CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Christine E. Nielsen

Project Number

J1527

Project Title

Sound Through Pipes

Abstract

Objectives/Goals

The objective is to determine how transmission of sound through a pipe is affected at different frequencies. I believe that the only result that will vary is the volume, with higher frequencies keeping the same volume and lower ones becoming quieter.

Methods/Materials

Sound waves were created by a laptop PC with a program for producing pure tones. These traveled through a pipe that was 27" long and had a 3" diameter, surrounded by a foam wall 4" thick. On the other end, 20" away from the end of the pipe, a microphone picked up the sound waves and transmitted them to another PC to a program that analyzed the sound, showing both frequency and decibel rating (volume). Data was collected with a wall in between sound generator and microphone, and without either a wall or pipe as a control.

Results

For all frequencies except 400 hz the volume after going through the pipe was lower. When the microphone was placed at a straight angle from the pipe, higher frequencies (1200 hz and above) were significantly louder than lower frequencies (1130 hz and below) although not as loud as the control. At 90 degree and 45 degree angles, the higher frequencies were not as loud as the straight angle, but lower frequencies were often as loud or louder than the straight angle test. The wall used was more effective at blocking out sound at higher frequencies, but was still effective at lower frequencies. At 400 hz the wall did not help at all in blocking sound, as the control (without pipe or wall) was the same volume as when I tested with the wall. Also, the tone at 400 hz was louder after it went through the pipe, at all angles, than the control.

Conclusions/Discussion

My conclusion is that after going through a pipe, most frequencies are quieter than they would be without a pipe. When testing with the pipe, sound distribution and volume differs from frequency to frequency. Higher frequencies tend to produce a 'sound beam', with sound concentrated at a straight angle, while at other angles, such as 45 degrees and 90 degrees, the sound is significantly quieter. 1130 hz has a wavelength of 12", or four times longer than the 3" width of the pipe. Lower frequencies appear to be much less predictable. Reflected sound may be responsible for less reliable control measurments.

Summary Statement

This project is about how transmission of sound through a pipe affects sound volume at different frequencies.

Help Received

My mentor was Eric Nielsen.