The effect of mouth shape on tone selection

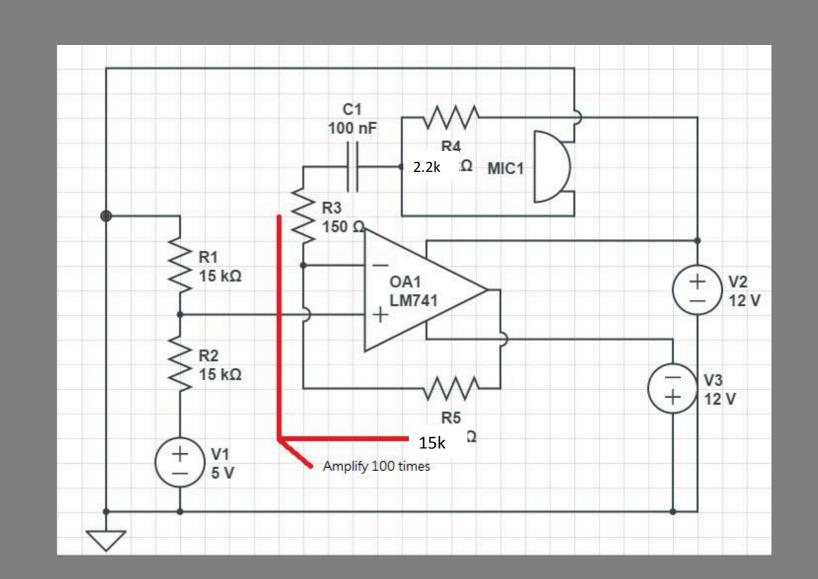
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Introduction

We connect Arduino card, the VB program and the analog circuit that we have learned in the experiment to explore the voice. We used to think of how different tune will affect the spectrum and the outcome will be the shift of base frequency. Meanwhile, what if we pronounce the same words in the same tune but different embouchure? In this project, we are going to find out the relationship between the spectrum and the embouchure.

The Microphone Circuit

In this circuit, we choose the Operational Amplifier-UA741 to amplify our signal. The R3 and R5 is used to control the magnification, and we choose 100 as our rate. Then, in order to let the voice become positive, we add the DC voltage. With the feedback of the output signal and the signal of microphone, we get the inverting input. The inverting input is used to control the output signal to be between 0 and 5 V.



How to work

Receiving signals by the micropho ne circuit.

Amplifying signals and receiving by Arduino card.

Doing FFT with the signals by visual basic 2013.

Analyzing the data spectrum.

Spectrum

Method of analysis Fast Fourier Transform

Fourier transformation, in generally speaking, is used to transform the signal from real time to the frequency. This transformation will transform the periodic signal to the peak on the spectrum. And we know that all kinds of wave are composed by the sine wave and cosine wave, and we can get spectrum of those wave.

Arduino Uno Card

Arduino Uno card is a device that can transform analog signal to digital signal or digital signal to analog signal by voltage reading and writing. It can also control by the program. It can only read the positive voltage and it can give the maxima voltage of 5V. We use it to make an oscilloscope on the computer

