

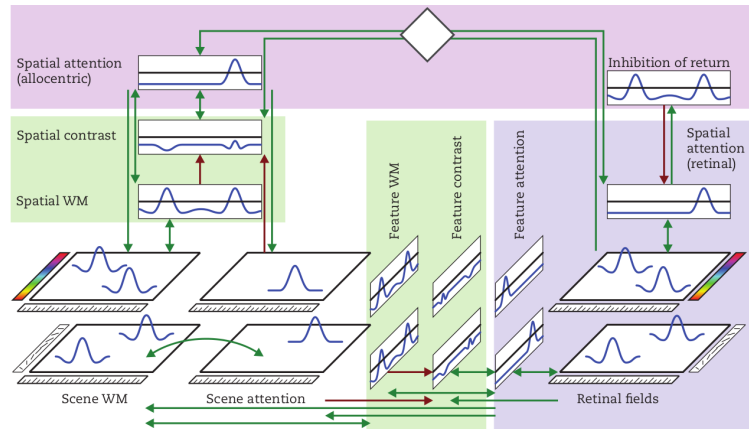
Project overview

Summer school: Neuronal dynamics
for cognitive robotics

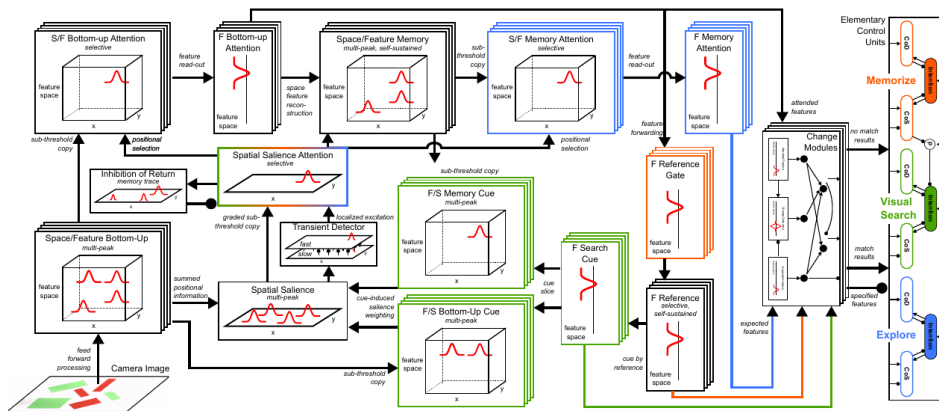
2019

A dynamic field architecture for scene representation

Tutors: Raul Grieben, Lei Zhang and Jonas Lins



- VWM for objects in a scene
- single feature (color)
- rebuild the model from chapter 8 (DFT book) in CEDAR
- camera input
- frontend for arm movement project (?)



[Integrating 'what' and 'where': Visual working memory for objects in a scene. Schneegans, S., Spencer, J.P., & Schöner, G. (2015).

In Dynamic thinking: A primer on dynamic field theory (chap. 8). Oxford University Press.]

[Sequences of discrete attentional shifts emerge from a neural dynamic architecture for conjunctive visual search that

operates in continuous time. Grieben, R., Tekülve, J., Zibner, S. K. U., Schneegans, S., & Schöner, G.. (2018).

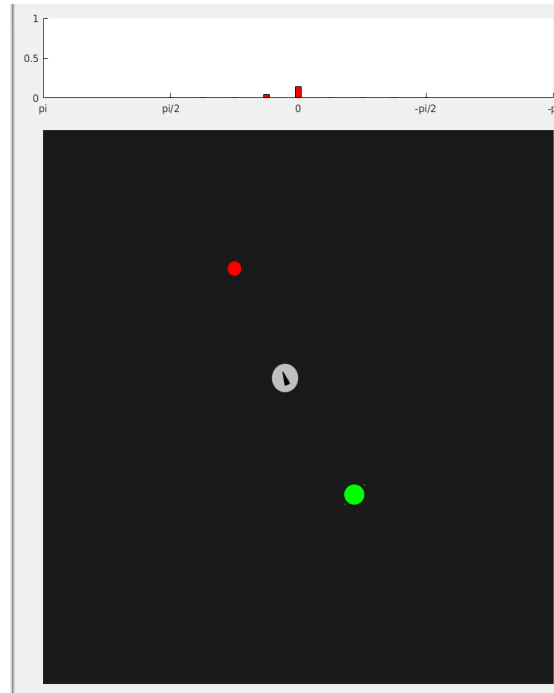
Proceedings of the 40th Annual Conference of the Cognitive Science Society (pp. 429–434).]



