# Sentence Onset Electrical Stimulation Task

This experiment was developed in the Brain Modulation Lab at MGH by Mohammad Rezaei, Matteo Vissani, Latane Bullock and Alan Bush. It involves task-related stimulation of DBS targets during speech production in participants undergoing awake DBS implantation surgery.

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## Basic Information:

This task is a speech sentence repetition task. Participants will hear a subset of sentences from the Harvard Psychoacoustic Sentence Set through loudspeakers. Participants will be instructed to repeat the sentence aloud following a beep, which serves as a GO cue. This task is purely auditory and does not involve any relevant visual stimuli.

## Instructions for participants:

"In this experiment, you will hear some sentences. Please repeat the sentences aloud after the beep. Ensure you wait for the beep before starting to repeat the sentence. "

## Audio threshold calibration:

To stimulate speech-onset or mid-speech, the stimulation is triggered from the microphone. To calibrate the threshold correctly, the background noise must be measured before running the task. Run the Task and select the option "1" to calibrate audio when prompted. This will record audio for a few seconds and then display the oscillogram. Select a suitable time window for the calibration. A log histogram will be displayed. Select a threshold based on this information. A suggested threshold is displayed.

## Preparations for stimulation:

* Measure the impedance of the DBS lead contacts against the reference
* Measure the impedance of the DBS lead contacts against the ground (i.e., temporarily switch ground and ref)
* Verify that segmented contacts to be wired together have matching impedances against the ground.
* Wire together segmented contacts to be stimulated.
* Test the stimulation settings using Ripple's stimulation GUI. Ramp up in 1mA steps until the intended stimulation amplitude. Verify that no sensations are elicited and that a similar effect to clinical stimulation is achieved. Do this for dorsal and ventral locations.
* Enter the electrodes and current amplitude configurations into the task script.

Per the IRB protocol, the stimulation amplitude is capped at 5mA. Note that this is well below the ~10mA safety threshold for segmented DBS contacts with a surface area of 2mm2.

Other stimulation settings: pulse width = 66us (per phase), inter-pulse-interval = 33us, symmetric charge-balanced monopolar pulses, cathodic phase first.

## Task design:

The task is designed to test different stimulation settings and blanks. A complete cross of the following conditions are tested:

* Location: Dorsal vs. Ventral contacts (no current steering)
* Frequency: High (130Hz) vs Low (30Hz) stimulation is tested.
* Time: Go cue vs mid-sentence.

These 3 factors, with two levels each, are crossed to produce 8 stimulation conditions. An additional condition of no stimulation is added (with two repetitions). These 10 stimulation conditions are crossed with 8 selected sentences from the Harvard Psychoacoustic Sentence Set to create the 80 trials of the task. The order of the trials is fully randomized.

## Troubleshooting:

## Microphone data not available to detect speech onset

Check the Volume settings for the microphone in the OS. Right Click on the audio controls on the taskbar notification area, and select ‘Sound Settings.’ Scroll down to Input and ensure the volume is 100% and not muted.

A screenshot of a computer

Description automatically generated