**Lab Journal 4 (8%): Exploring Sound**

You can submit a draft version for feedback before uploading the final version on Blackboard. You are encouraged to work in groups of 2 – 3 students. If you work alone, analyze only one dial pad tone and another sound source in Part 1; answer only questions 1, 3 and 6 in Part 2.

**Part 1. Fourier Analysis of Sound (20 pts.)**

Analyze the sound spectrum of several sources using a free FFT app or tool. I recommend this one for phones and tablets: <http://ensoftware.net/index_eng.html> since it allows zooming and labels the frequency peaks. Note, that you may have to adjust the settings of the app to limit the number of labels of peaks, and to adjust the scales of frequency and loudness in order to have a more precise measurement.

Insert a screenshot of the spectrum and write down the peak frequencies for the following sound sources:

1. Three keypad dial tones of a phone.
2. One simple alarm or ringtone on your phone.
3. Two other sound sources of your choice (e.g. a car horn, a microwave beep, musical instruments).

Summarize what you found interesting or surprising about the spectrum of each type of source.

1. Read the following page about spectrograms: <https://nmc.ca/seeing-timbre/> (National Music Centre) and watch the video ”Intro to spectrograms”. Summarize what a spectrogram is, and what its applications are.

* Spectrogram display the frequency of sound we make. Every single sound has a frequency, the lower the sound, the lower the frequency. Interestingly, sound we product in one second can have different level of frequency due to the echo in the sound. We probably don’t notice the echo, but if you listen carefully, there’s will be a short echo and that echo also produce frequency. Spectrogram is part of timbre, in which allow use to recognize sound at different tone, frequency and volume. Timbre distinguish overtone into 2 types: timbre bright and timbre dark. According from musicians, timbre bright also known as overtones, occur when sound vibrate at more than one speed, create different pitches and blended altogether. Basically, timbre bright occur when there’s a high pitch sound and otherwise for timbre dark.
* According from the video, our mouth can produce different sound when we speak. The more we open our mouth, the more overtones exist. Video also shown that when the musician play the instrument, there’s only one sound exist while using our mouth exert more frequency (different tone vibrating at the same time). Shapes can also determine how the timbre looks like on the graph. For example, a cylinders shape would produce overtones, which will darken the timbre, while cones keeps the overtones stay longer, which will make the timbre brighter. Besides shape, sources of vibration can partly affect how the timbre moving. We don’t and can’t see sound, but we can hear how it produced.

**Part 2. Fourier Synthesis (10 pts.)**

Use the following interactive tool where you can add up to 8 harmonics of a sine wave, observe and hear the result: <https://soundphysics.ius.edu/?page_id=949> (Forinash). Briefly summarize what the two panels of the app show. Answer questions 1, 3, 6, 7 and 9, after briefly paraphrasing them in your work.

**Works Cited:**

Forinash, K. Sound: An Interactive eBook on the Physics of Sound. <https://soundphysics.ius.edu/?page_id=949>. Web. 4 April 2018

National Music Centre. <https://nmc.ca/seeing-timbre/>. 2016. Web. 4 April 2018