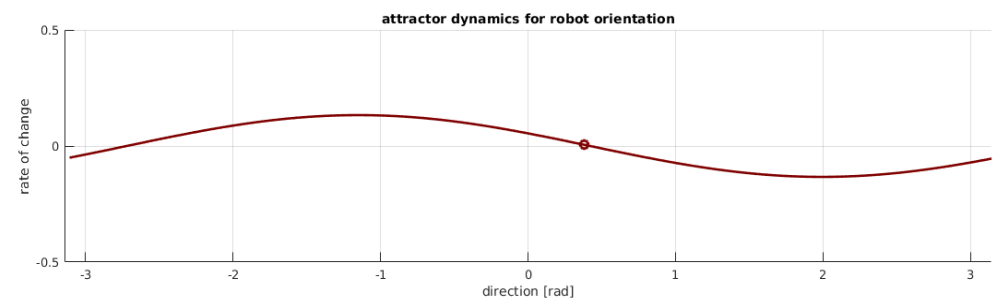
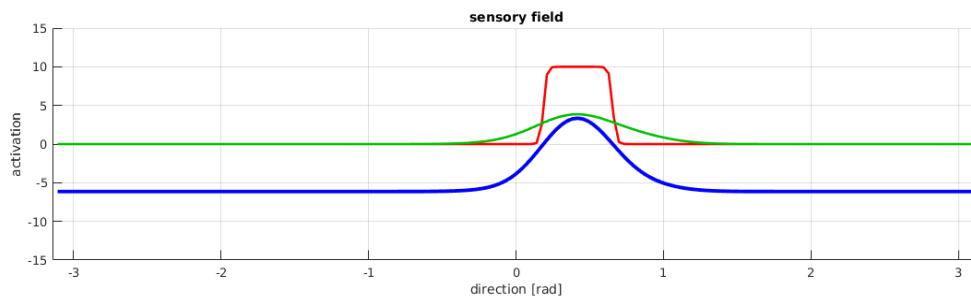
A Behavioral Dynamics for a simulated Robot

Tutors: Cora Hummert and Rachid Ramadan

- Simulating Robot with Cosivina (Matlab)
- Navigation in arena: Approaching targets and avoiding obstacles



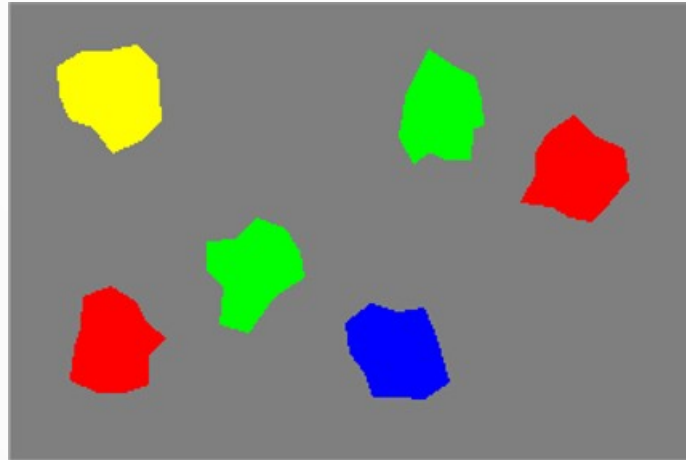
Add features of your own choosing (memory trace, open arena, ...)



