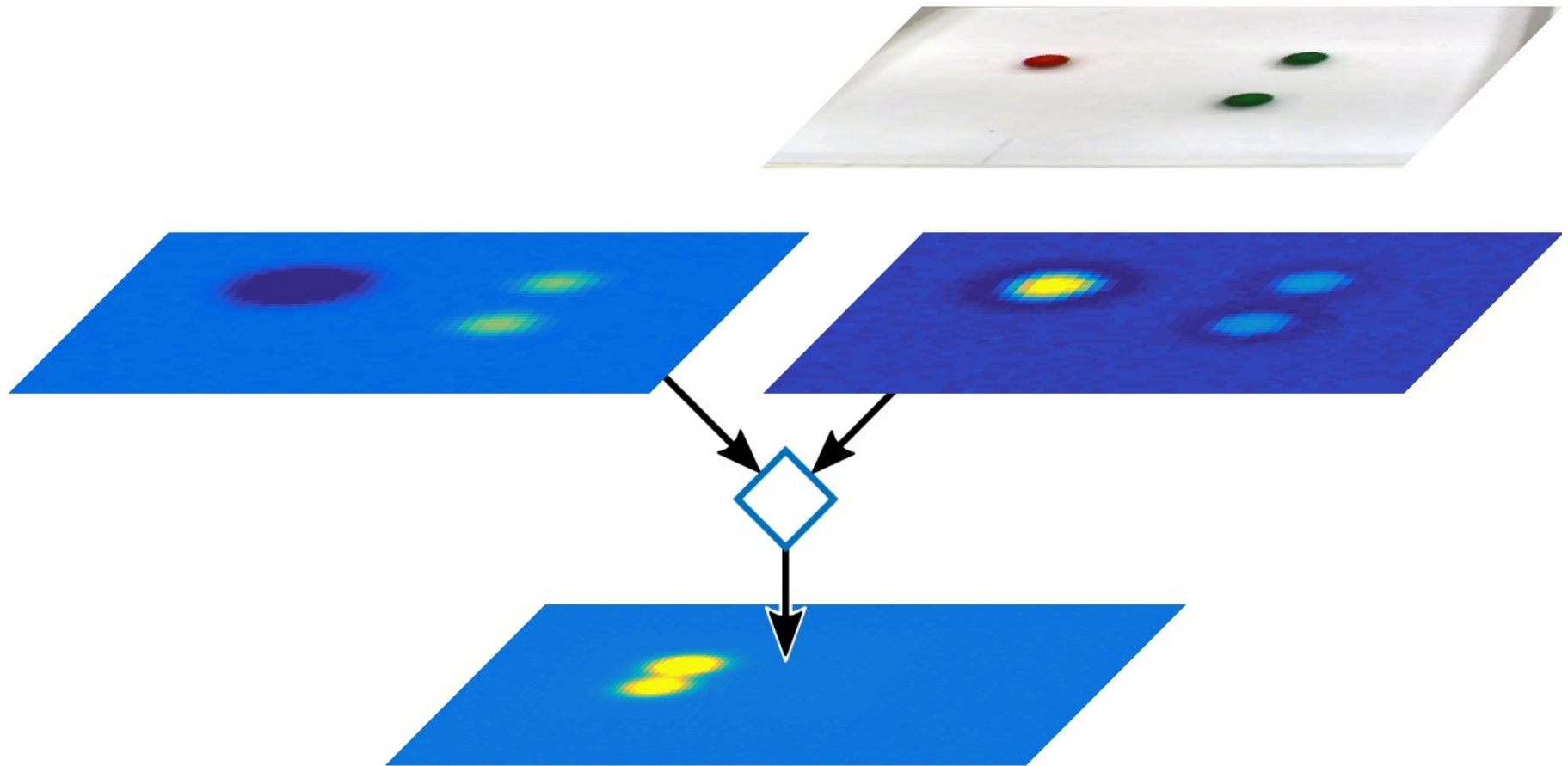
target object

reference  
object

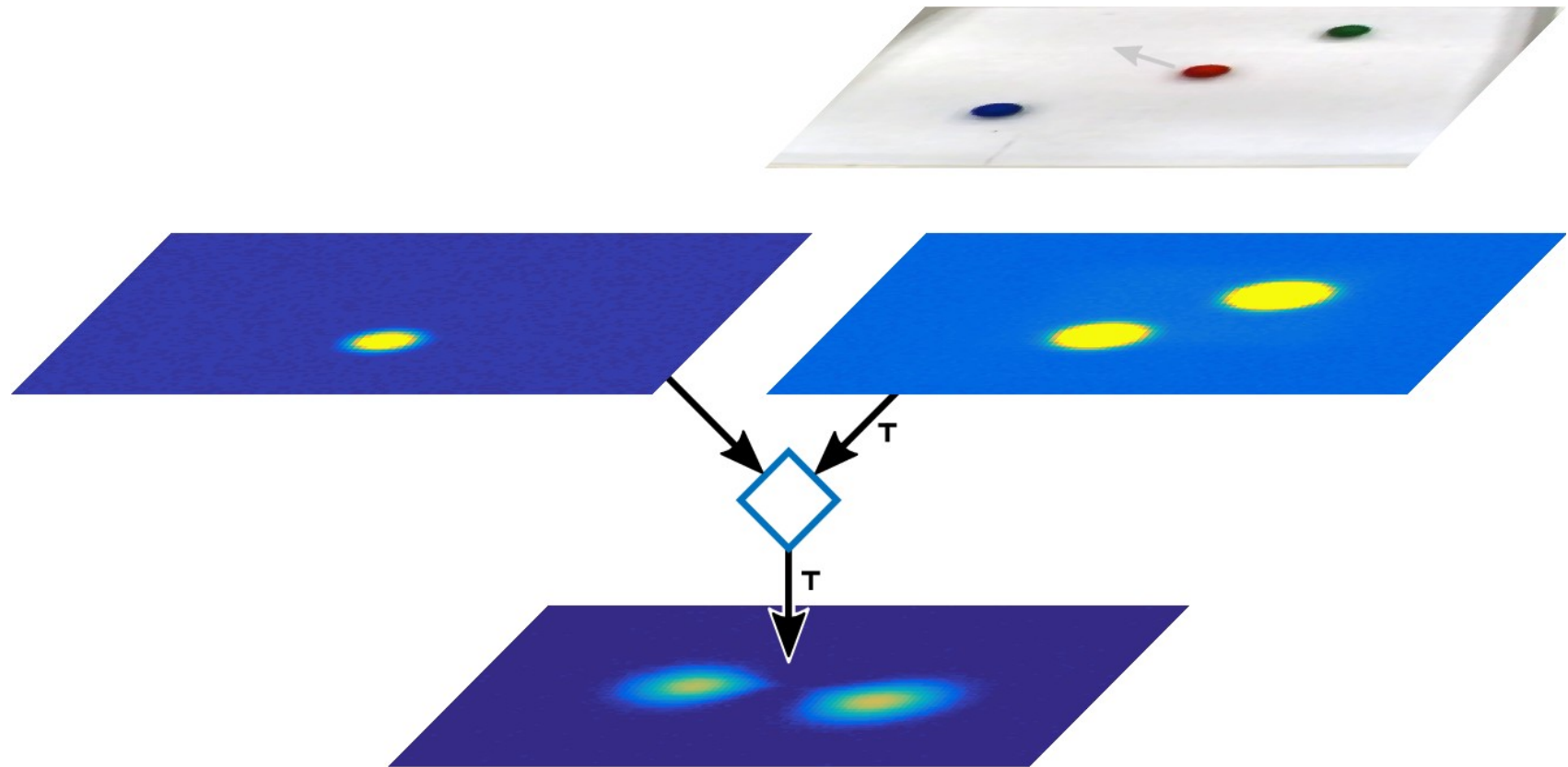
match field

mismatch  
field

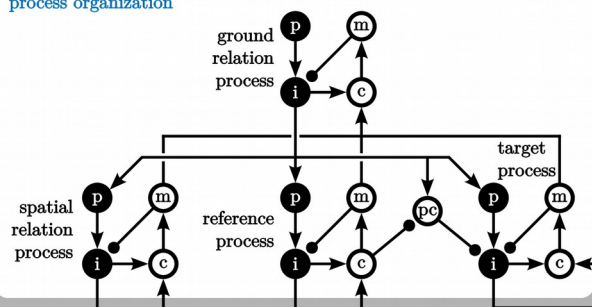
# Spatial transformation (Translation)



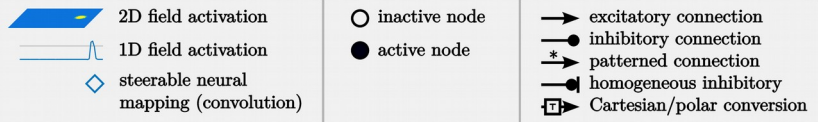
# Spatial transformation (Rotation)



