

# Journal Club – Aug 30, 2017

Neuron  
**Perspective**



## **Are We Ready for a Natural History of Motor Learning?**

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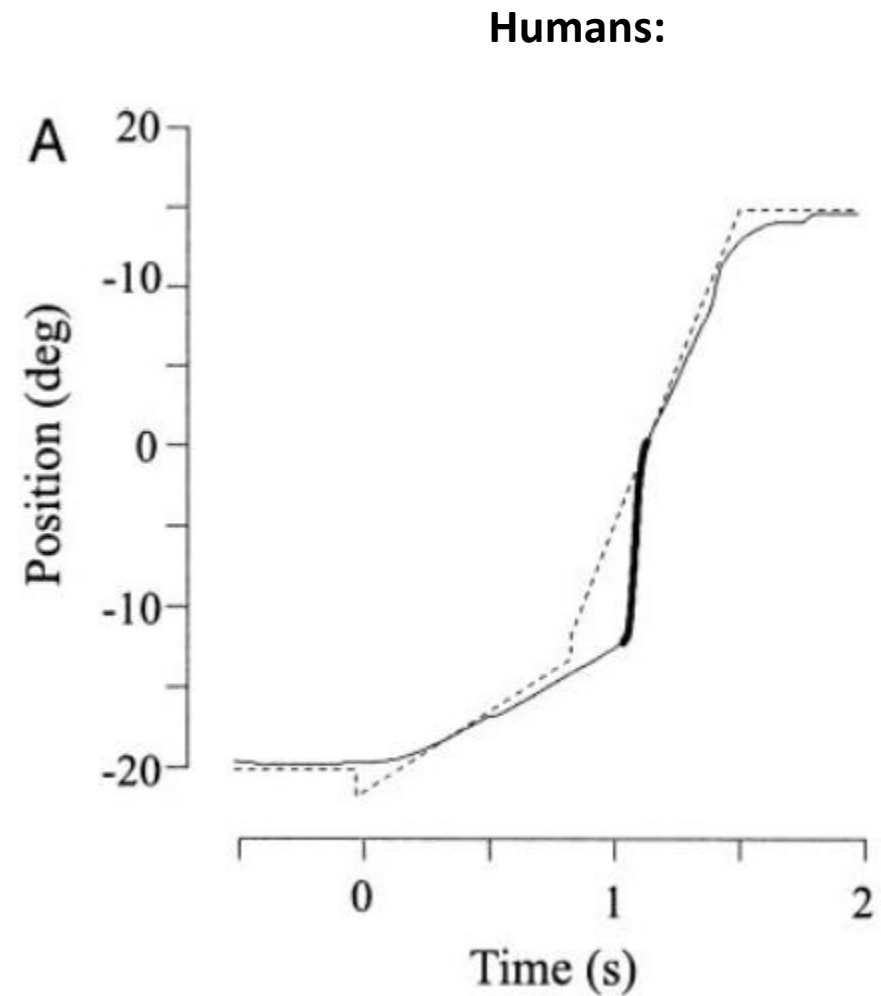
