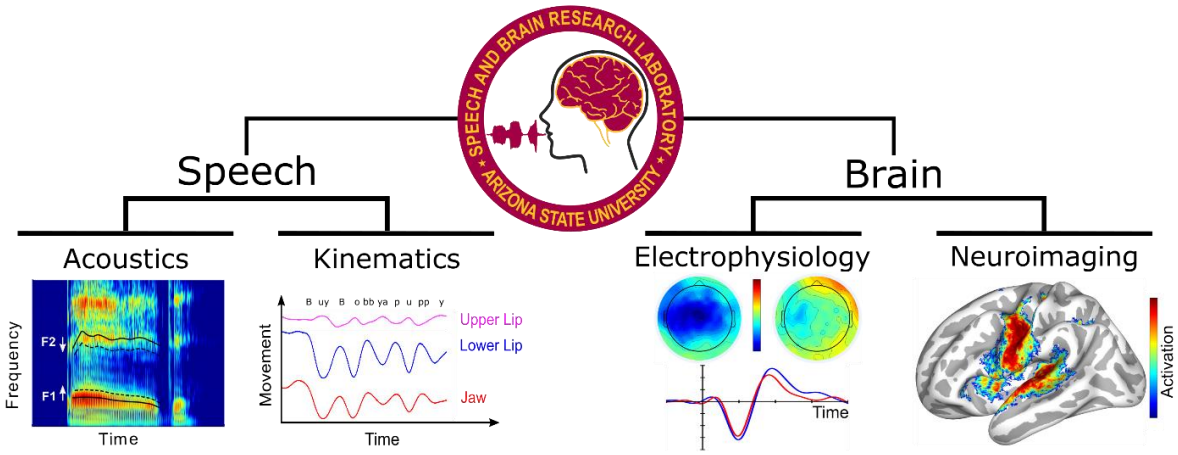


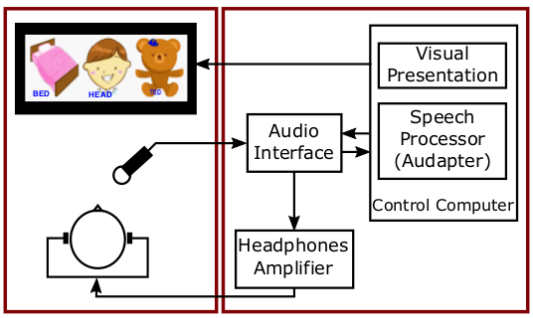
Speech and Brain Research Laboratory

In the Speech and Brain Research Laboratory, we investigate the neural mechanisms underlying speech production and its disorders. Our research lies at the intersection of **Speech Science**, **Neuroscience**, and **Engineering**. We use a combination of brain recordings (EEG and fMRI) and behavioral recordings (speech acoustics and speech movements) to examine sensitivity, accuracy, and integration of sensory feedback during speech production. To systematically manipulate specific parameters of sensory feedback, we employ sensory feedback perturbation techniques. Using such paradigms, we can investigate the integration of sensory feedback for online feedback monitoring, and calibration/maintenance of the speech production system.

Currently, we have several projects with the focus on (I) the **speech science and neuroscience** aspects of our research (i.e., collecting and analyzing acoustic and brain signals), or (II) the **engineering** aspect of our research (i.e., developing hardware and software solutions for speech therapy).

I- Speech/Neuroscience Oriented Projects:

In these projects, we collect speech data (using a microphone) from human subjects while they are producing different speech sounds. We use a speech processor to manipulate their auditory feedback in real-time. For example, subjects produce “bed” (recorded with the microphone) but they hear “bad” through headphones. Then, we measure their speech output and examine whether or not subjects change their speech in response to the manipulations. In some of these projects, we also collect EEG data (brain waves) using a special electrode cap. Then, we examine the brain signals in response to the manipulations during speech planning vs. speech production. These projects are ideal for students with interest in speech, neuroscience, psychology, biomedical engineering, and signal processing. In the figure below, you can see a typical setup of our experiments.



II- Engineering Oriented Projects:

In these projects, we develop hardware and software solutions that have direct clinical implications in treatment of disorders of speech (e.g., stuttering), in addition to their basic science applications. These projects are focused on tools that would allow us to manipulate auditory and/or somatosensory feedback. For auditory manipulations, we use an open source C++ library to change parameters of speech in real-time. The current version of the software has several limitations. We are planning to build the next generation of the software. In the following projects, we are aiming to develop and implement procedures to overcome the limitations.

In the first project, we want to develop, compile, and embed the available source code on a Texas Instrument DSP board (TMS320C6416 DSP). Students need to have a basic understanding of C/C++ and MATLAB/SIMULINK. By completing this project, students will learn about embedded coding, DSP programming, and speech signal processing.

In the second project, we want to modify the current source code and implement new procedures for both formant and pitch tracking in real-time (<20ms latency), and new functionalities for perturbations. Students need to have a basic understanding of C/C++ and signal processing. By completing this project, students will have an in-depth understanding of speech signal processing, low-level audio programming (using ASIO), and C/C++ programing.

These projects are ideal for students with interest in speech, biomedical engineering, and signal processing.

Requirements:

We are looking for motivated students with a strong interest in scientific research. Students will be heavily involved in all aspects of our research, including experimental design, data collection and analysis, developing and implementing new techniques and devices, and preparation of manuscripts for publication. The above-mentioned projects are ideal for undergraduate students (e.g., honors thesis). In all of the projects, students will receive the necessary training, and will be closely supervised.

Start Date: Summer (preferred) or Fall 2017

Hours Per Week: 8-10

Desired Academic year: Junior and Senior

Location/Campus: COOR, Tempe

Application Instructions and Contact Info:

Email your CV to Dr. Daliri Ayoub.daliri@asu.edu

https://sites.google.com/a/asu.edu/sbr-lab/home