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Event Related Electrical Potentials Recorded From The Brain Prior To The Initiation Of Speech

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Prior To The Initiation Of Speech

Hannah Hansen, Samantha McNeely, and Ethan Germann

Conclusion

Using a novel method based upon the use of a two-channel audio recording system, CV speech was repeated (lower right figure) and the EEG was extracted from the opposite channel at the exact initiation of speech. The EEG was extracted one second prior and one second after speech. Extracted EEG was summed for 100 CV occurrences and is shown in the Results figure. The results are in agreement with Wohlert (1993). The “Speech” mark on the figure was the point taken from the vocal onset. The benefit of this method will allow a more detailed analysis of the electrical changes in shorter time intervals before speech initiation.

Abstract

This research will explore the neurologic pathways that occur before the initiation of speech. The basis for this project and the research component will include the electrical potentials along the speech production pathway. The subjects will be given a target consonant-vowel (CV), and their speech production will be recorded simultaneously with their neural activity. We will be attempting to record the electrical signals from the cortex. Subjects will be neurotypical. Benefits of this research will include an increased understanding of normal neuro-electrical properties of the speech production pathway. The clinical benefit will include understanding variations from the norm with application to neuro-motor disorders.

Background

In 1993, Wohlert aimed to find a baseline of pre-speech Readiness Potentials (RPs), which could potentially be used in clinical application for diagnosing disorders such as apraxia. Pre-speech RPs are neural activity that occur prior to speech. This neural activity can be recorded using electrophysiological tests such as EEG, EMG, and EOG.