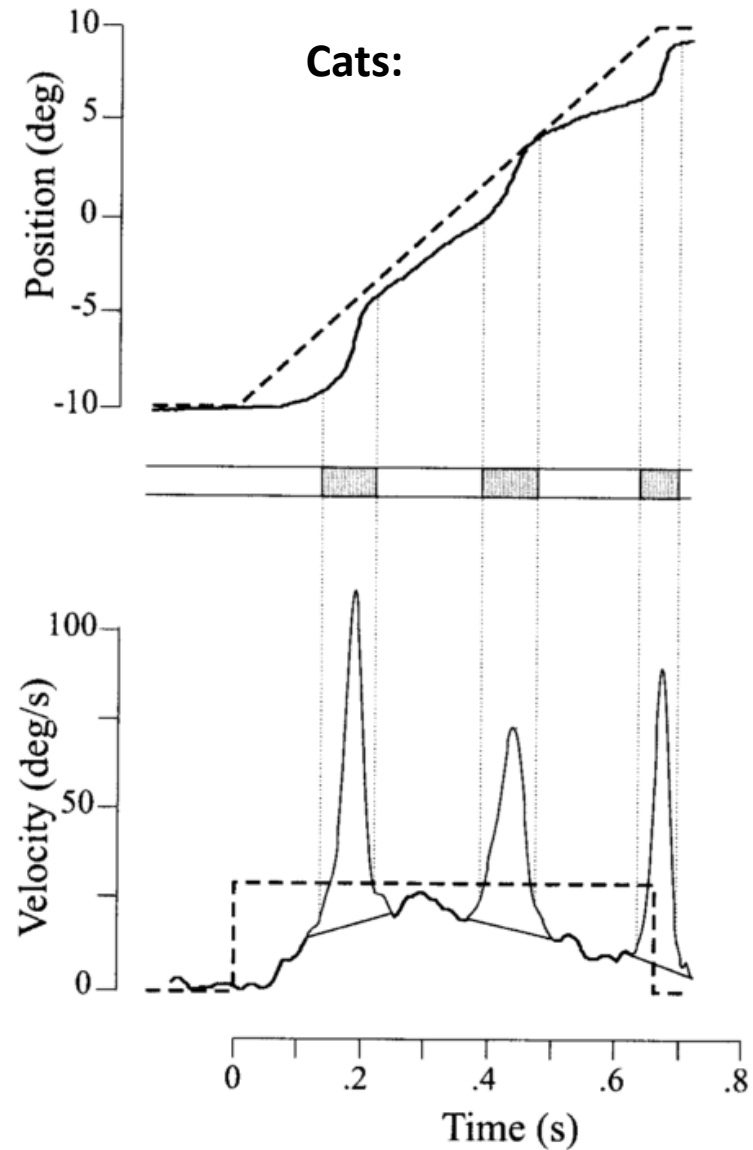
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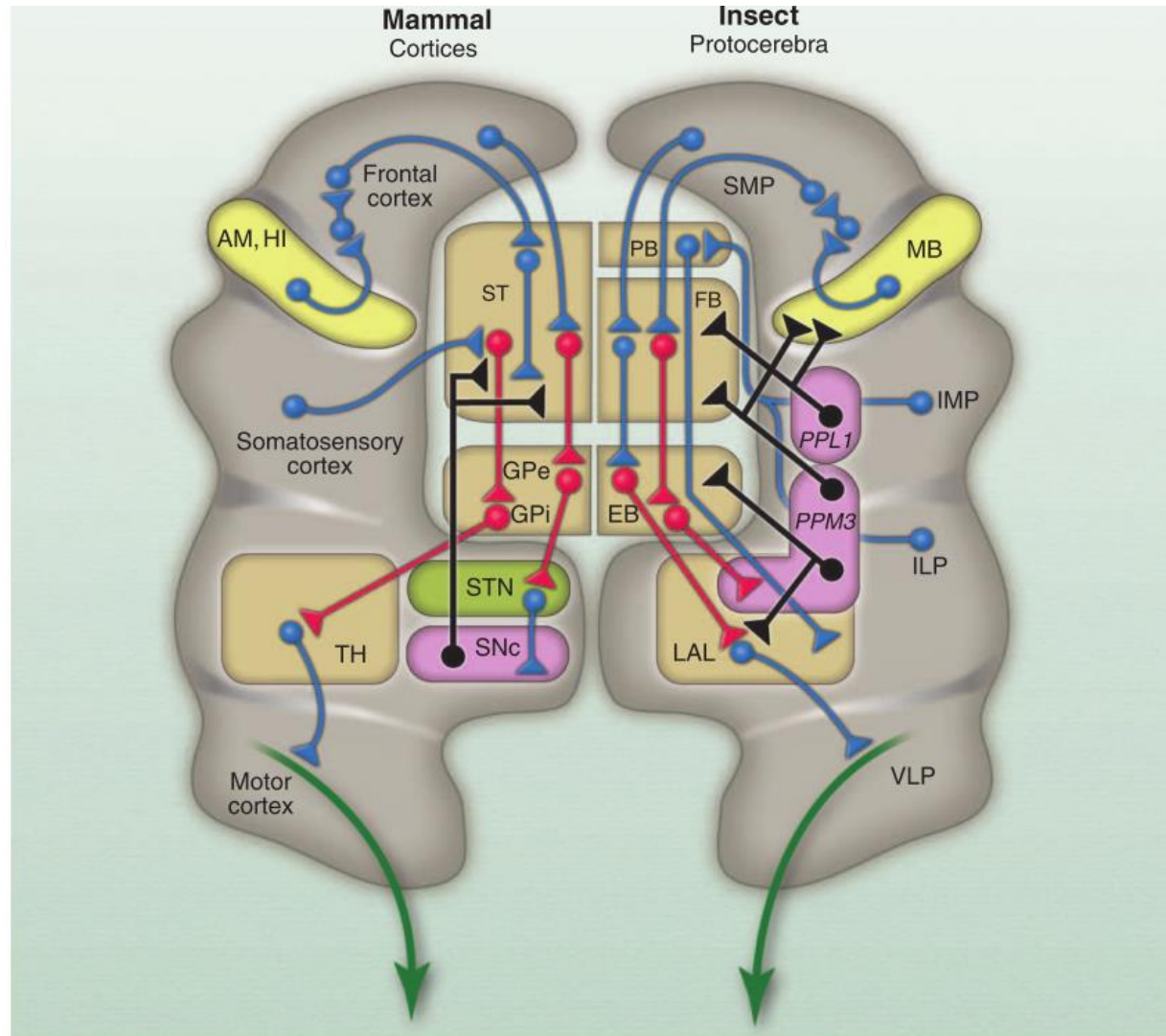
# General Discussion Questions

