

# What is DFT?

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# Hypothesis

- thinking and acting are brought about by the embodied and situated brain that is shaped by evolution and development

# Cognition in the wild...



# Cognition in the wild...

## visual cognition

- attention/gaze
- active perception/working memory





# Cognition in the wild...

spatial cognition

■ spatial map/memory



# Cognition in the wild...

decisions

- action plans/decisions/sequences
- goal orientation





# Cognition in the wild...

language

■ coordination/communication



# Cognition in the wild...

concepts, knowledge

■ background knowledge





# Cognition in the wild...

development, learning

■ learning from experience



# Cognition in the wild...

- attention/gaze
- active perception/working memory
- action plans/decisions/sequences
- goal orientation
- coordination/communication
- background knowledge
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# Cognition in the wild...

## ... underlying neural processes

- continuous time and space/ state (embodiment)
- continuous/intermittent link to the sensory and motor surfaces (grounding)
- closed loop (situated)
- discrete events and categories emerge
- autonomous learning





# Cognition in the wild...

## ... embodiment hypothesis

- “all cognition is like soccer playing” ~ shares the process properties
- => there is no particular boundary up to which cognition is embodied/grounded and beyond which it is computational/symbolic



# Hypothesis

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# Neural theory of cognition

- =neural process account of thinking and acting...
  - that may actually bring about thoughts and action
  - while respecting neural principles
  - that explains the laws of thinking and acting

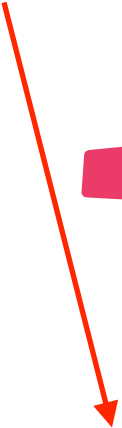


# Neural theory of cognition

- not the same as: mapping cognitive function onto brain areas (cognitive neuroscience)
- not the same as: mapping cognitive function onto neural mechanisms at the level of neural circuits, synaptic dynamics, neuro-transmitter dynamics, etc (computational neuroscience)
- not the same as: computational process theories (information processing)

# Neural theory of cognition

what principles?

- 
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    - that explains the laws of thinking and acting

# Neural principles ~ connectionism

- 1 activation = state of neural networks
- 2 sigmoidal threshold function
- 3 functional significance of activation comes from its connectivity ...



# Neural principles ~ connectionism

- 1 activation = state of neural networks
- 2 sigmoidal threshold function
- 3 functional significance of activation comes from its connectivity ...

but: these are not sufficient...

# Neural principles: autonomy

- conceptually, most current neural network accounts are input driven
- while thought and action are driven by the **inner state** of the mind/brain = **autonomy**
- => these inner states arise, persist, and evolve in time based on **neural dynamics with strong interaction**

# Neural principles: spatial coupling

- higher cognition as characterized by productivity, compositionality, systematicity etc is challenging to understand in conventional connectionism
- => DFT postulates **patterns of spatial coupling from which higher cognitive processes emerge** while retaining grounded/embodied properties

# Dynamic Field Theory (DFT)

- 1 **Time**: autonomy emerges from neural dynamics
- 2 **Space**: higher cognition emerges from coupling across low-dimensional spaces
- 3 Cognition emerges from **space-time integration**...
- => DFT provides a vision for a neural process theory of cognition