Spatial language grounding

Tutors: Cora Hummert, Daniel Sabinasz

- fundamental aspect of cognition: ability to understand and express relations
- relational language is indispensable in communicating about shared environments



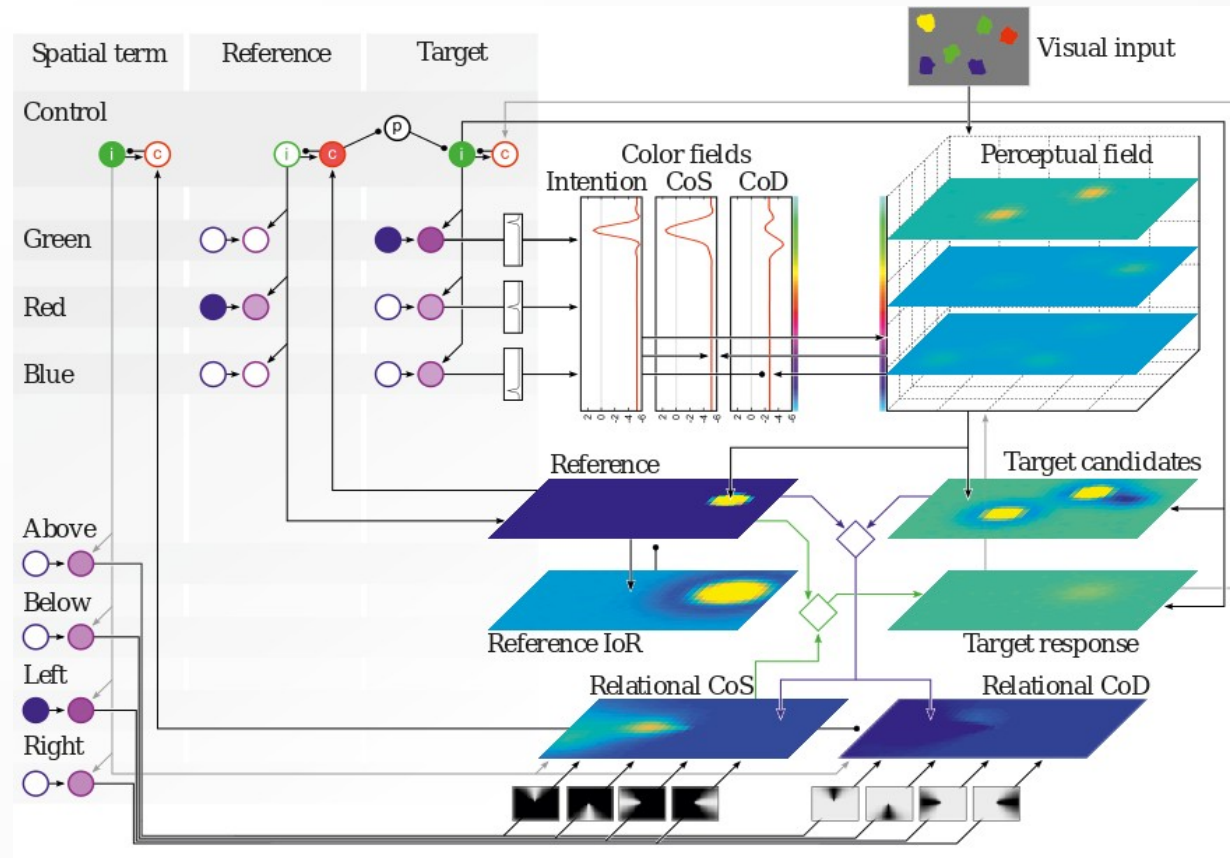
*“the red object
to the right of
the green object”*

- what are the neural processes that govern the perceptual grounding of relations?