Experimental Outcome

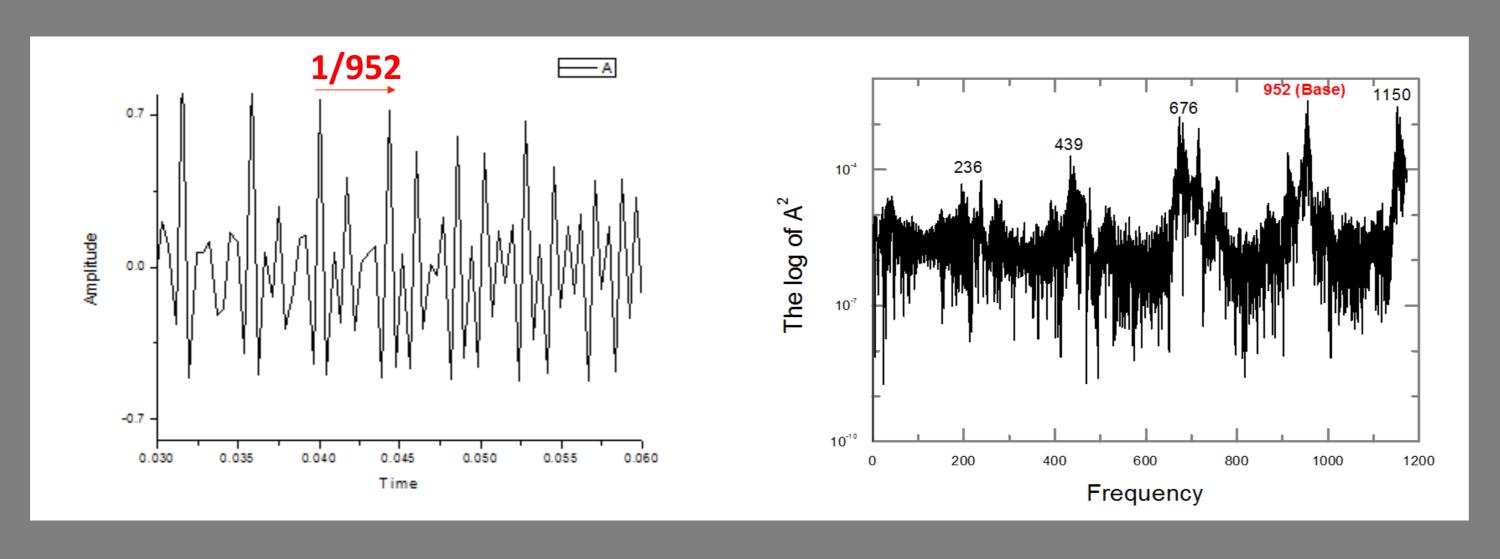


Mouth Shape

4 cm

Real wave

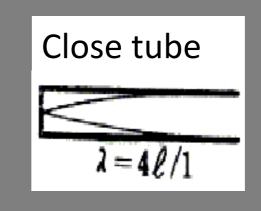
Pronounce A with the embouchure of A

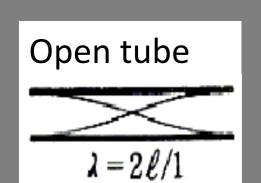


Standing Wave

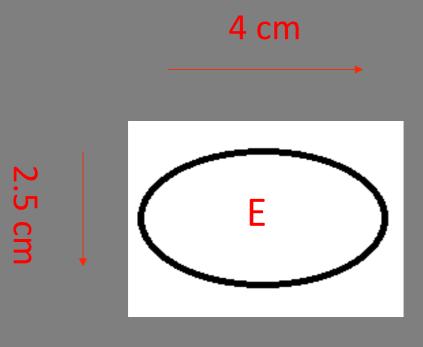
Close tube:
bigger wave length and lower frequency.

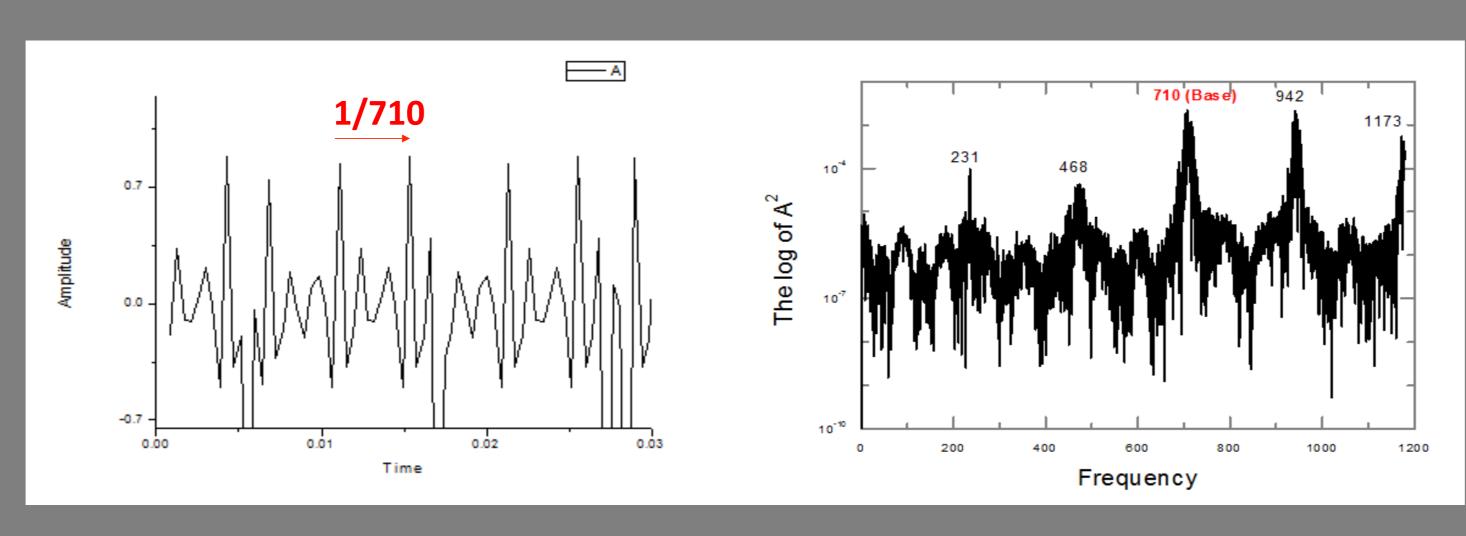
Open tube:
Smaller wave length and higher frequency





