Lecture 15

Motor System

What features are represented in motor cortex

- Fairly high-level structure
- Several synapses between motor cortex and neurons innervating muscles
- Thus, unlikely that motor cortex explicitly represents signals related to muscle contraction
- It is **unknown** precisely what information is represented explicitly in motor cortex. Several possibilities proposed:
    - End-to-end goal (location based code)
    - Trajectory of movement
    - Configural information over time
    - Velocity information
    - Kimenatic information more broadly
        - e.g., trajectory, velocity & acceleration
    - Feedback/control system signals

Neural coding of movement in motor cortex

- Oldest, classical studies
    - Monkey + motor task (joystick)
    - Activity of single neurons in motor cortex is **correlated** with the direction of the intended movement

The population vector model of motor cortex

- Average over the neurons to get indication of what direction you want to move
- The aforementioned method is too basic, not enough flexibility
- Motor cortex isn't just sending the 'already calculated motor command', it prepares using memory and other areas.

Motor neurons have complicated dynamical properties

- Storage + execution phase
- Target -> Preparatory activity -> Go -> Peri-movement activity (move)
- Different neurons have different storage and execution responses
- Planning and movement don't have to be consistent

The affordance competition hypothesis of movement control

- The processes of action selection and motor planning occur simultaneously and evolve continuously across a hierarchical, parallel network

Population vectors vs affordance competition

- Affordance competition model: the situation is more complex as it is happening all at once
- Preparatory activity and action plans in dorsal premotor cortex
- Spatial cues -> animal doesn't know which one so there are two populations firing for different locations
- Memory period
- Color cue -> increase in activity of only the cue color (intended motor action)
- Go signal -> booooooom (actual motor action)

Corpus Callosum and Learning

- Heavily connected (bigger) corpus callosum have better bimanual coordination

Cerebellum lesions affect learning

- When you have a lesion in the cerebellum, you adapt slower or not adapt at all