- **Role of comparative studies across species** in motor control, perception, decision-making:
  - More explicitly accounting for homology or divergence in species comparisons
- “The observation that all of life shares an evolutionary history imposes enormous regularity on biology in the form of conserved traits amenable to general description and explanation” (Krakauer, 2002).

# Comparative Example: Saccade & Pursuit Interactions in humans vs cats



# Comparative Example: Basal Ganglia functional organization in mammals vs insects

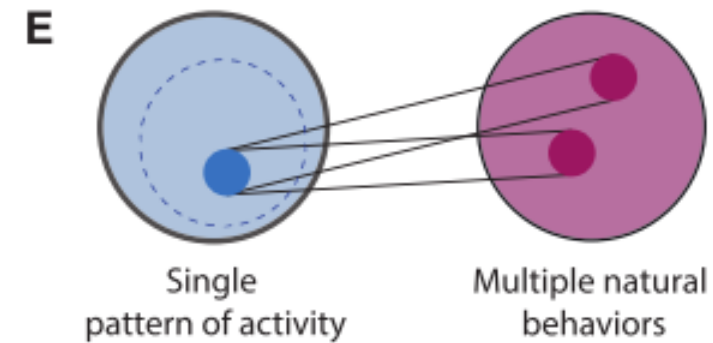
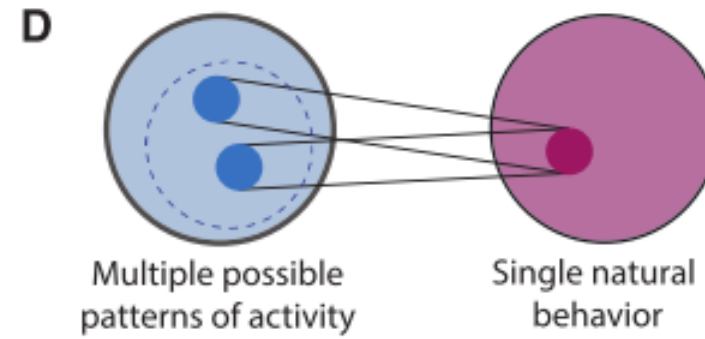
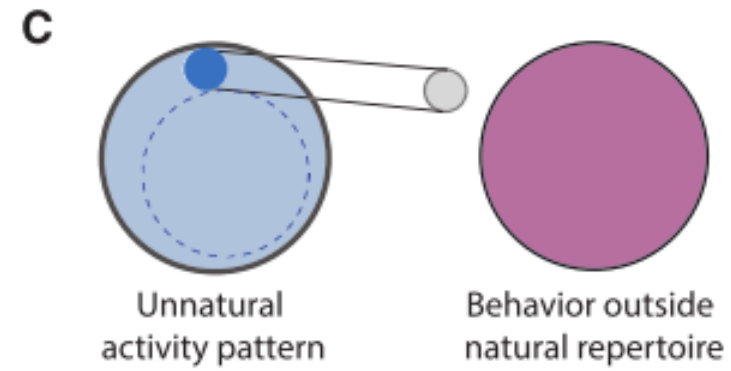
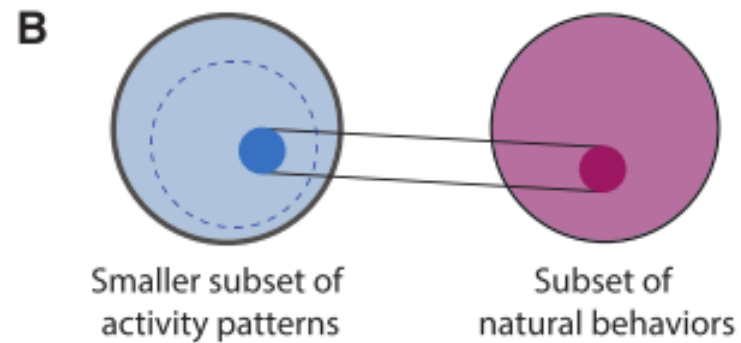
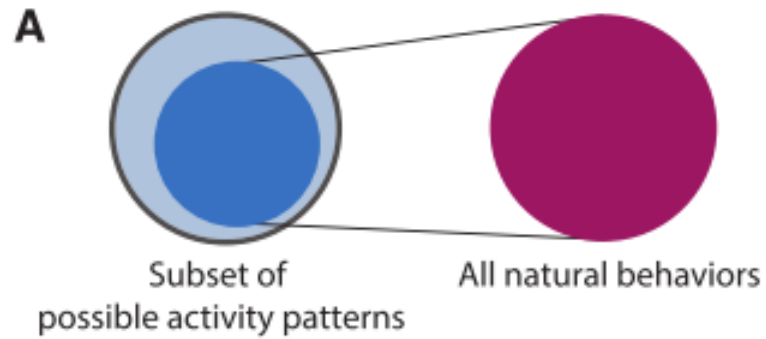
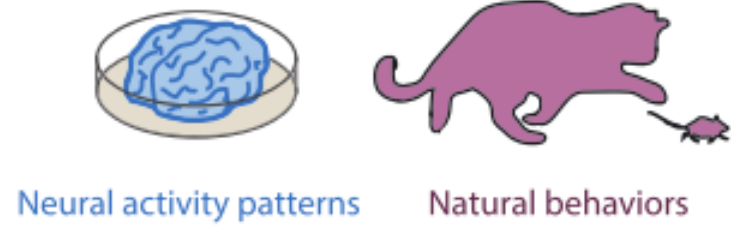