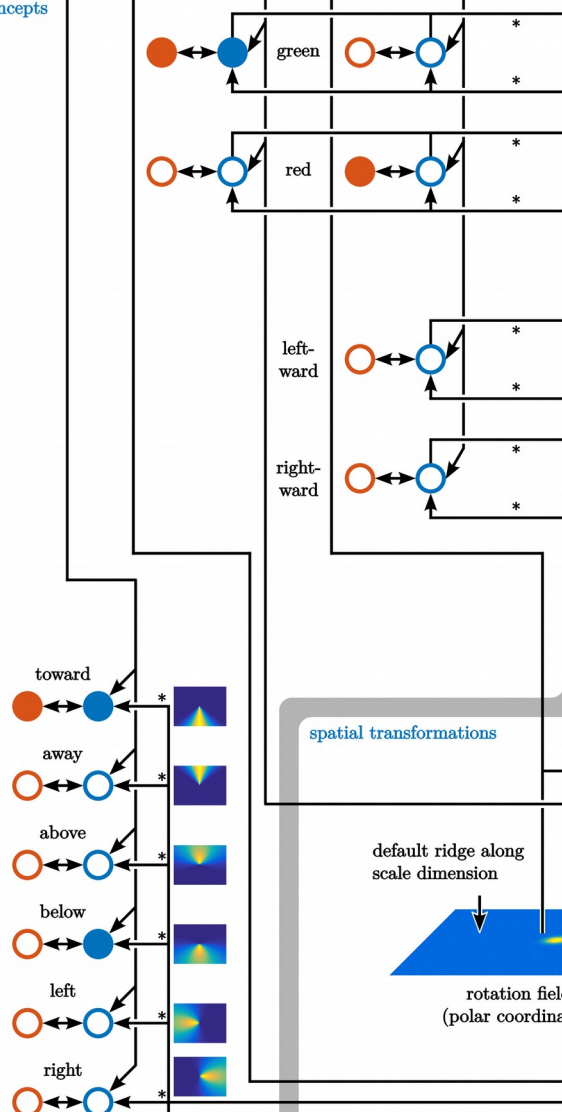
process organization



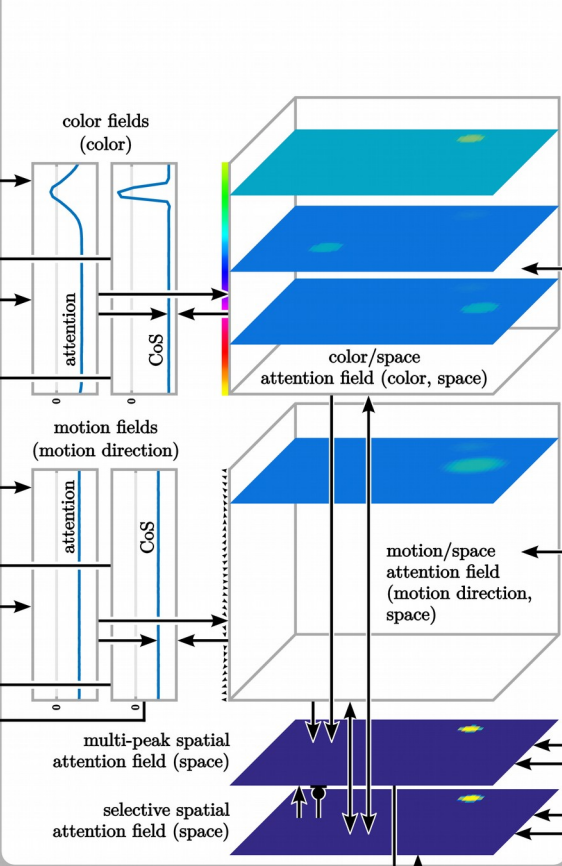
notation



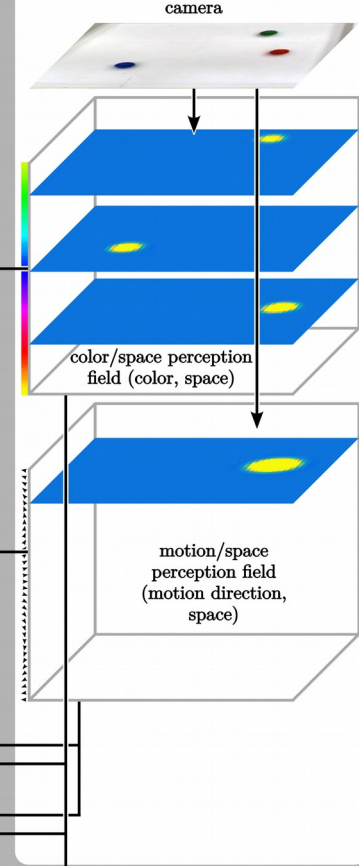
concepts