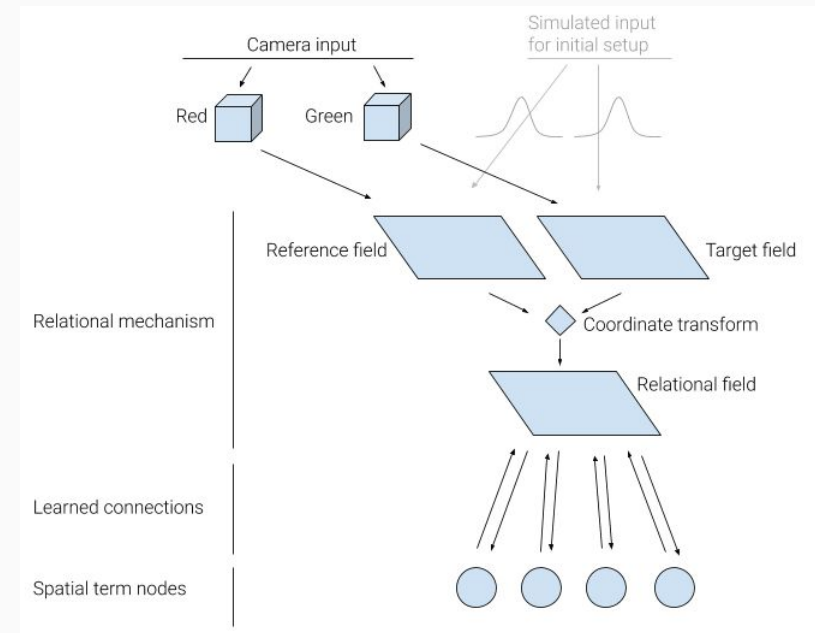
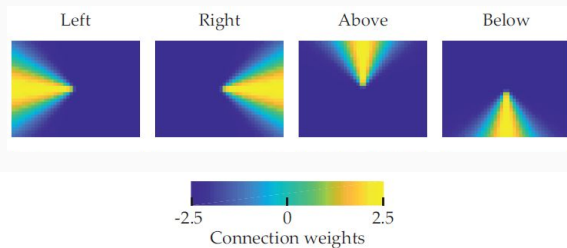
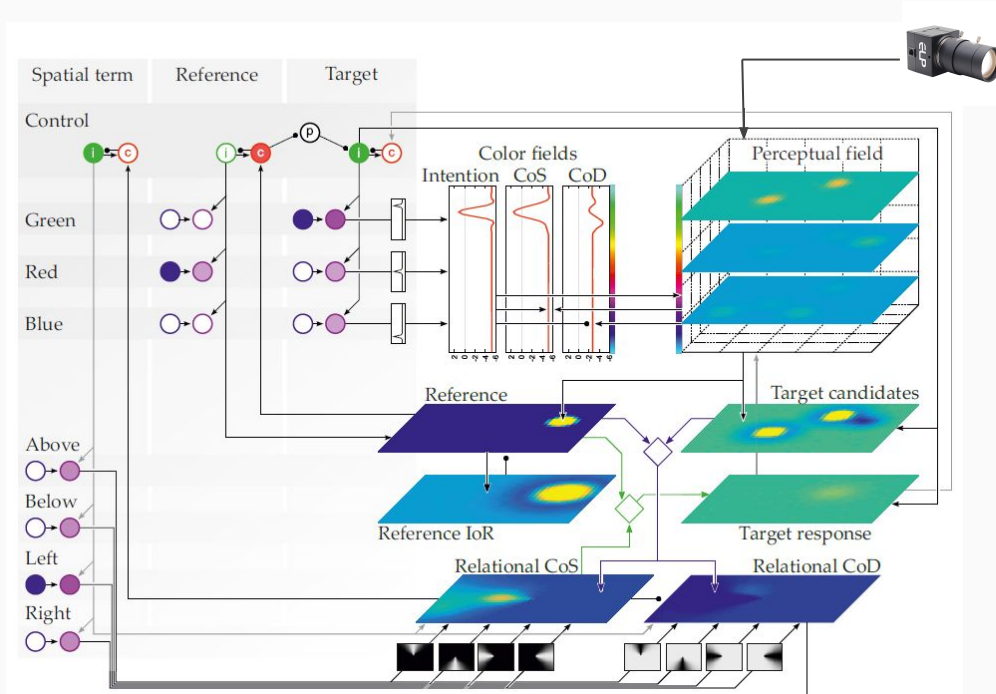
Spatial language grounding