Strausfeld and Hirth, 2013

**Fig. 2. Proposed correspondences of neural organization of the mammalian basal ganglia and insect central complex.** Corresponding regions of the basal ganglia (left) and insect central complex

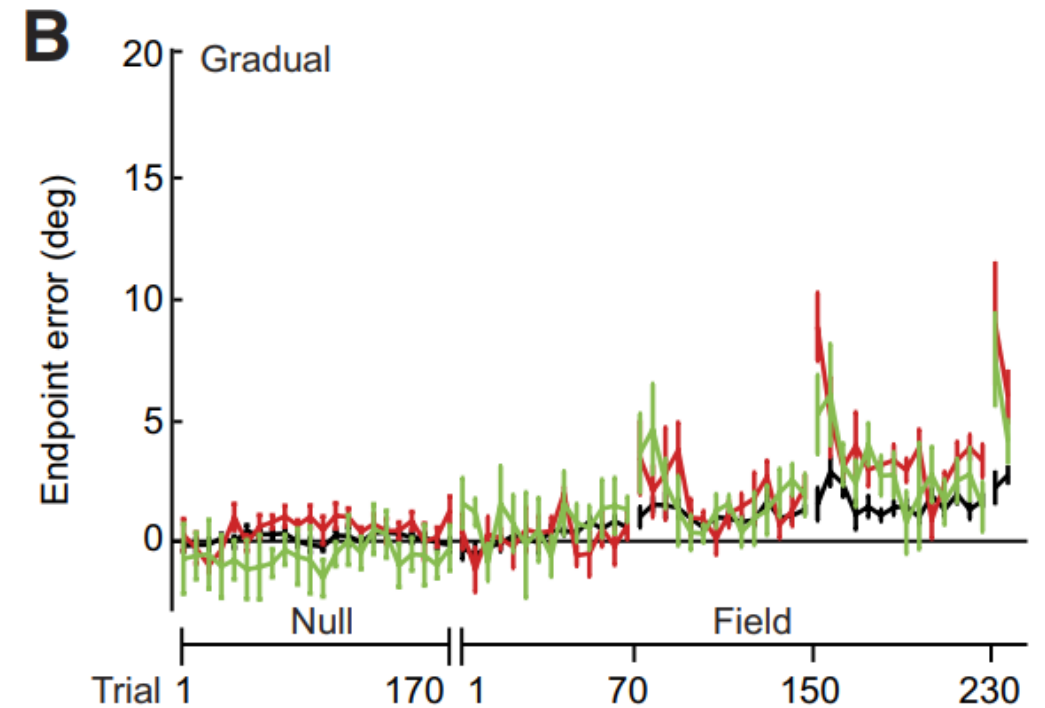
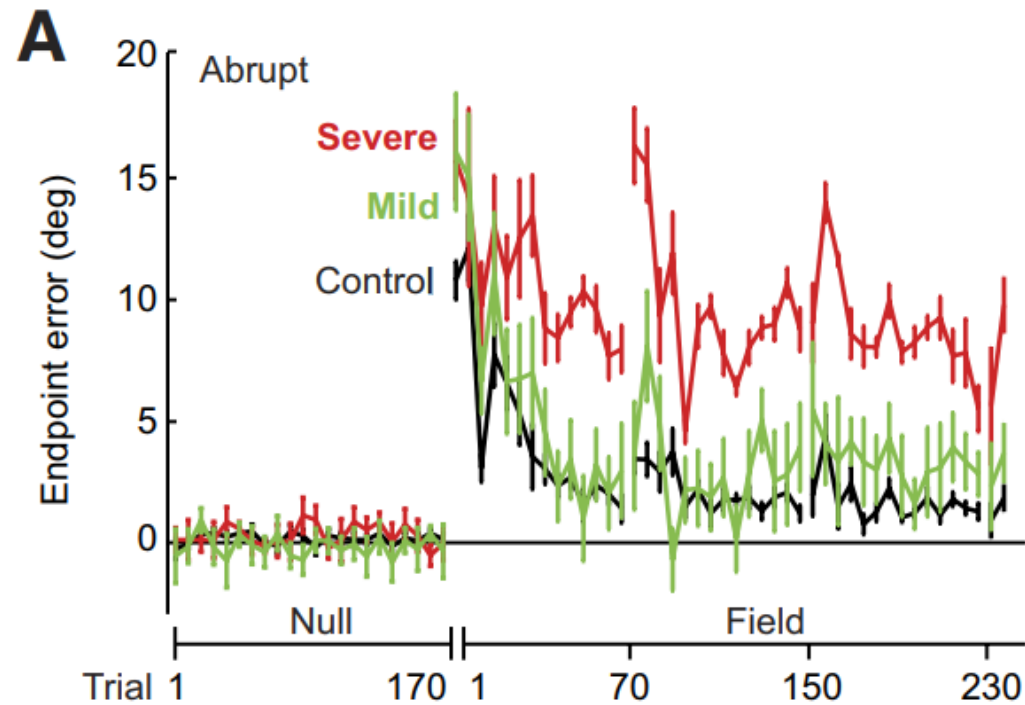
# General Discussion Questions

