Lab 13: Sound and Music

Purpose

To visualize sound and recognize the difference between noise and musical tones.

Introduction

Most of the sounds we hear are noises. The impact of a falling object, the clapping of hands, the sound of traffic, and most of human speech are noises. Noise corresponds to an irregular vibration of the eardrum produced by some irregular vibration source.

The sound of music has a different characteristic, having more or less periodic tones produced by some regular vibration source — of course musical instruments can make noise as well! A graph representing musical sounds has a shape that repeats itself over and over again. Such graphs can be displayed on the screen of an oscilloscope when the electrical signal from a Sound Sensor is measured.

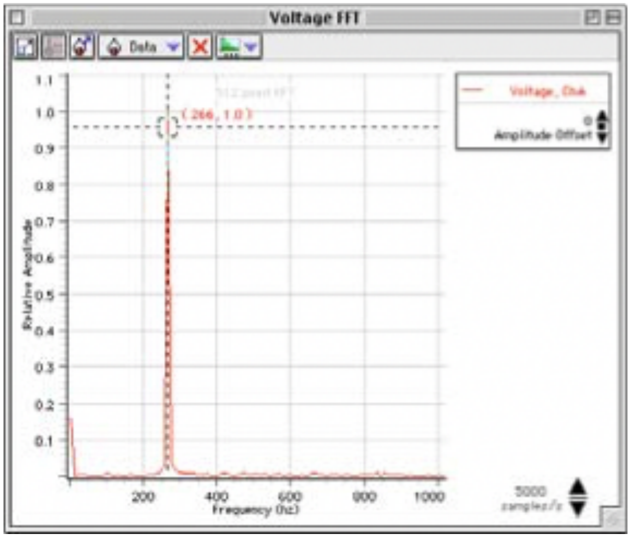
The Greek mathematician Pythagoras found that notes played together on musical instruments were pleasing to the ear when the ratios of the string lengths were the ratios of whole numbers. The Italian scientist Galileo introduced the concept of frequency. A sequence of notes of increasing frequency makes up a musical scale. Many different scales exist. The simplest musical scale in many western cultures is the “just major scale” (for example, “do-re-mi-fa-so-la-ti-do”). In this scale, the ratio between frequencies of two successive notes is 9:8, 10:9, or 16:15. For example, the ratio of “re” (297 Hz) to “do” (264 Hz) is 9:8 (or 1.125).

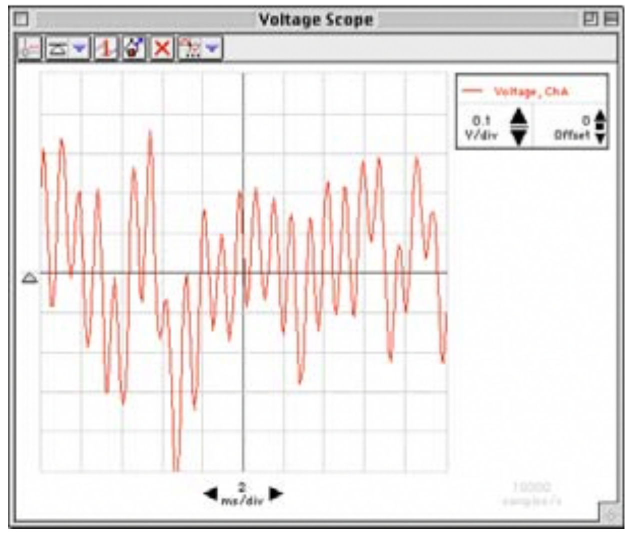
Procedure

1. Setup the computer and interface with the sound sensor connected to the interface on channel A.

2. Open DataStudio and select Create Experiment. Select the channel A port on the picture of the interface and select Sound Sensor.

3. Open the Scope and FFT displays.





4. Click start to start recording data and play an instrument or use your voice to create a tone or noise, and answer the questions in the analysis section.

5. Repeat step 4 for four different instruments/noises (you can use your voice for one of them).

Analysis

Instrument 1: ______________

Sketch the Voltage Scope (waveform) and Voltage FFT (spectral analysis) plots for this instrument?

Is the sound produced by this instrument a noise or a musical tone?

Is there a fundamental frequency, if so what is its value in Hz?

Do the fundamental frequency corresponds to a musical note? If yes, which note?

Is there any distinguishable harmonic frequencies?

Instrument 2: ______________

Sketch the Voltage Scope (waveform) and Voltage FFT (spectral analysis) plots for this instrument?

Is the sound produced by this instrument a noise or a musical tone?

Is there a fundamental frequency, if so what is its value in Hz?

Do the fundamental frequency corresponds to a musical note? If yes, which note?

Is there any distinguishable harmonic frequencies?

Instrument 3: _____________

Sketch the Voltage Scope (waveform) and Voltage FFT (spectral analysis) plots for this instrument?

Is the sound produced by this instrument a noise or a musical tone?

Is there a fundamental frequency, if so what is its value in Hz?

Do the fundamental frequency corresponds to a musical note? If yes, which note?

Is there any distinguishable harmonic frequencies?

Instrument 4: _____________

Sketch the Voltage Scope (waveform) and Voltage FFT (spectral analysis) plots for this instrument?

Is the sound produced by this instrument a noise or a musical tone?

Is there a fundamental frequency, if so what is its value in Hz?

Do the fundamental frequency corresponds to a musical note? If yes, which note?

Is there any distinguishable harmonic frequencies?

Appendix

Use the following table to relate frequencies to musical notes

https://pages.mtu.edu/~suits/notefreqs.html