A London police whistle produces a sound with two high pitches and a lower third pitch, which is a good example of the production of subjective tones. Within the compact whistle are two short pipes (A and B) which produce two separate high frequencies when blown.

These two high frequency tones interfere with each other and produce a beat frequency. The beat frequency is equal to the difference between the frequencies of the two tones and is perceived by the human ear as a third tone, called a "subjective tone" or "difference tone".

Experimentally the frequency of whistle A was 2168 Hz and that of whistle B was 1843 Hz. The difference between these is 325 Hz. Use the matlab code below to simulate the operation of this whistle. Note that the sum of the two tones is divided by 2 before being output to the speakers. The reason for this is as flows: matlab expects the amplitude of the wave given to the “sound” command to vary between -1 and 1. Anything outside this range will be clipped off.

```
>>Fs = 20000;      %# Samples per second
>> nSeconds = 20;   %# Duration of the sound
>> t = linspace(0,nSeconds, nSeconds*Fs);
>> y1 = sin(t*2*pi*2168);
>> y2 = sin(t*2*pi*1843);
>> plot(t,y1+y2)
>> sound(y1,Fs)
>> sound(y2,Fs)
>> sound((y1+y2)/2,Fs)
```

Feel free to play around with the frequencies to achieve lower beat frequencies. Make sure to stay in the audible range if you want to hear it! (20Hz – 20kHz)

Adapted from HyperPhysics “London Police Whistle” [Available online:] http://hyperphysics.phy-astr.gsu.edu/hbase/sound/london.html#c1