

04/04/2016 Progress Report for “Clinical Analysis of Speech Rhythm in Language Development using MATLAB”

The goal of our project is to develop a program that will analyze the rhythm in the speech of children with and without language impairment. Our analysis process will exist entirely in one program, MATLAB. This will increase efficiency, decrease time spent on data analysis, and automate the speech analysis process. Ultimately, the code will output two scores representative of the individual’s rhythmic abilities, self and global-synchrony scores, determined by Circular Statistics analysis conducted in MATLAB. Our hardware component, a Scarlett i2i sound card, will simultaneously play a metronome and record the patient’s speech. The collected data will be transferred to MATLAB for analysis and output the patient’s synchrony scores. In the previous weeks our advisor Dr. Gordon requested us to use the variable “mean vector length” to determine our synchrony scores. We had been exploring the `circ_r` function (outputs “r” mean vector length) in MATLAB’s Circular Statistics Toolbox. We had also been working on the “Hand Adjustments” section of our speech analysis code and trying to get our soundcard to play a metronome and record speech at the same time.

Since our past reporting we implemented the `circ_r` function into our code. We had previously figured out that a hand adjustments part in our code would fix our problem of peak misdetection. However we realized that it takes very long for the user to click on every peak, and is unnecessary if only few peaks have been miss-detected in a small part of the code. In the past week we wrote a code to allow hand adjustments to be done in four smaller time fragments of the speech recording to be analyzed. This allows the user to confirm the correctly detected peaks and do hand adjustments only in the sub-time fragments where peaks have been incorrectly identified instead of having to do hand adjustments through the entire length of the speech waveform. Our biggest accomplishment since past week was writing a code which allows our soundcard to simultaneously record speech and play a metronome. Our soundcard can now directly input speech waveforms and metronome waveforms simultaneously into our speech analysis MATLAB code which can output synchrony scores in real time. We also started working on our poster presentation powerpoint slide. Furthermore, we are currently putting together an instruction handbook describing the components of our design and how to make our code work for the Music Cognition Lab’s use in the future.

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Currently our biggest problem is getting accurate `circ_r` scores from our circular statistics analysis. Although hand-adjustments portion has been useful, we are trying to truncate our data to limit the occurrences of peak misidentification which has proven to be a challenge. Furthermore, we would like to see our design being used as a diagnostic as well as therapeutic for Specific Language Impairment (SLI) however a problem standing in the way of this has been the scarcity of SLI patient speech data. Finally, we have observed that pilot study participants who have done the speech cycling task with our design in the past week to have difficulties in keeping up with a 90 bpm metronome.

In the following weeks we will continue working on the `circ_r` function. We have emailed Alison, who has suggested using `circ_r`, to schedule a meeting to talk about our synchrony scores and troubleshoot our code. We will also continue our efforts to truncate our data and explore the effects of using different filters in peak identification accuracy (currently we are using a low pass filter). We will also be collecting speech data from an SLI patient this Wednesday and observe potential differences in speech waveforms of SLI patients and typically developing (TD) six year-olds. We will also further explore different metronome paces and identify the pace which works best with our code and is more natural to synchronize to for patients.

We expect to meet our stage-gates in time with the proposed schedule depicted in our Gantt chart. There appears to be no additional hardware or software components that is needed to be purchased at the time.