- **Role of decomposition and localization approach?**
- “We argue that there is continuing usefulness for decomposition and localization as heuristic strategies in mechanism-based neuroscience research ([Betchtel and Richardson, 2010](#))”
- “Decomposition is just a starting point or null hypothesis, which in our view is more useful than vague statements about the “loop” or the “whole circuit” doing the work with no suggestion as to how this would be proven experimentally or modeled computationally.”



# Reductionism Example: Cerebellum as locus for motor adaptation?

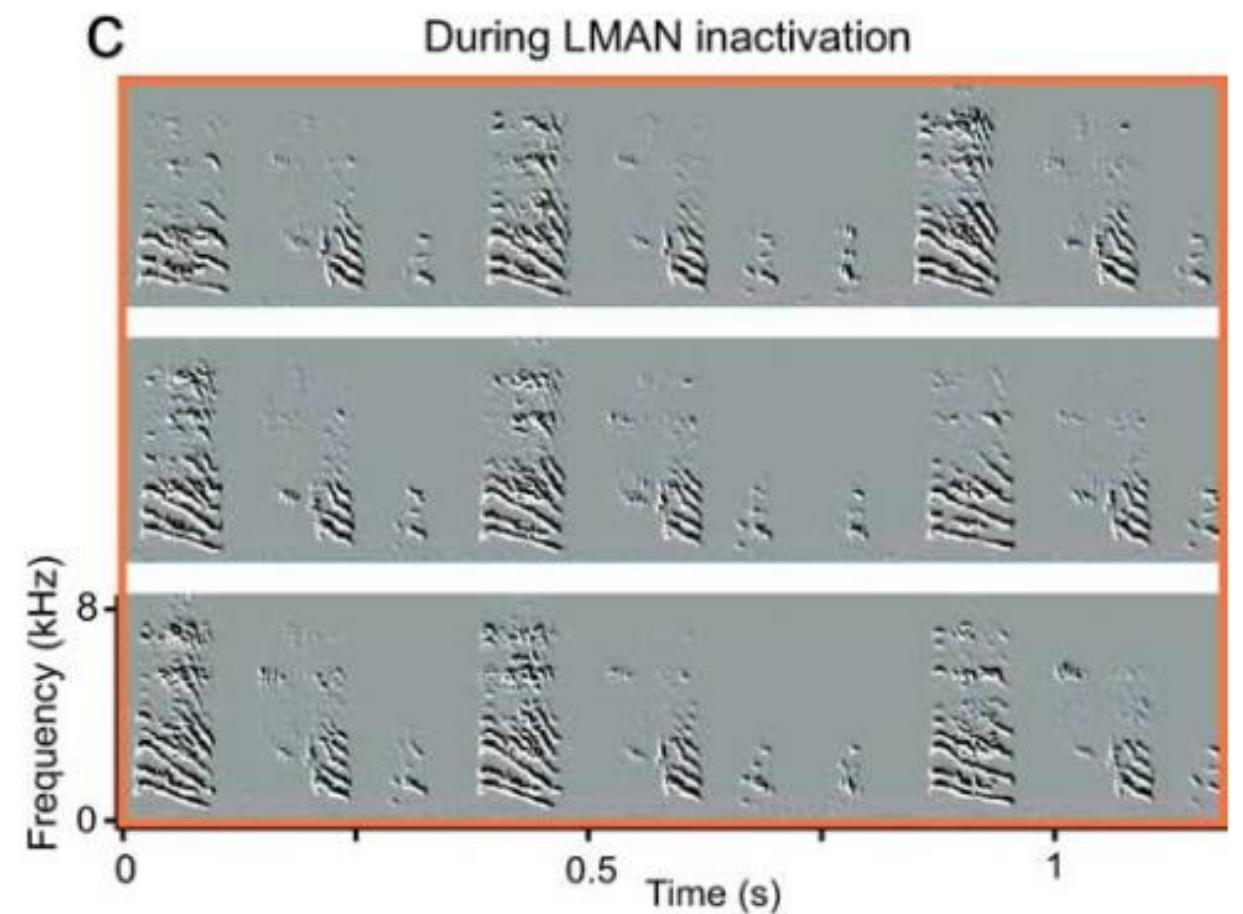
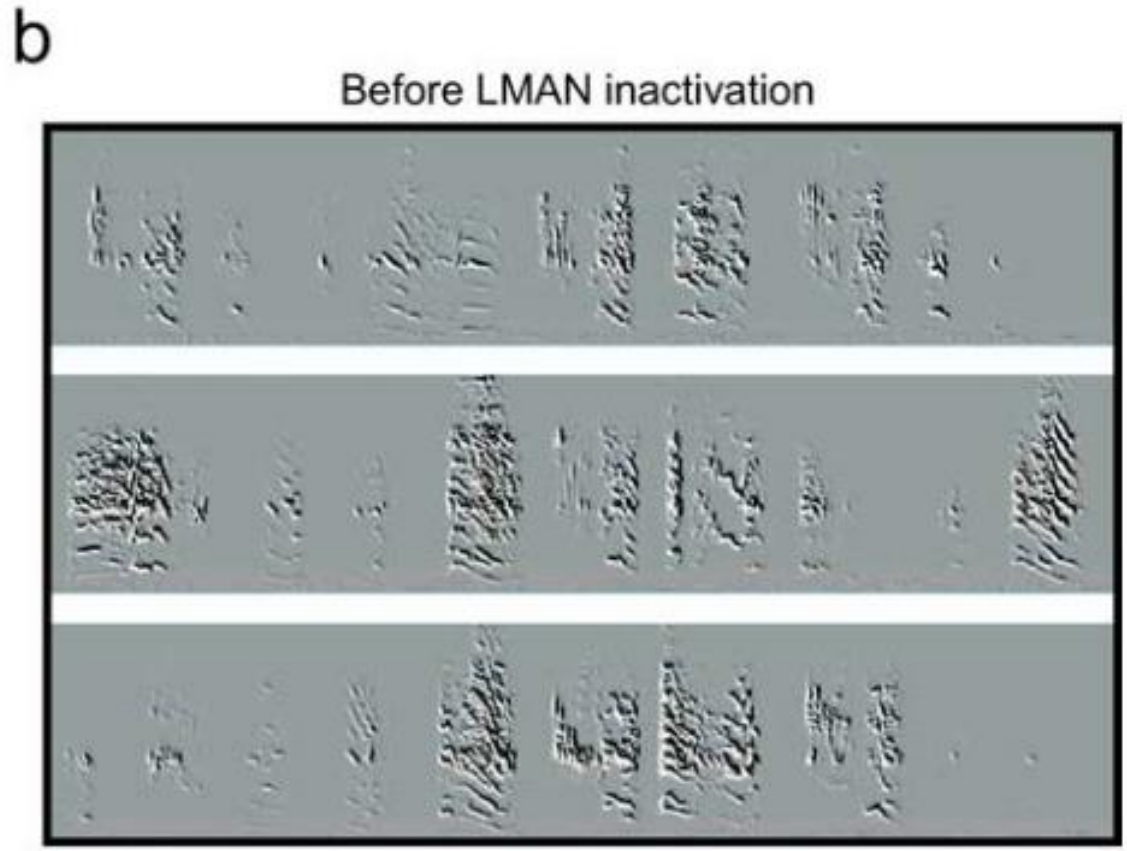
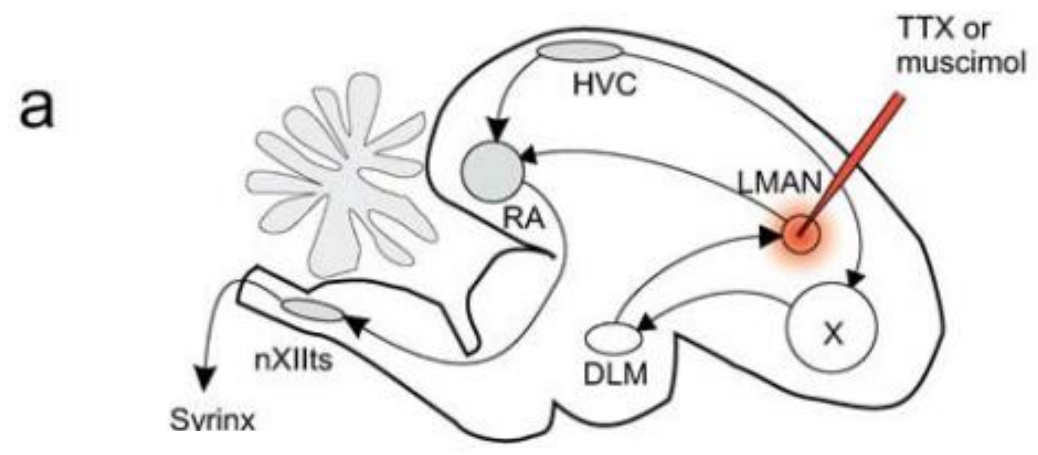
CRISCIMAGNA-HEMMINGER, BASTIAN, AND SHADMEHR