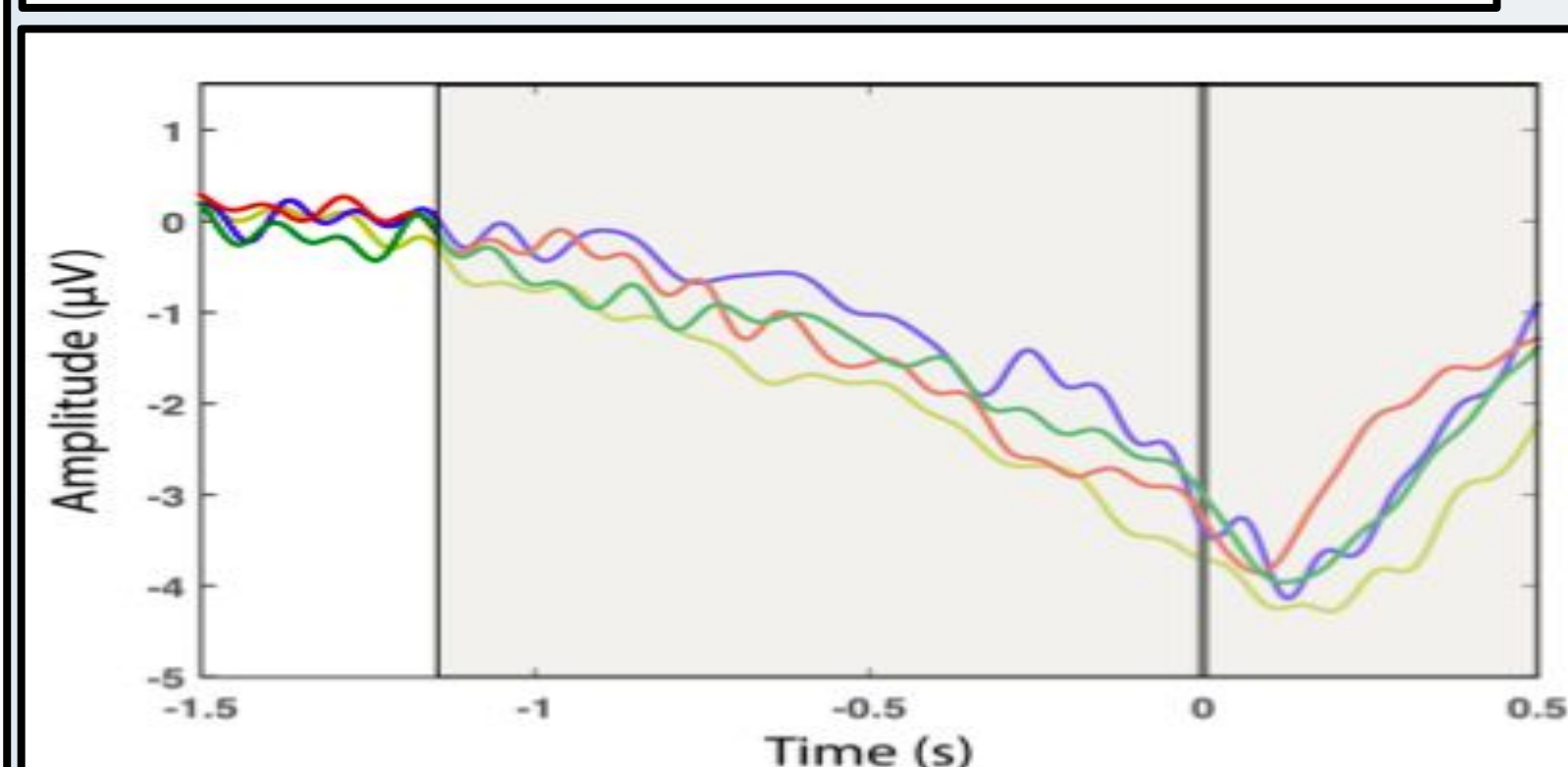
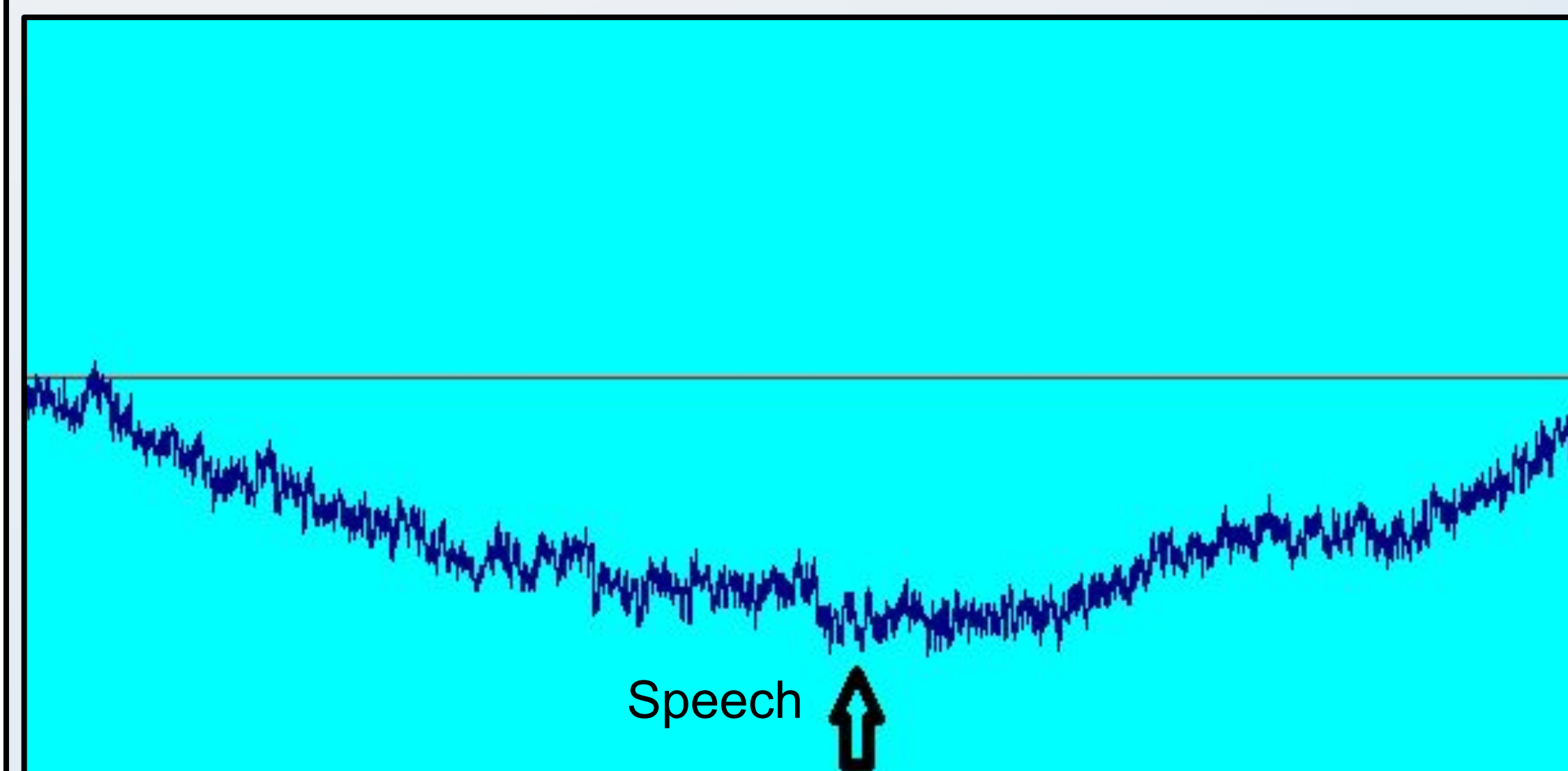