Tutors: Cora Hummert, Daniel Sabinasz

- implement a neural dynamic architecture with cedar that solves this task
- represent perceptual information in activation fields
- represent concepts via activation nodes and synaptic weight patterns
- make detection and selection decisions to bring visual objects into attentional foreground
- perform coordinate transformations
- determine degree of fit of a spatial relational template
- discrete processing steps emerge from dynamic instabilities



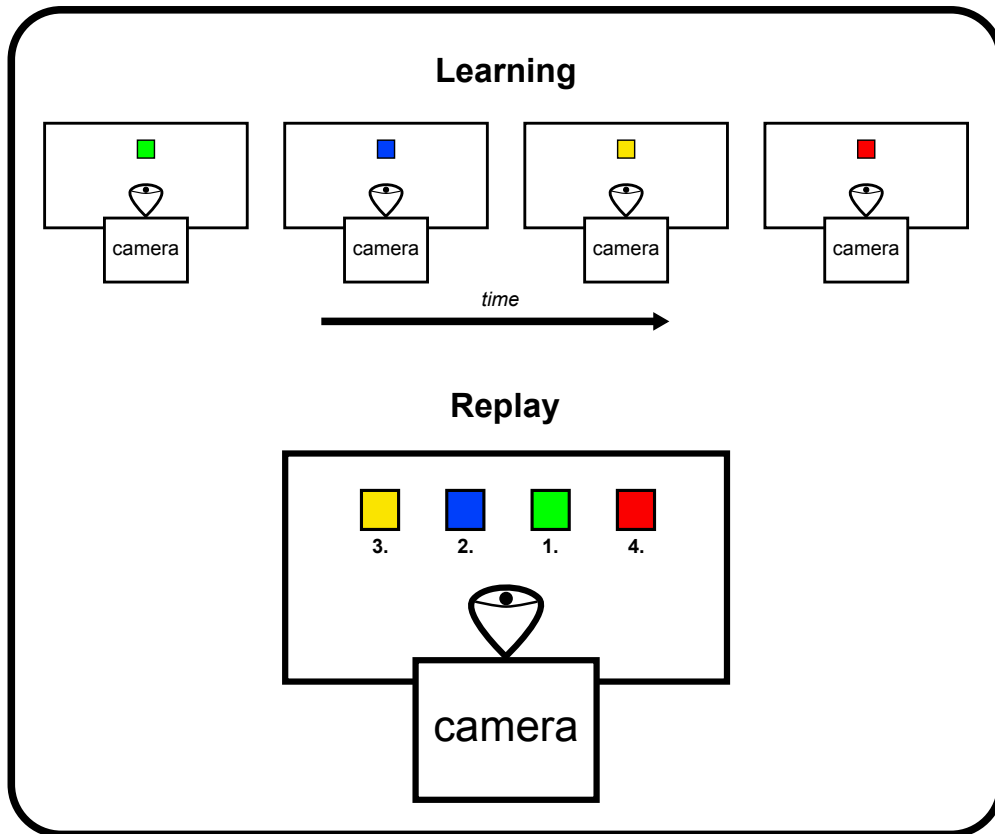
Learning relational concepts with DFT



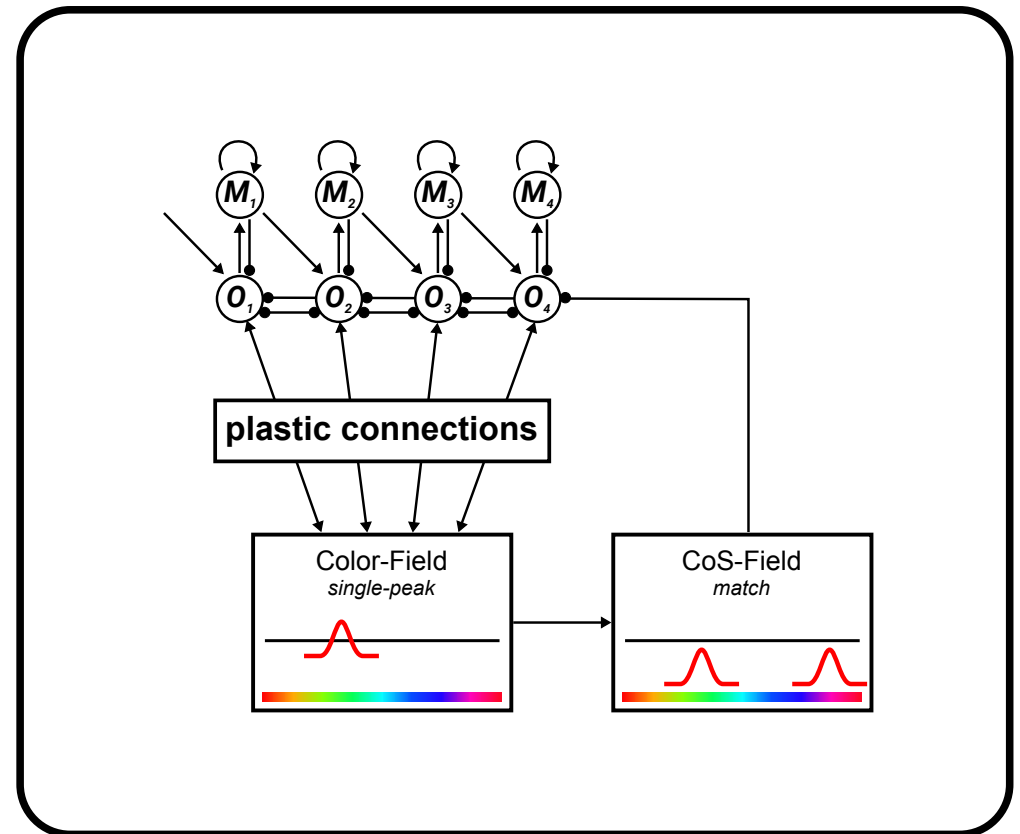
Using serial order to learn and replay a sequence