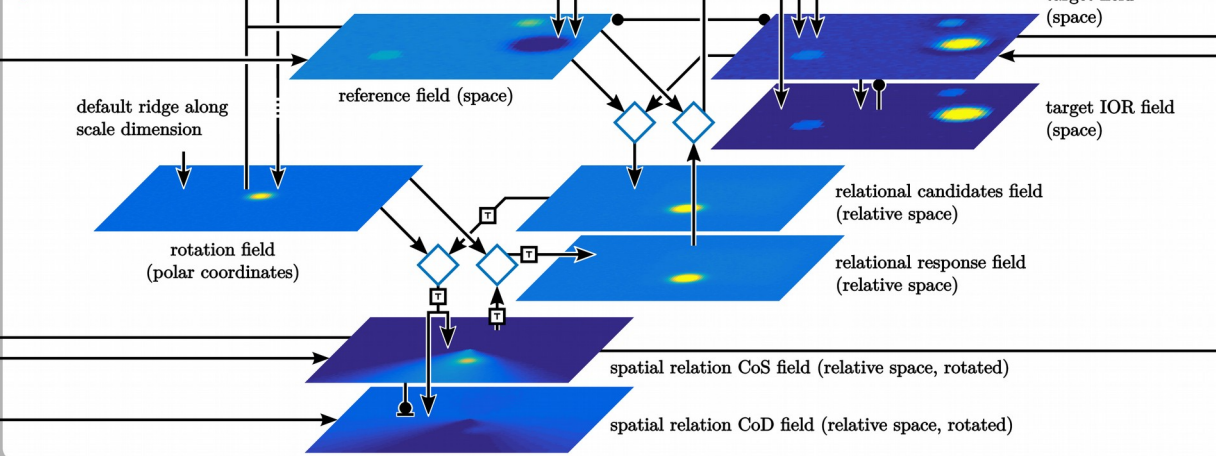
attention



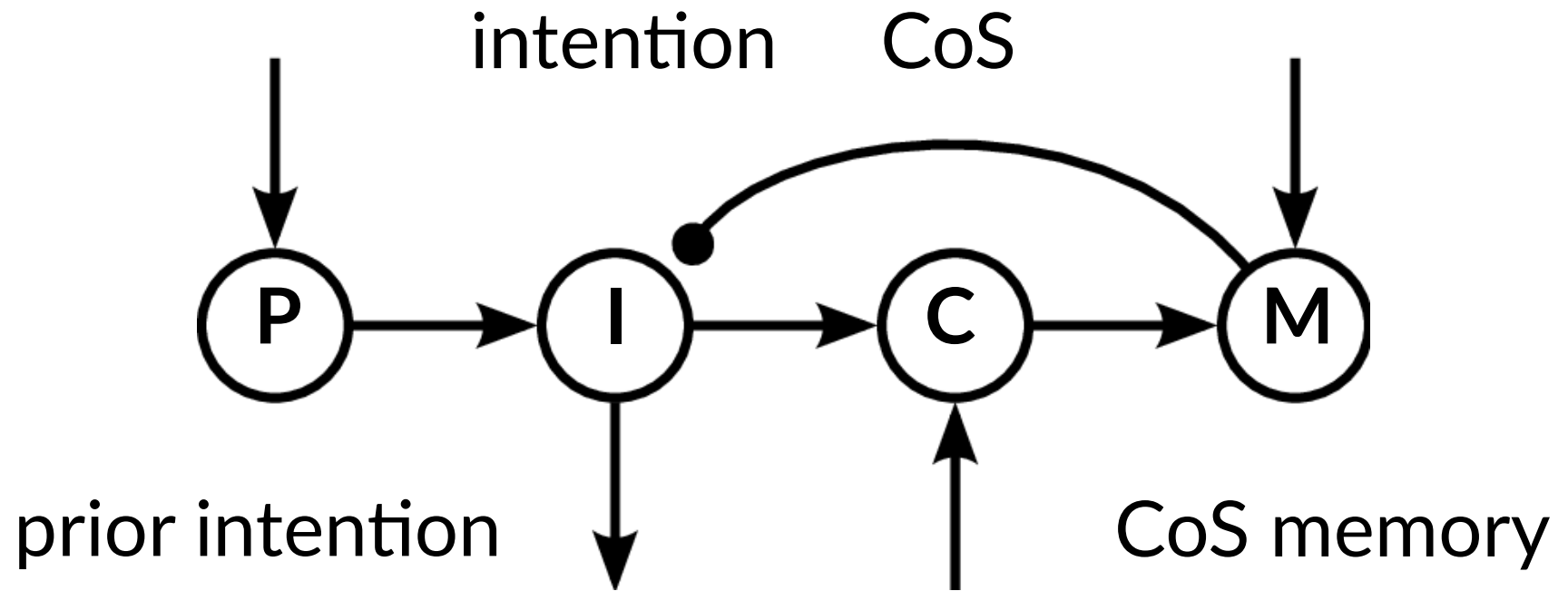
perception



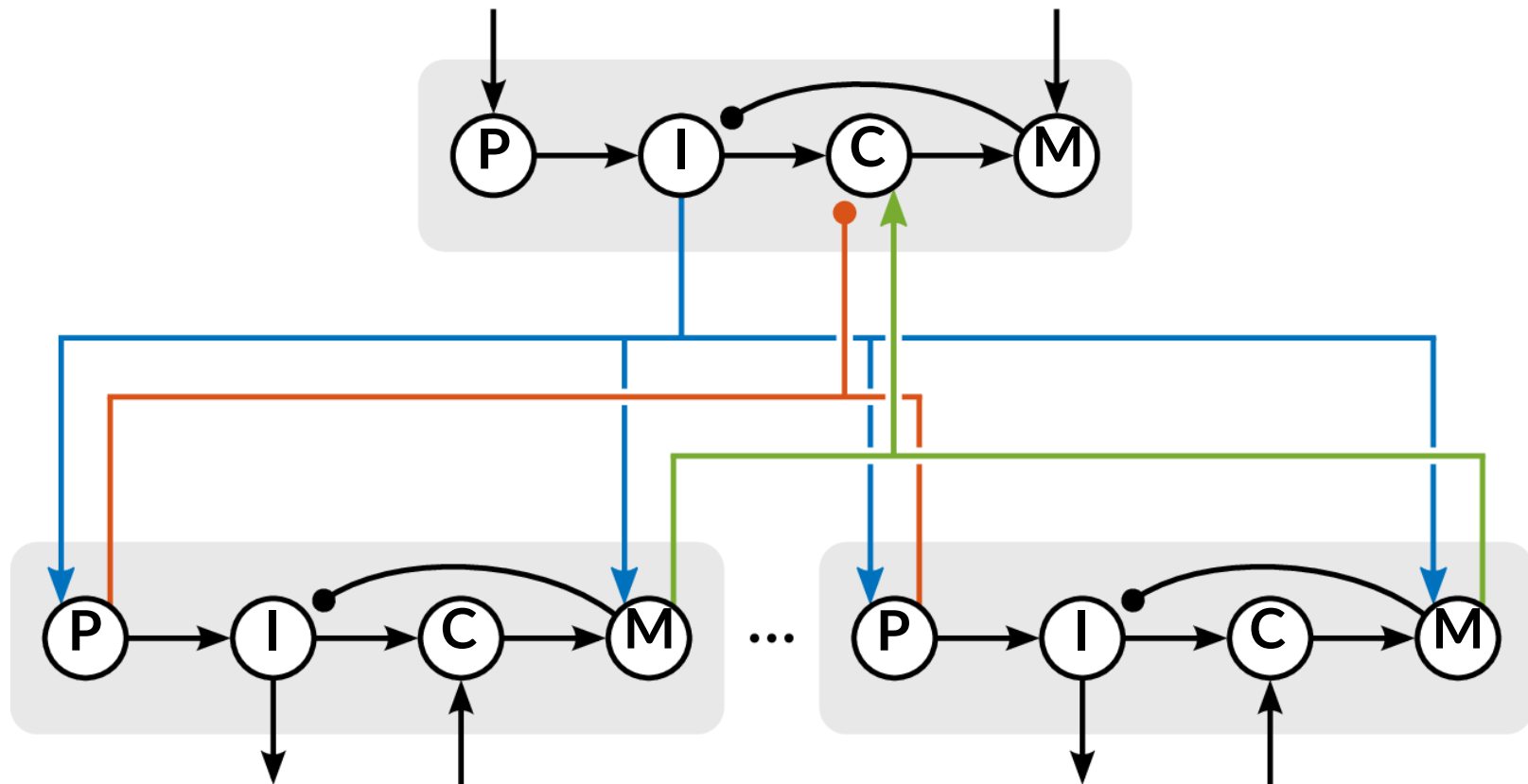
spatial transformations