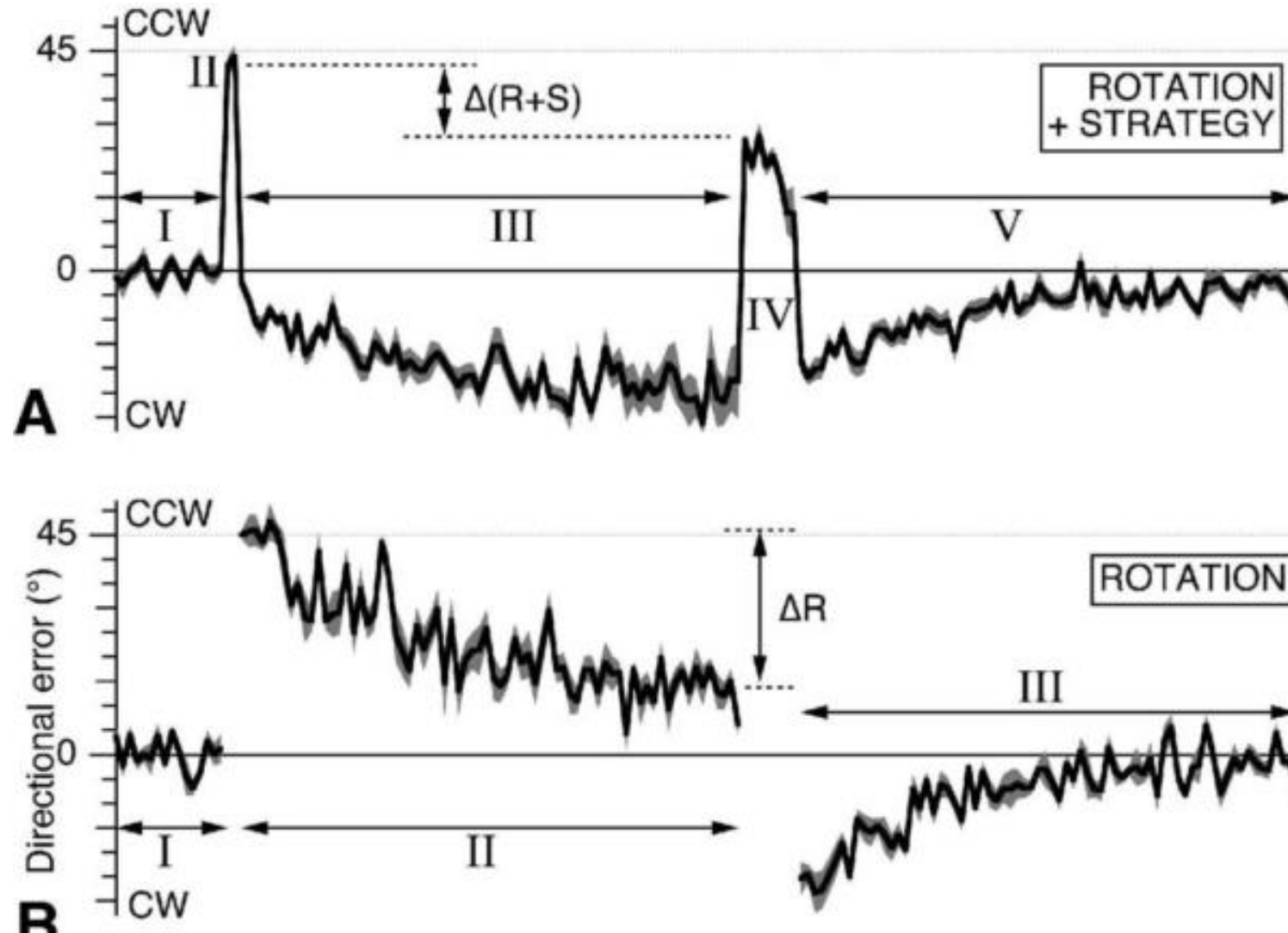
# General Discussion Questions

- **Specificity of vocabulary in Motor Control literature**
  - What is really meant by “motor learning”?
  - Learning to select correct action?
  - Learning to select correct sequence of actions?
  - “Motor skill learning”: improving quality of movement (ie: speed and accuracy)
- Role of motor variability?
  - Noise? → nuisance variability?
  - Exploration? → useful variability?



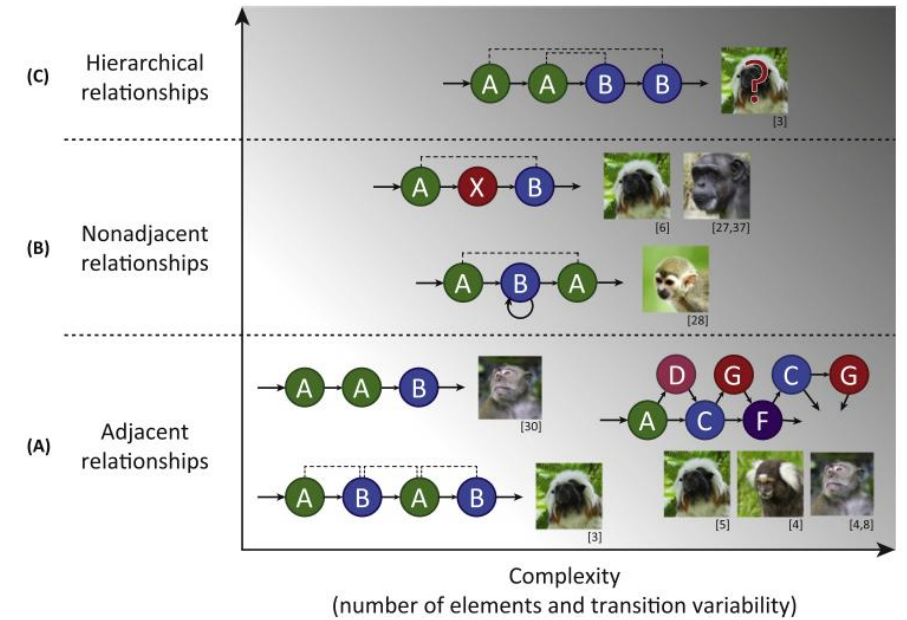


# Simultaneity of different learning mechanisms



# Basal Ganglia

- Evolved from principally targeting tectum in amphibians (control of stereotyped, stim-locked movements) to also targeting cortical regions in reptiles → vertebrates
- Critical for early learning of sequential actions
- Quality of movement rarely assessed in sequential tasks



Trends in Neurosciences



# Basal Ganglia

- Example of distinction between action sequence and kinematic parameterization of action: expert vs. untrained musicians

- Untrained

- Learn sequence of notes, over practice refine motor subtleties to mimic the sound they are trying to recreate (tone, accents, timbre, etc)

- Expert

Years of practice solidifies into characteristic motor patterns, song learning more guided by sequence of notes/chords

Quality of sound becomes somewhat stereotypical, but individual, transferrable across different sequences/song structures...but flexible (individual & genre-specific styles)

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- What model system and paradigm would be best suited to test if there is a transition from control of action selection to vigor/urgency in sequential learning in BG

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Article

## The Basal Ganglia Do Not Select Reach Targets but Control the Urgency of Commitment