The Tone Trainer

A DSP project created by Charles Bolton

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The "Tone Trainer" is a Command Line Interface game that allows users to test their recognition of various music-theoretical concepts in the same way that a singer might practice sight singing or a pianist might practice scales up and down the piano keyboard. There are currently four games: pitch trainer, interval trainer, chord trainer, and scale trainer. Each game accesses a different set of wav files from a directory based on waveform type selection. The selections include sine, square, triangle and saw. All of these files were generated by the program using the tone_generator module. All of the sound included in the base game was generated in code. A future version will include piano tones probably not generated from mathematics. I am indebted to tonedear.com for the inspiration for this project.

The inspiration for the Tone Trainer came from a few places. I wanted to learn how the Discrete Fourier Transform worked at a very fundamental level, so I began investigating how it worked. After months of trying to understand how it worked, I finally understood enough to implement one of my own. The idea for the interval trainer was born out of this process; I first generated 88 sine tones in code and saved them as .wav files to playback. For fun, I created the pitch trainer. But my real goal was to add two sine waves together and find out if my DFT could give me the composite waves in return. Because adding two sine waves together naturally creates an interval, I decided to add sine waves together to create all the common musical intervals in an octave with a given tonic. The interval generator does this based on waveform selection. The dft then takes all the samples from one of these files and returns the composite frequencies to the trainer. The trainer looks these up in a dictionary and gives them back to as playbackable files to the user. The chord generator and chord trainer work in a similar way, with a dft parsing 3 or 4 frequencies. The dft only has 88 bins, to speed it up. The scale trainer was mostly a desired feature that I added for fun but it was still a learning experience.

In addition to learning about the DFT, I wanted to learn about basic additive synthesis. In addition to generating sine tones and adding them together, I also generated square, triangle, and saw waves and added them in the same ways, creating intervals, chords, and scales.