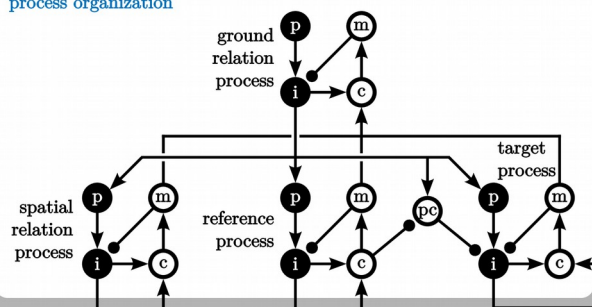
# Processes and sequences



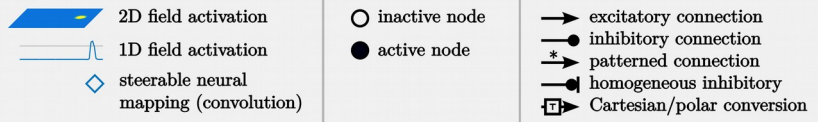
# Processes and sequences



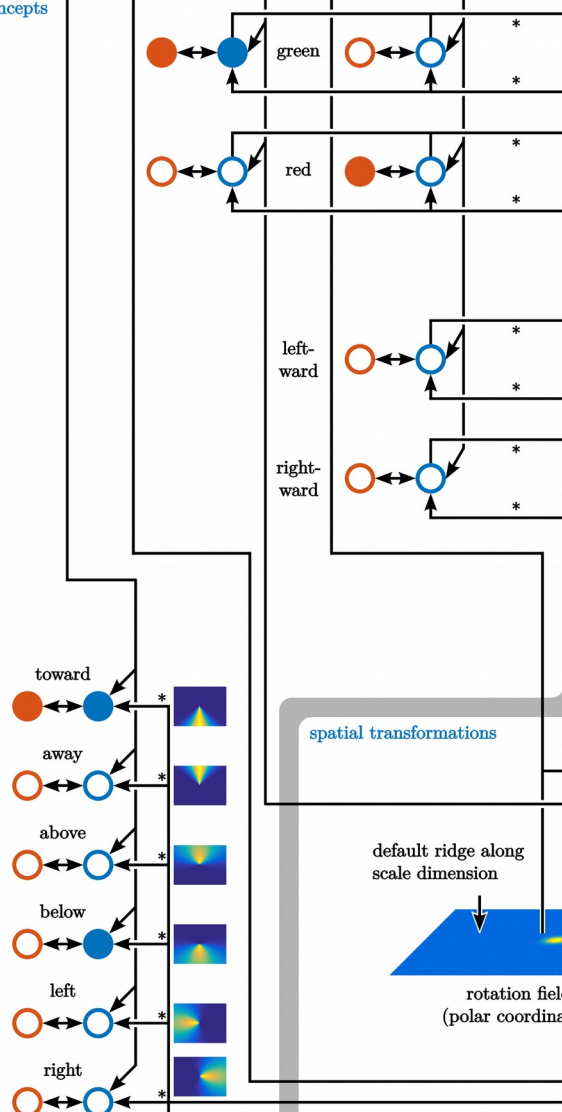
