CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
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Project Number
J1518

Project Title
What Didge You Hear?

Abstract

Objectives/Goals
My objective was to build a didgeridoo (didge) type musical instrument of any desired base frequency by using and verifying the appropriate acoustic physics model. I tried to determine how modifications and playing technique affect the total sound produced.

Methods/Materials
Using 2 inch PVC pipe and fittings I constructed a set of 6 didges ranging in frequency from 110 Hz to 51 Hz by adding different lengths of tubing to a 110 Hz base unit. A 7th didge for the set and 2 more identical single piece didges all of a specific desired C2 (65.4 Hz) frequency were made to verify predictions. A heat gun was used to modify the two identical didges with grooves, dimples, bends and an end bell. Sound spectral analysis of each didge played by me was done using a computer program (Amadeus II). Data recorded in table form allowed analysis and recognition of patterns for conclusions.

Results
I verified that a closed end tube acoustical model was consistent with the observed harmonic frequencies of my didges. The simple equation, Length = Speed of Sound / 4(base frequency), predicted the didge length to within 2% for a range of measured base frequencies. C2 (65.4 Hz) base frequency didges were successfully made by cutting tubing to the predicted length. Modifications of an end bell, a first bend and a very hard blowing technique could increase frequencies while a second bend decreased frequencies. The spectral sound pattern of harmonics in my didges was influenced far more by subtle differences in playing technique than by my specific modifications.

Conclusions/Discussion
I was able to build a didge with a desired base frequency. The total didge sound is composed of a number of harmonics combined together. The fine lip control and voice cavity modification needed to play a didge consistently are difficult skills that I did not fully master. Even though the didgeridoo is a simple and ancient musical instrument, the sound its produces is quite complex.

Summary Statement
Didgeridoo type musical instruments with specific base frequencies were constructed using acoustic physics principles, and the harmonics that create the total musical sound were analyzed.

Help Received
Father helped gathering materials, instructing proper use of dangerous shop tools; Mother helped assemble board; Dr. Kutchera-Morin gave me information through a personal interview.