Hearing Simulator; Web Application

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Objective

Use technology to develop a better understanding of hearing loss that motivates empathy, accessible design, and prevention of hearing damage.

Hearing Loss

There are three types of hearing loss; conductive hich occurs to the outer and/or middle sections of the ear, sensorineural which occurs to the inner section of the ear, and mixed a combination of both. Apporximately one third of individuals experience one of these types of hearing loss throughout their lives.

Audiograms

Audiograms are a tool used by Audiologists to score an individuals level of hearing based on frequency ranges. As seen in Figure 2, hearing capability for each left and right ear are scored for each frequency range, measured in the attenuation of decibels heard in that rang

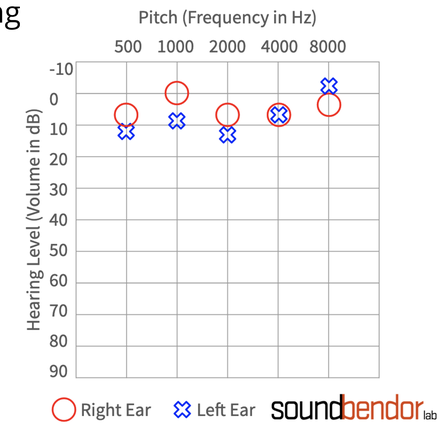

Figure 1: Example of an Audiogram

Implementation

Implementing the Hearing Simulator; Web Application can be broken down into a overview steps.

1. Render an audio input into an Pulse Code Modulation (PCM) buffer
2. break audio into frequency bins (Fast Fourier Transform)
3. Attenuate bins based on user specified slider values (Peaking Filter
4. Output the manipulated Audio

ith the frequency bins extracted in step 2, we can visualize the decibel outpu for each of those frequency bins as seen with the bar graph. Then we can overlay this vizualization with the replicated audiogram, including interactive sliders controlling the peaking filters.

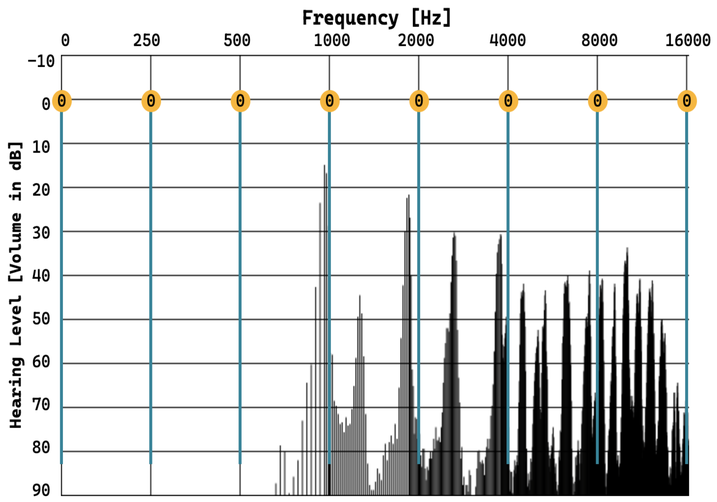

Figure 2: Screen capture of Hearing Simulator

Technology

This project is written entirely in JavaScript, which allows the audio manipulation to happen on the client side. The audio is loaded, manipulated, visualized, and output using the Web Audio API library. By using this library, audio files such as .mp3 can be rendered as an Audio Context which maintains object like functionality. This functionality allows us to use React Redux to store the audio state, providing efficient audio transformation. The Web Application is a Single Page Application (SPA) including the interactive audiogram as well as information about the project. Audio selection is pulled from the freesound.org API, where audio segments are uploaded by individual contributors.

Future Work

Moving forward with this project there are a couple main goals to further differentiate this project from other hearing simulators and provide intuitive, interactive design aimed at meeting the pojrcet objective. These goals are to collaborate with Audiologists and education professionals to determine audio hardware to prioritze for implementing live audio input through microphones, as well as stereo output to allow manipulation of both left and right ears.

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