EMG Recording of Phonemes

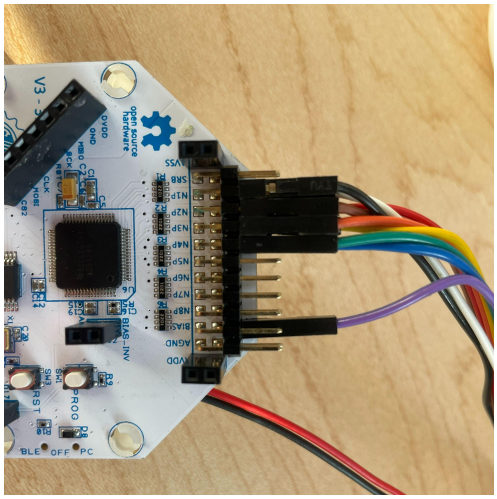
Materials Needed:

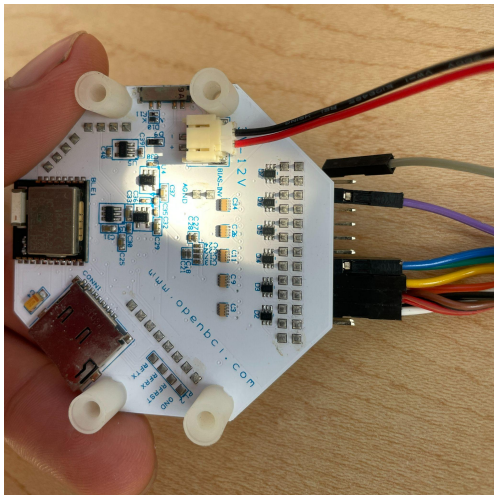
1. OpenBCI Cyton Board & USB Dongle
2. Dry Surface Electrodes w/ 0.1” F end
3. Conductive Lubricant
4. PC or Laptop with USB port w/ downloaded OpenBCI GUI
5. Clean up items (alcohol wipes/tissue and water available)
6. Faux lever for recording collection marking

Prepare Cyton Board for EMG collection

Set BIAS

1. Connect female end of F-M BIAS pin to bottom BIAS male pin





Place Electrodes with gel using above picture as a guide

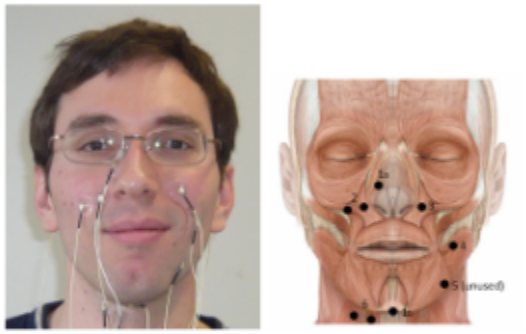
1. Connect female end of 1st F-M pin to top N1P male pin
2. Connect female end of 2nd F-M pin to bottom N1P male pin
3. Repeat 4 times once for each phoneme

Streaming EMG Data with OpenBCI GUI

Downloading OpenBCI GUI

1. Select appropriate installer from link below
2. For windows extract .zip and open OpenBCI GUI found in extracted folder
3. Once installment is complete open OpenBCI GUI to start