process organization



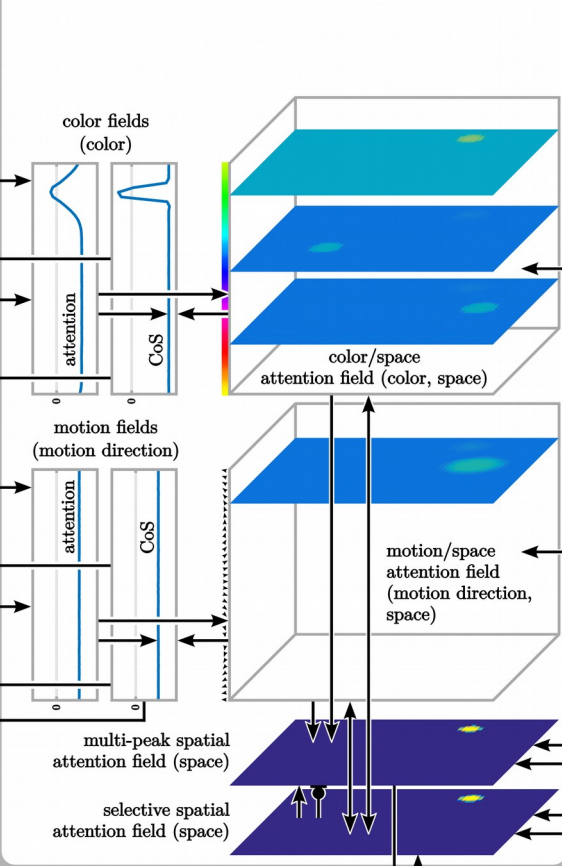
notation



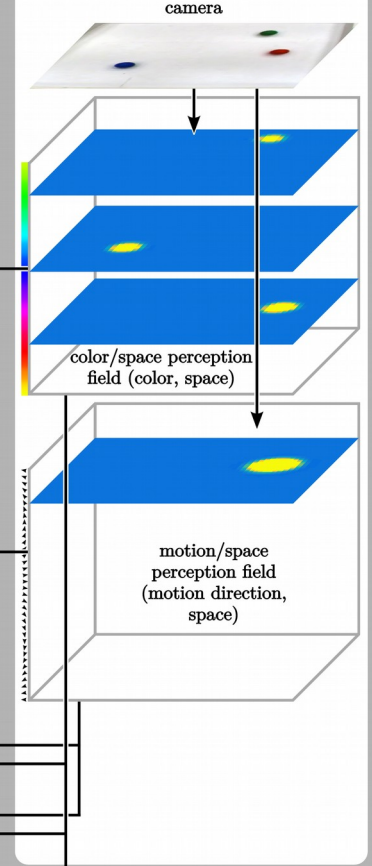
concepts



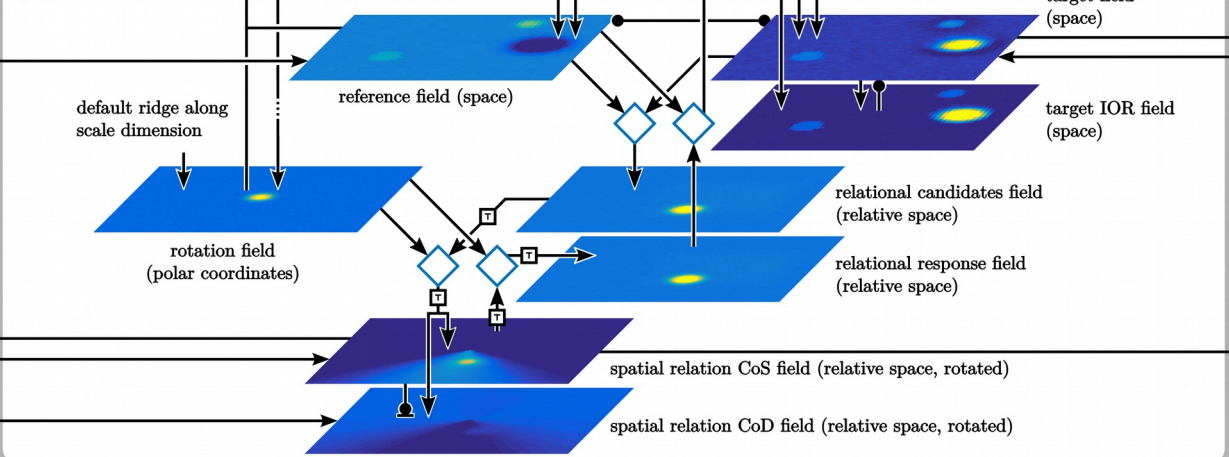
attention



