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
- learning from experience

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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Neural principles ~ connectionism

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

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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