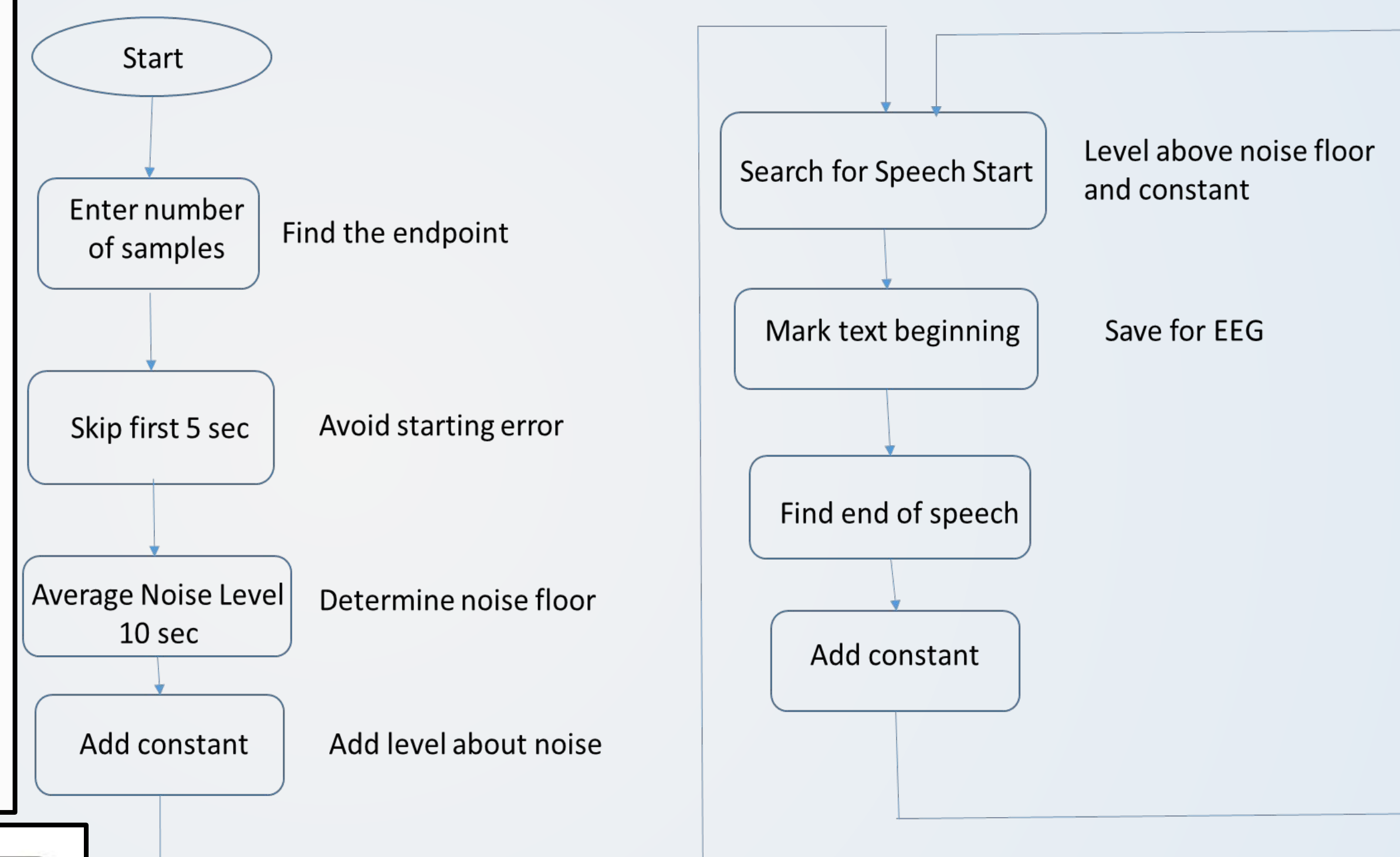