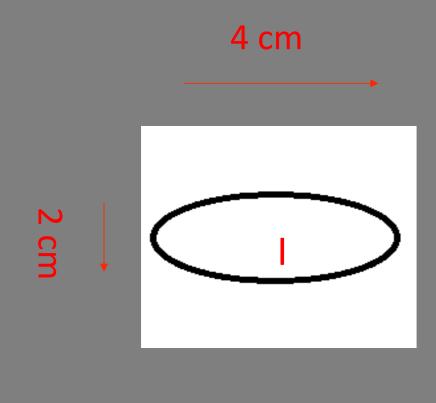
Pronounce A with the embouchure of E

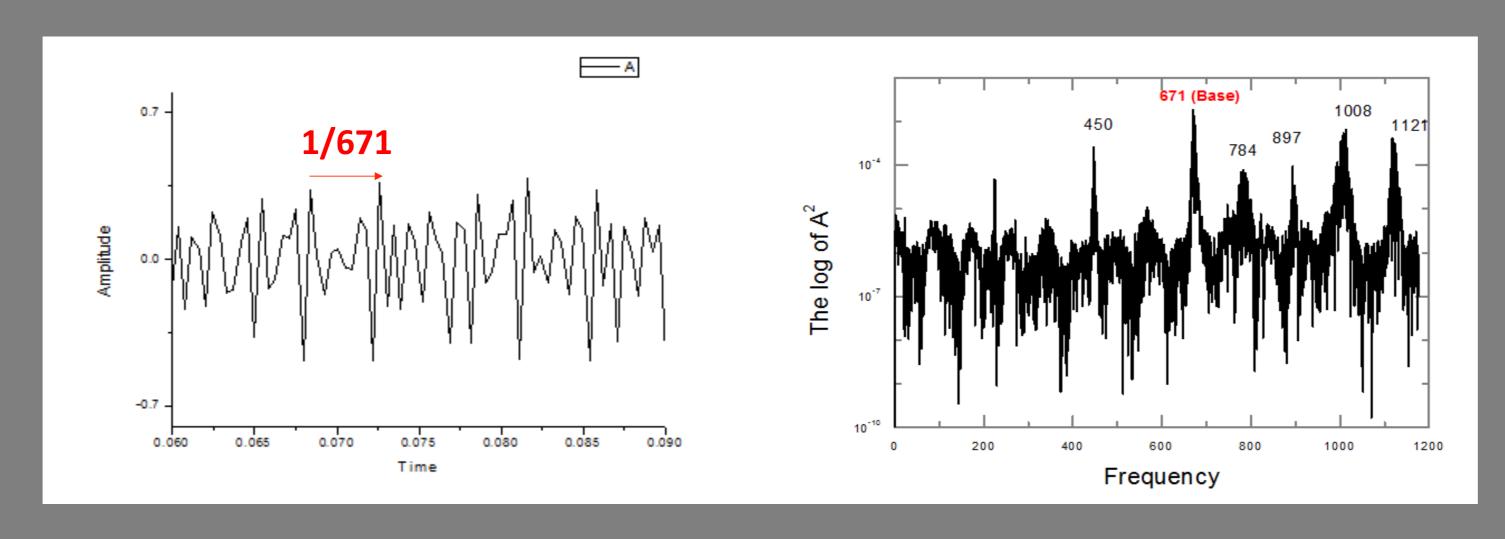




Standing wave is a kind of wave that can allow waves with particular frequency to exist. There are three kind of modes under these conditions: opened at both sides, closed at both sides, one side opened and the other side closed. With those particular modes, we can guess if we change our embouchure from big to small, our mode will change from opened at both sides to the one opened and the other closed. Between these changes, the wave length will become bigger, which means the frequency will become lower in this process.

Pronounce A with the embouchure of I





Conclusion

- 1. As for the mouth shape, A has the biggest bore and the highest frequency. I has the smallest bore and the lowest frequency.
- 2. We can compare the mouth shape with the tube and they will have the same properties.

With the same tone, we change the embouchure and used the spectrum to analyze it. We can assume the oral cavity as tube opened in both side. With the mouth becoming smaller, the one side will like closed, which can be explained by the standing wave.