

LAB 51: WAVES AND INTERFERENCE

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QUESTION

Why are there loud spots and “dead” spots when music is played in large rooms?

SAFETY

Standard safety precautions apply.

MATERIALS

Concentric circles printed on transparency material, computer, tone generator program

PROCEDURE

When two waves of any kind cross each other’s path, they interfere either constructively (increase amplitude) or destructively (decrease amplitude). When sound waves do this, the result can be heard. You will be simulating wave interference with some models of sound waves. Then you will download software on a computer that will allow you to experience the interference for yourself.

To do this, you will need a Windows computer with a sound card and stereo speakers. It will not work with headphones. Go to www.nch.com.au/tonegen/index.html to download the evaluation version of the NCH Tone Generator software and install it on your computer. If this website changes, simply search for “Free Tone Generator” on a search engine and several may be found.

Part 1

1. Cut out the four sets of concentric circles on the transparency. These circles represent sound waves emanating from a source at the center. The black parts can be thought of as areas of compression and the clear areas are areas of rarefaction.

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2. Put circles 1 and 2 so that they overlap about halfway.
 - a. What do areas where black crosses black represent? Are these areas loud or soft?
 - b. What do areas where white and white cross represent? Are these loud or soft?
 - c. What do areas where white and black cross represent? Are these loud or soft?
 - d. Measure how far apart two consecutive dark crossing spots are.
_____ cm
3. Put circles 3 and 4 so that they overlap about halfway.
 - a. Would these sounds be higher or lower pitch (frequency) than the last two?
 - b. Measure the distance between two consecutive dark crossing spots.
_____ cm
 - c. Are the dark crossing spots closer together or farther apart than those in Step 2?
 - d. What can you say about the distance between interference points as the frequency of a sound decreases?
4. Now overlap #1 and #4. How does the pattern made by the dark and light spots compare to the last two?

Part 2

1. Open the NCH Tone Generator program on your computer.
2. Set up your speakers so that they are not both on the same side as you.
3. Set the program to be in stereo by clicking Menu, Tone, and Stereo (see Figure 51.1, p. 217).
4. Set both the left and right speakers to play a constant sine wave with a frequency of 2,000 Hz (a fairly high frequency) by clicking Tone and Sine and then double-clicking both the Sine 1 Left Frequency and Sine 1 Right Frequency and changing the values to 2,000 Hz.
5. Click the Play button and adjust the volume of the speakers to a comfortable but easy-to-hear level.
6. Plug one ear with your finger and move your head back and forth. You should be able to hear the sound getting louder and softer.
7. Estimate the distance between two loud or two soft spots.
_____ cm
8. Now lower the frequency. According to your results in Part 1, do you think that the loud spots are going to get closer together or farther apart?
9. Now change the frequency to 1,000 Hz and find the loud and soft spots again.
10. Estimate the distance between loud or soft spots. _____ cm
11. Were they closer or farther apart than those in Step 7?
12. Predict how far apart they will be when you change the frequency to 500 Hz (a fairly low frequency).
13. Perform the experiment and estimate the distance between the loud spots.
_____ cm

Section 3

