Electronic Oscillo-keyboard

Every sound is made when something vibrates. Sometimes it's the skin stretched across a drum, sometimes it's a plucked string. By fine-tuning the amount of what is vibrated, you can make notes.

Scientists and engineers use a tool called an oscilloscope to compare different waves, including sound waves. The "oscillo-" part of the word means "swing", just as in the word “oscillate." This keyboard has an oscilloscope built in!

Musicians don't usually pay any attention to the shape of the waves, but this special instrument makes sound, lets you see the wave a physicist would see it, and then lets you play around with a note.

Procedure

1. Use your cursor to "press" keys on the keyboard. Tip: You can also use your computer’s keyboard

   2 3 5 6 7 9 0 =
   Q W E R T Y U I O P [ ]

   Note the frequency in hertz (Hz) and the shape of the wave in your notebook.

2. Click on the "Play with a wave" switch.
   - Change the shape of the wave by clicking on the sliders next to square, sawtooth, triangle, and sine.
   - Listen for the difference in the tone and watch how the curves change for the same key when the keyboard is set to sine, square, and triangle.
   - Change the shape of the wave by sliding the frequency slider back and forth. Observe how the wave in the window changes.
   - Change the shape of the wave by sliding the volume slider up and down. Observe how the wave in the window changes.
3. Turn off the "Play with a wave" button. Turn on "live input.” Make sounds towards the microphone or built-in sound sensor on your electronic device. Hum or sing a high note (like “eeee!”), then hum or sing a low note (like “OOOO!”).
4. Musicians call "middle C" the note that is 261.63 Hz. Can you find the note corresponding to middle C, also known as C4? How about a note that is twice its frequency, C5, at about 523 Hz?
5. Musicians often tune their instruments using the "A4" note, which is the "A" just above middle C. Its frequency is 440 Hz. Can you find the key corresponding to A4?

Turn and Talk

Think about it. Discuss these questions with a partner.

Is there a difference between volume and amplitude?

How do the different shapes (square, sawtooth, triangle, and sine) sound different?

Why does the live input of the microphone make such jagged waveforms, while the notes produced by the computer are much more smooth?

Describe the different waves for different pitches for high and low notes.

How does pitch or frequency affect the waveform on an oscilloscope?

How do the curves compare for keys whose frequencies are 440 and 220 Hz?

How do the sounds compare when the same note is played as a sine, square, or triangle waveform?