Brain control of complex arm movement

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Electrocorticography (ECoG)
How does the brain control movement?

- Working with Kat Steele’s lab to calculate synergies
  - which muscles activate together?
  - when do they activate?
Experiment Background

- Strips patient with left parietal coverage
- 16 EMG electrodes covering 8 muscles
- 6 directions: up, down, right, left, forward, back

James Wu
http://www.wpclipart.com/medical/anatomy/muscle/arm_muscles_labeled.png.html
ECoG and EMG

- Background around 0 correlation
- Areas of higher correlation centered around electrodes over MC
- Somatotopically aligned with expected arm control (relative to hand control)
ECoG and Synergies

ECoG High Gamma Frequencies (Left Parietal) and 7 Muscle Synergies

Synergy Set 1

Synergy Set 2

Synergy Set 3

Synergy Set 4

Synergy Set 5

Synergy Set 6

Synergy Set 7

Brachial Radialis

Post. Deltoid

For. Flexor

For. Extensor

Ant. Deltoid

Triceps

Biceps
Machine Learning

- Up: 27.00%
- Down: 15.00%
- Left: 21.00%
- Right: 2.00%
- Forward: 25.00%
- Back: 27.00%
- Total: 100.00%
Conclusions

• Specific brain regions appear to align well with specific muscles
• We haven’t seen good evidence for muscle control from the brain with muscle groups
• The computer is able to extract information from ECoG but not yet enough to power a prosthetic—potentially with more investigation
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