Figure 1: The readiness potential at electrode Cz for the four conditions: left finger extension (green), right finger extension (yellow), lip pucker (red), and production of /p/ words (blue).

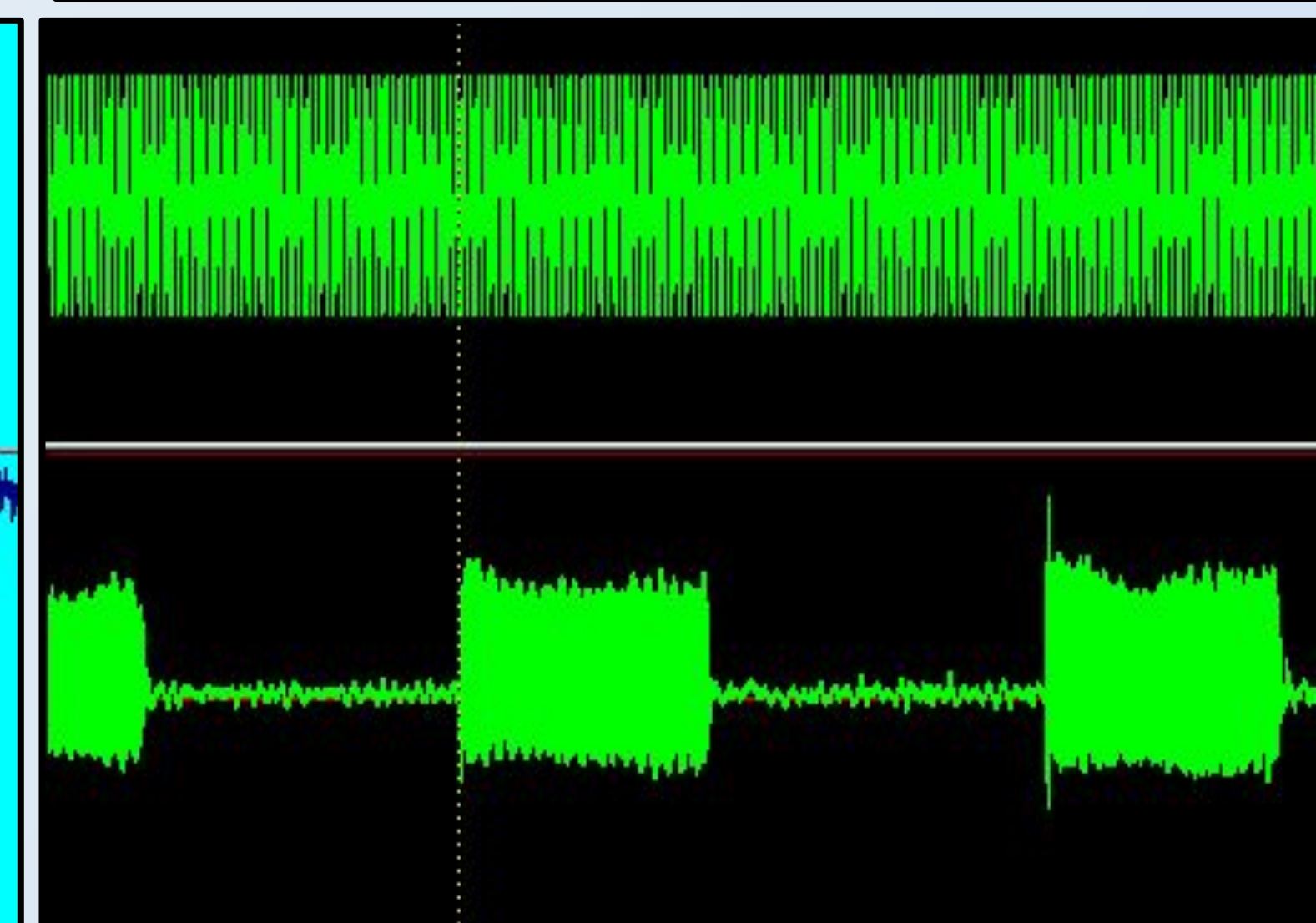
RP (e.g., transitioning into an intentional movement preparation period). The combined results define a filtering pipeline that is capable of finding onsets of the RP in single trial data.

Methods



Future Goals

Future goals for this research include increasing the number of neurotypical subjects in the data collection as well as applying the method to subjects with motor-speech disorders. This method of analysis will aid in analyzing the electrical changes prior to speech production. Examining the electrophysiology of speech production is important to contributing to the general understanding of speech.



References

Wohlert, A. B. (1993). Event-related brain potentials preceding speech and nonspeech oral movements of varying complexity. *Journal of Speech and Hearing Research*, 36, 897-905.