The sequential organization of behavior and processes Part 2

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Sequential behaviors or mental acts

behaviors/mental states are attractors

that resist change...

to induce change in sequential behavior/ thinking: induce an instability

Condition of Satisfaction

- an action or thought is represented by an "intentional" node
- or an "intentional field" that represents specific actions/thoughts within low-dimensional feature spaces



Condition of Satisfaction

- the intention preactivates a "condition of satisfaction" field with the predicted sensory information
- the CoS field goes through a detection instability as sensory input matches the prediction



Condition of Satisfaction

this detection instability in CoS triggers the sequential transition by inhibiting the intention



Active transient of the CoS



Conclusion

the CoS organizes the transition away from on ongoing behavior/mental state

based on a signal from perception or from an inner state of a neural architecture that is predicted to be indicative of successful completion of the behavior/ mental act



next challenge:

the CoS does NOT organize yet, how the next behavior/mental state is selected



[Helson, Burgess, 1997]



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[Kazerounian, Grossberg, 2014]

Gradient-based

- In many DFT architectures, this is effectively the mechanism in the sense that a new peak is generated within a field at a location that wins the selective competition
- based on inputs...
- e.g. salience map for visual search
- e.g. selecting the most activated location in a relational field

Gradient-based

- each behavior/ process is selfterminating
- which behavior/ process is activated next depends on its inputs or on chance

Chaining

- as in many "fixed action patterns"
- e.g. reach-grasp
- e.g. locomotory patterns
- in our models: e.g fixed order of processing steps in some models

Chaining

pre-condition nodes implement chaining directly

Chaining

inherent limitation: difficulty when states may be followed by different successors

not obvious this is particularly flexible

Positional representation

- In which a neural representation of "ordinal position" is organized to be sequentially activated...
- while the contents at each ordinal position is specified by neural projections from each ordinal node...

[Sandamirskaya, Schöner: Neural Networks 23:1163 (2010)]

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Positional representation

- amounts to chaining... if the projections are fixed..
- potential realization in Hippocampus
- is used in DFT models when serial order is learned..

Serial order demonstrated/enacted

[Tekülve et al., Frontiers in Neurorobotics (2019)]

FIGURE 5 | Time course of learning a three element sequence with varying presentation time.

Time course of attention selection and building of scene memory

FIGURE 4 | Time course of building a scene memory.

FIGURE 6 | Time course of recalling a three element sequence through pointing at colored objects.

Conclusion

in DFT, autonomous sequence generation entails two steps

- I) condition of satisfaction: detection/reverse detection instabilities create an active transient that deactivates the current intentional state
- 2) the subsequent state arises from competitive selection (gradient approach), from chaining (pre-condition), or from a positional representation of serial order