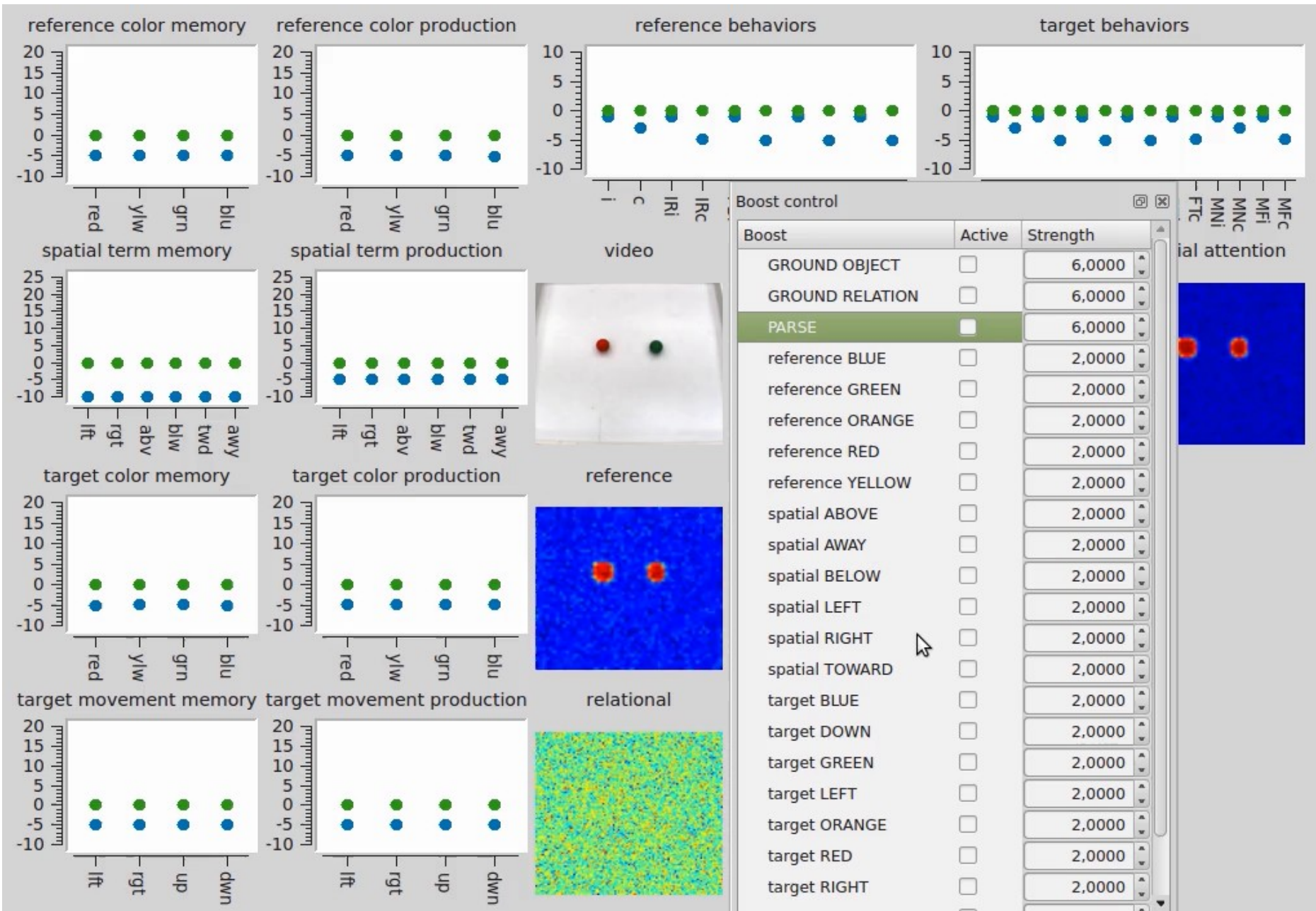
perception

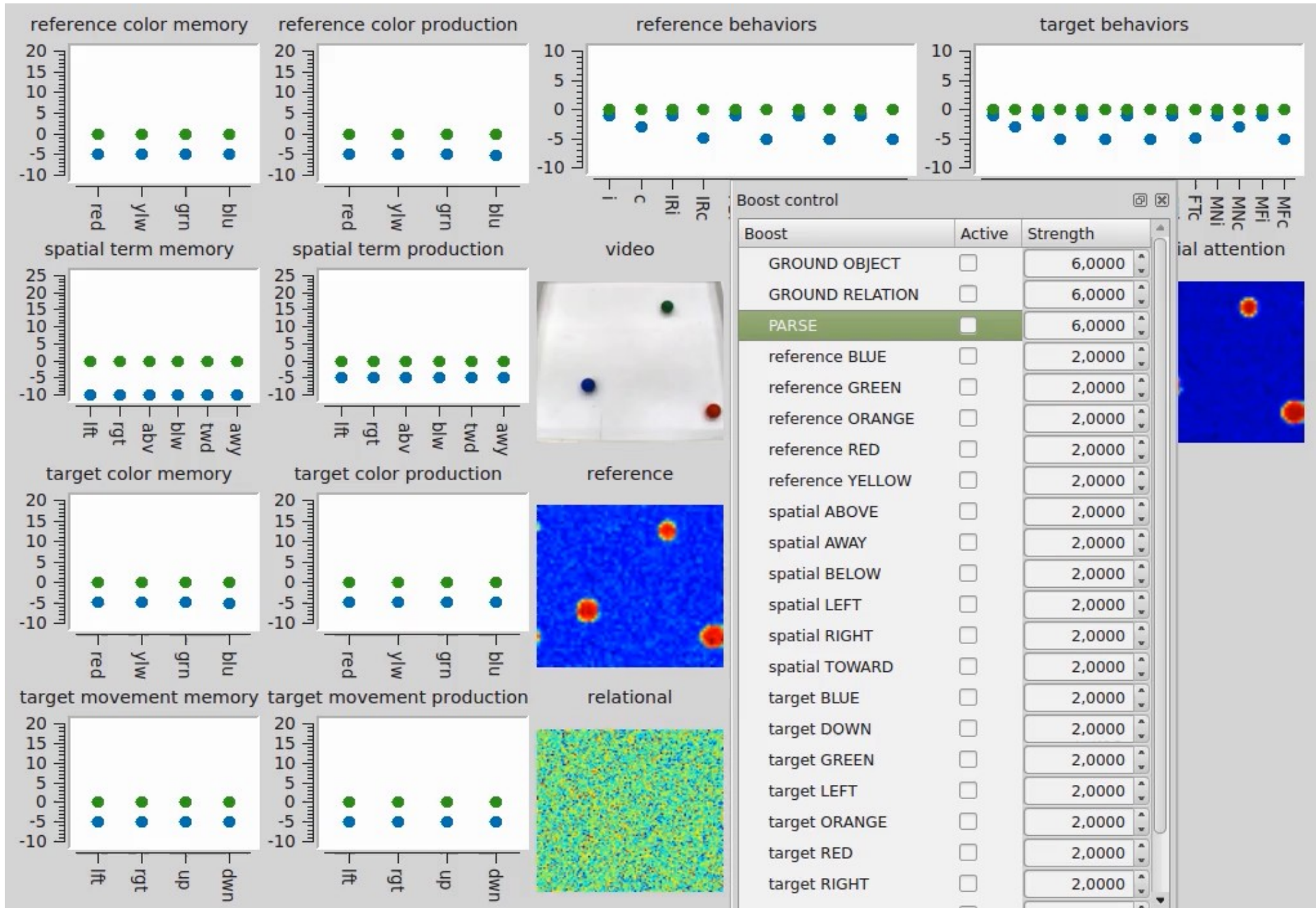


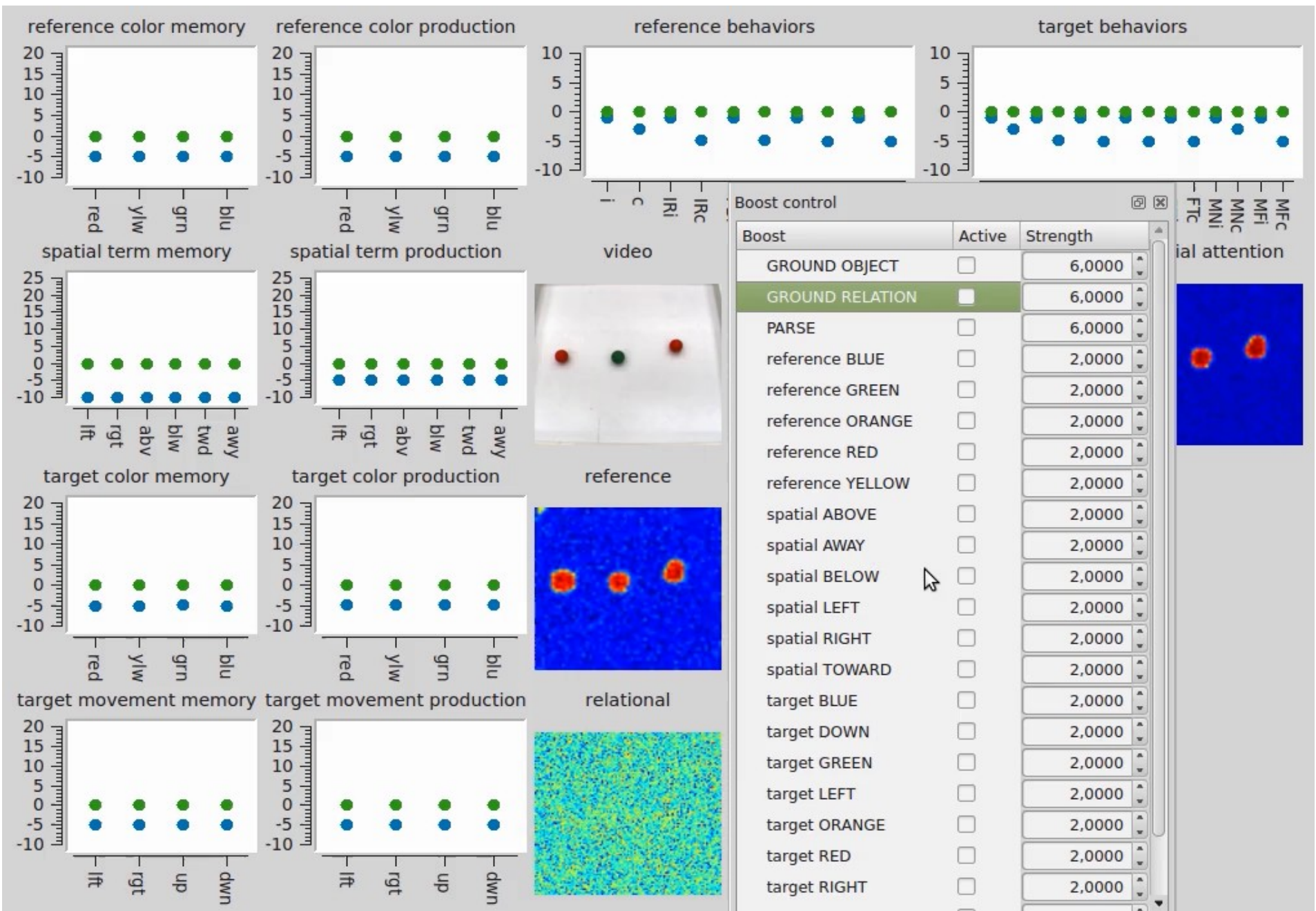
spatial transformations