Tutors: Mathis Richter and Jan Tekülve

Possible Scenario



Architecture Sketch

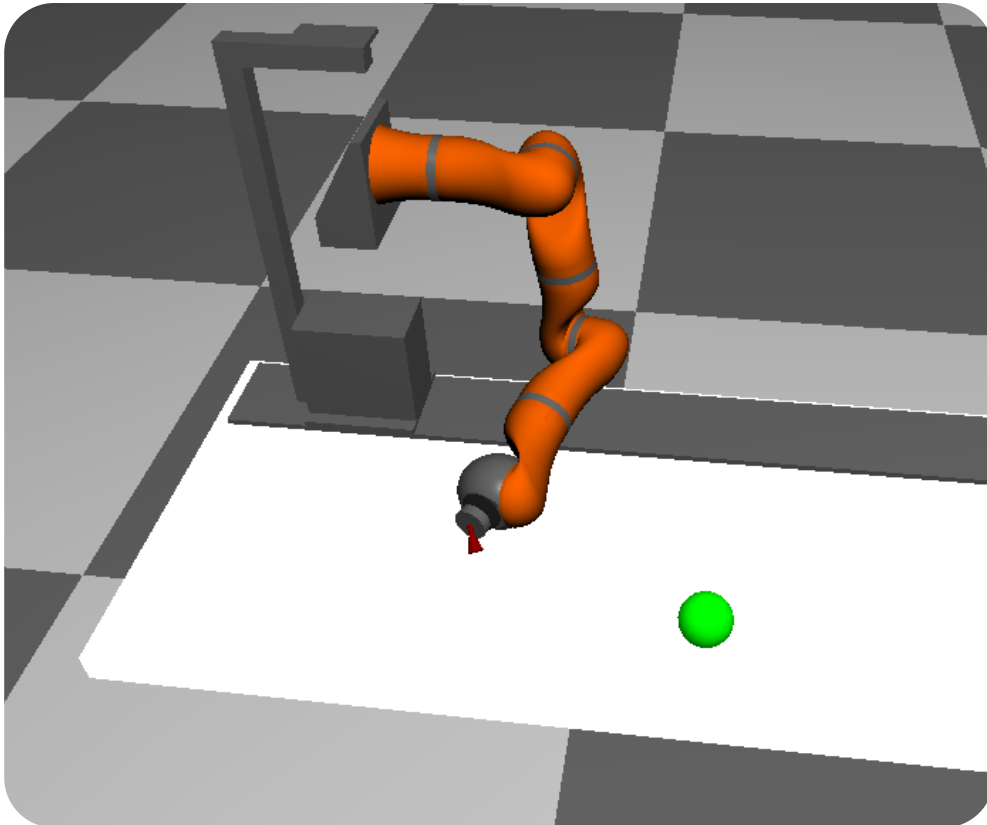


["Autonomous Sequence Generation in Dynamic Field Theory"
Sandamirskaya, 2015, *DFT Book (Chapter 14)*]

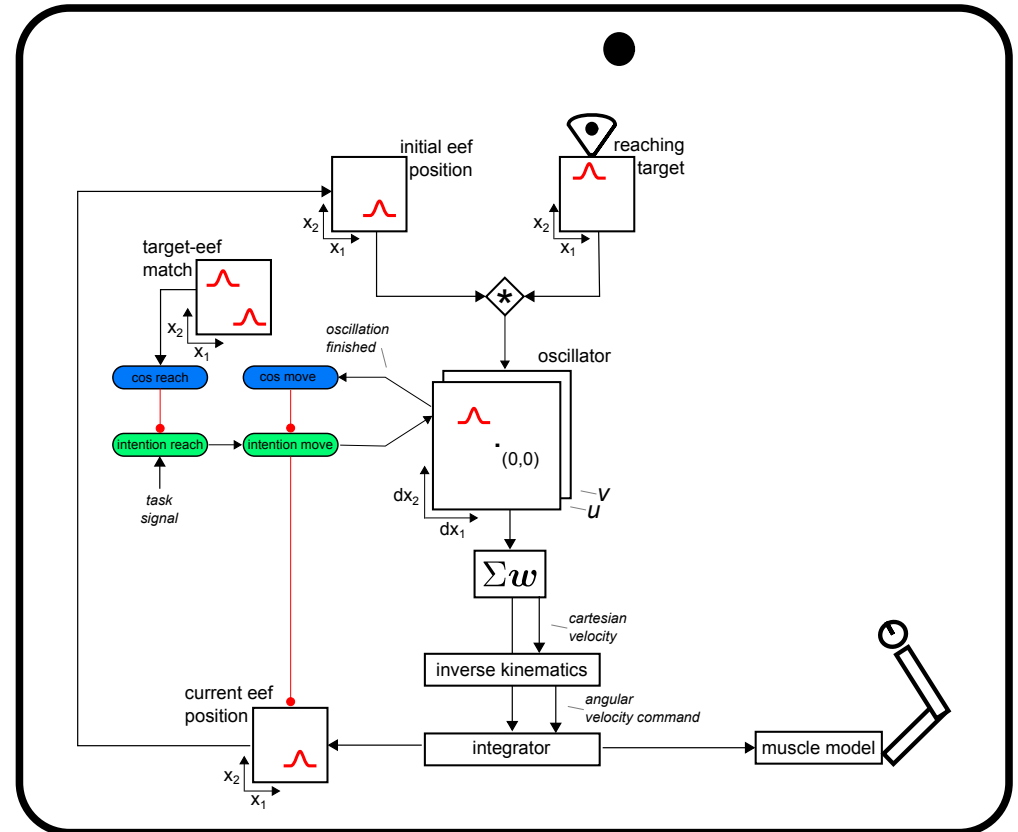


A dynamic field architecture for goal-directed reaching

Tutors: Mathis Richter and Jan Tekülve



Architecture Sketch



["The neural dynamics of goal-directed arm movements: a developmental perspective", Zibner, Tekülve, Schöner, 2015]

