CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35548

Project Title

Sound Wave Shape and Hearing Frequency Range in Adolescents

Abstract

Objectives/Goals

I have always been interested in sound, and I had just discovered synthesized waveforms. My goal was to investigate if synthesized sound waveforms might affect the ability to hear higher frequencies. My hypothesis was that synthesized waveforms might allow the subject to hear higher frequencies. I felt that my project was important because it might somehow allow hearing aids to help the elderly hear higher frequencies.

Methods/Materials

In my experimentation, I tested 80 subjects aged 9-14 for their hearing range with sine, square, triangle, and sawtooth waveforms. In my procedures, I used a pair of headphones, a frequency generator, a logbook, a pencil, and a playback device. For my procedures, I plugged the headphones into the frequency generator and asked the subject to raise their left hand when they heard a tone, I then played frequencies with various sound wave shapes at intervals of 1,000 Hz, beginning at 8,000 Hz and ending at 21,000 Hz. I logged when the subject stopped hearing the tone, the subject's age, and gender.

Results

On average, the 38 males heard up to 17,000 Hz for sine waves, 21,000 Hz for square waves, 20,000 Hz for triangle waves, and 21,000 Hz for sawtooth waves. The 42 females exhibited the same averages. Subjects listening to square, triangle, and sawtooth synthetic waveforms heard significantly higher frequencies than for the sounds emitted as sine waves.

Conclusions/Discussion

My hypothesis that the synthesized waves would enable my subjects to hear higher frequencies was supported. the subjects on average heard an 18% higher frequency range with the triangle waves and a 24% higher frequency range with the sawtooth and square waves. The synthesized waves are believed to emit more harmonics, but the harmonics are of even higher frequencies than the original tone. it would be interesting to test adults to see if the test results are similar.

Summary Statement

The goal of this project was to investigate if synthesized sound waveforms might affect the ability of human test subjects to hear higher frequencies.

Help Received