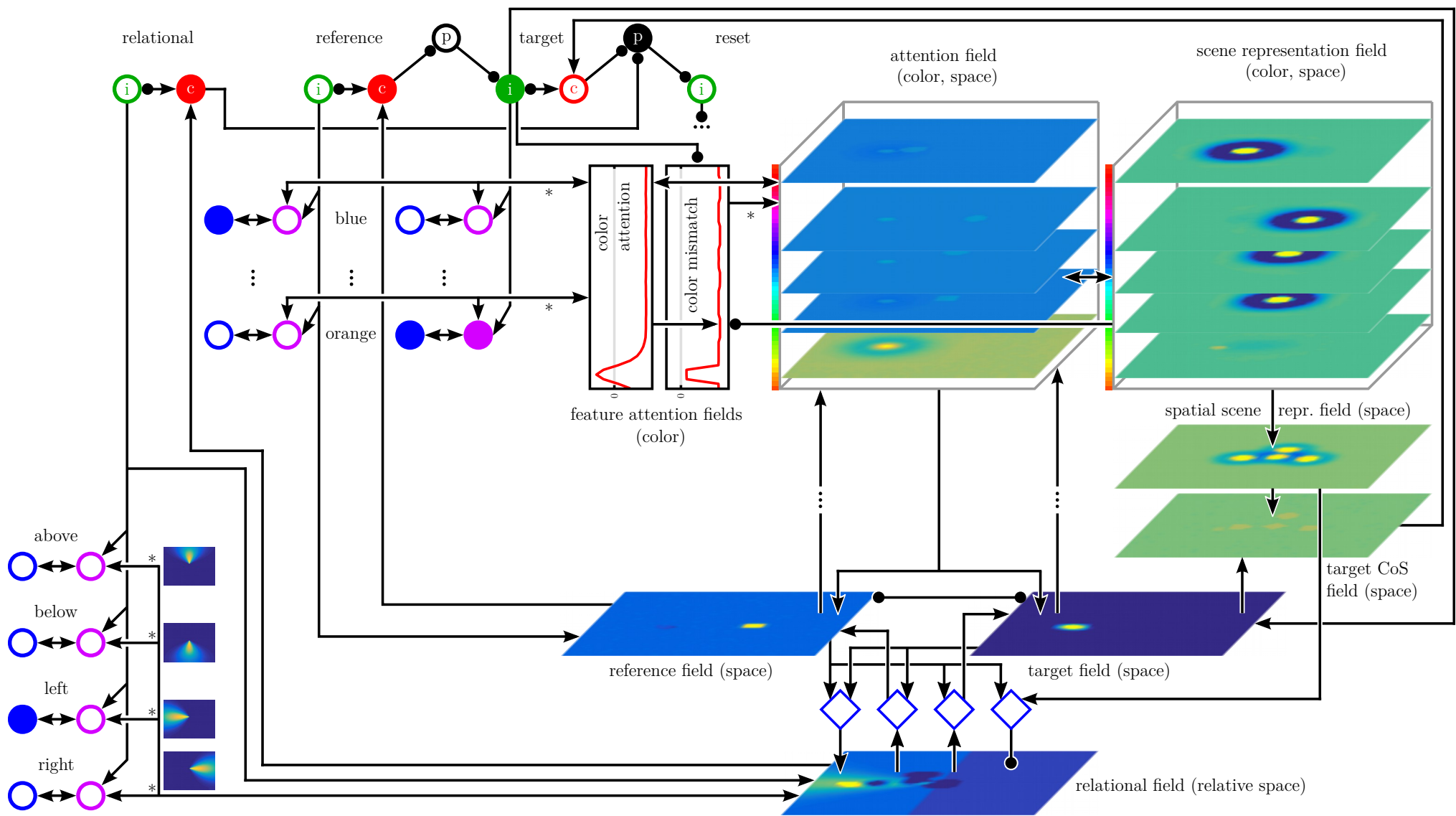


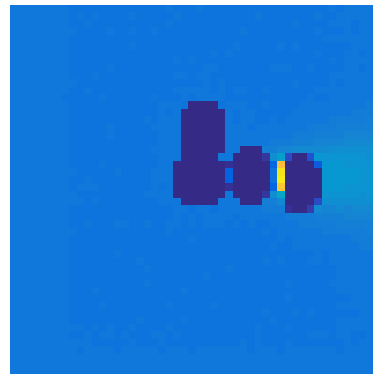
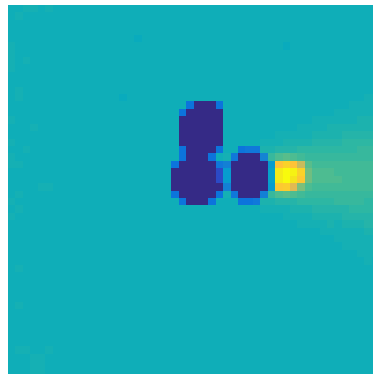
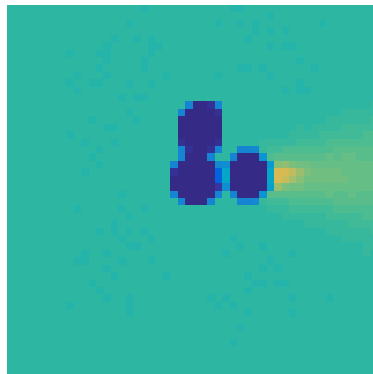
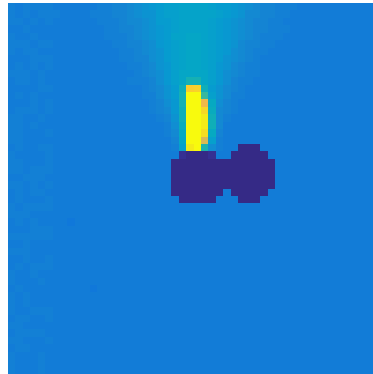