Electrode placement



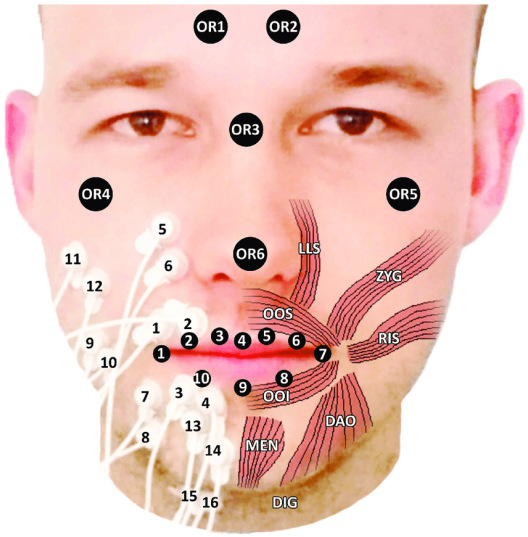


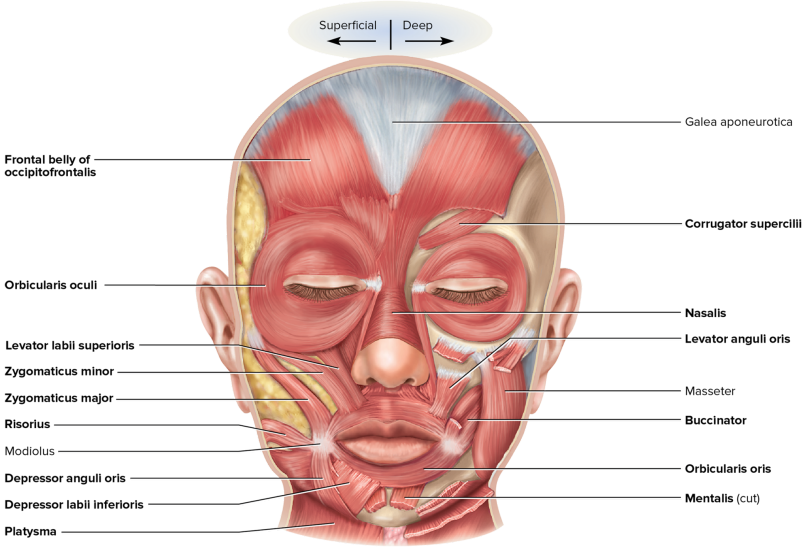
Figure 1: *Electrode positioning for the EMG-UKA corpus (muscle chart adapted from [15])*

EMG UKA Paper Placements

1. Anterior Belly Digastric (unipolar / ground at nose)
2. Levator anguli oris / Zygomaticus Major (bipolar / ground at same muscle)
3. Levator anguli oris / Zygomaticus Major (unipolar / ground behind ear)
4. Platysma (unipolar / ground behind ear)
5. Platysma /Depressor anguli oris (unipolar / ground behind ear) (unused/unstable)
6. Tongue (bipolar / ground at same muscle)

Our Potential Placements

1. **Zygomaticus major**
2. **Depressor labii inferioris**
3. **Risorius**
4. **Orbicularis oris inferior**
5. **Orbicularis oris superior**
6. **Levator labii superioris**
7. **Platysma**
8. Mentalis
9. Depressor anguli oris



Start OpenBCI GUI on Device w/ Administrator Access

1. Plug in USB Dongle into USB port on Device
2. Turn switch on Cyton Board to PC mode
3. Under “DATA SOURCE” click “CYTON (live)”
4. Under “PICK TRANSFER PROTOCOL” click “Serial (from Dongle)”
5. Set settings appropriately for use
6. Under “SERIAL CONNECT” click “AUTO-CONNECT”
7. If all goes well it should pop up with a new screen with 3 sections

EMG collection

Recordings were performed with the open source OpenBCI Cyton Board. Technical specifications include an amplification factor of 1170, 16 bits A/D conversion, a resolution of 0.033 microvolts per bit, and a frequency range of 0.9-295 Hz. EMG signals were sampled with a 250 Hz sampling rate. Recordings were performed in a push-to-talk setting and were controlled with the open source OpenBCI GUI, they were performed in quiet rooms, but without electrical shielding: We expect this to be closer to real-life usage than using a specialized recording room.

Adjust Settings for EMG collection

1. Under “Time Series” Turn off any unused channels
2. Go to Hardware settings and turn off SRB2 for all streaming channels
3. When ready press “START DATA STREAM”
4. Ensure faux muscle lever functions (when closed should show signal)

Stimulus Presentation

Familiarize individual with phonemes

1. /b/ as in beg & bag
2. /v/ as in vin & volt
3. /i/ as in eel or cheese
4. /u/ as in food or mood
5. Other possible phonemes:
    - /o/ as in boat or row

Per Phoneme

1. Pronounce 10 times
2. 1-2 second pause between pronunciations
3. Wait 4-5 seconds between phoneme groupings

Notable Links-

OpenBCI GUI download link

Works Cited-

Muscles of the Speech Production Mechanism

List of Phonemes

List of Phonemes 2 (More examples)

The_EMG-UKA_Corpus_for_Electromyographic_Speech_Processing

Hand Gesture Classification Article

Hand Gesture Code

Bilabial/Other Categories for Phonemes