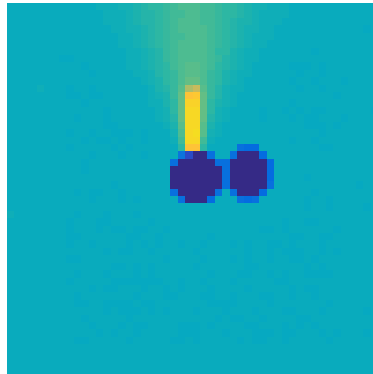
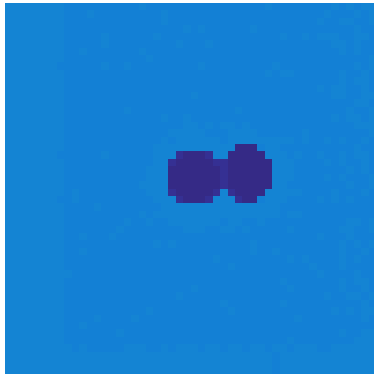


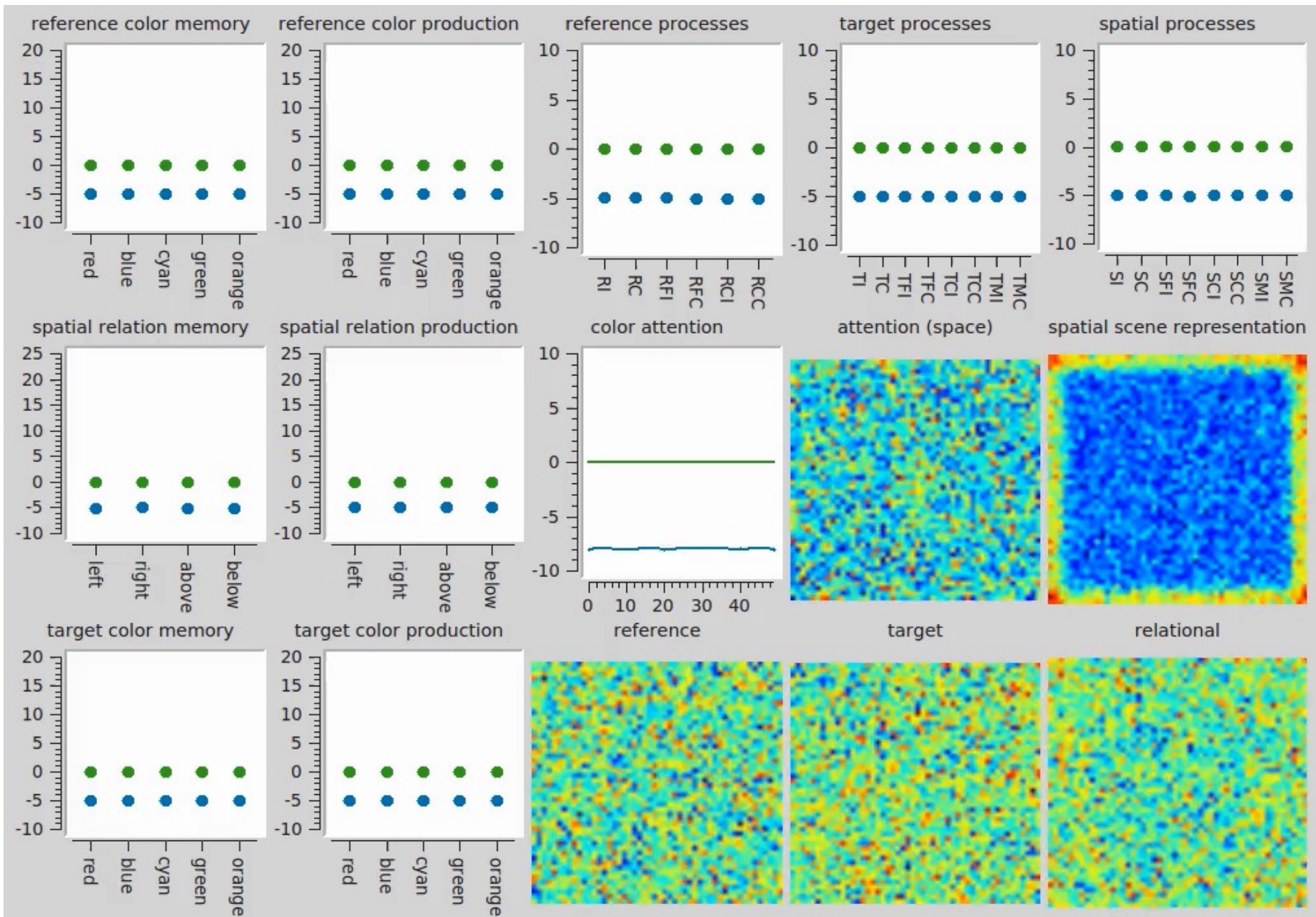




Mental imagery







Compositionality