Fletcher-Munson Curves of Equal Loudness

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The assignment:

Determine your own equal-loudness contours at three listening levels (near your hearing threshold, at a comfortable level, anc painfully loud). Place the reference tone at 1000 Hz and compare the reference tone in loudness to these frequencies: 100 Hz, 1 4000 Hz, and 10,000 Hz. The reference tone is to be set at a constant volume. You are to match, as close as you can, the loudne variable tones. If you want to see more structure in your curves, test other frequencies against the reference tone.

How to do the assignment:

1.) Open the test program for the experiment :

/dist/PsychoAcoustics/TwoWaves

2.) Record data

Here is the setup I used for collecting data for the graph below:

For the low intensity level, NeXT keyboard volume button is placed 24 keypresses up from the lowest amplitude (hold down t volume decrease until the sound dies out, then press the increase volume button 24 times). A strange fact about the NeXT is th background noise is less every multiple of four volume keypresses. I then used as a reference the 1000 Hz tone at -60 dB in Tw which was very quiet but still audible for me: you set the dB reading to a quiet but audible reading for yourself.

For the medium intensity level measurements, the NeXT keyboard volume button is set at 32 keypresses above the minimum loudness level. For the reference tone, the 1000 Hz tone was set to -30 dB for myself: you set the level to a comfortable level fo yourself.

For the high intensity level, NeXT keyboard volume button is set at 40 keypresses up from the minimum loudness level. Refe tone for myself was set to 1000 Hz at -25 dB.

The offsets mentioned in the Mathematica notebook were figured out like this:

The offset of 70 comes about because I decided that my -70 dB reading at 4000 Hz corresponded to 0 dB_{SPL}.; therefore, I added all dB readings from TwoWaves data for the final graph in order to place them into the dB_{SPL} scale.

Likewise for the medium intensity levels which was 15 dB louder than the low intensity readings, the offset was 70 + 15 = 85 d Likewise for the high intensity levels, 70 + 15 + 16 = 101 dB.

Recording more frequency data than the 4 frequencies of 100 Hz, 1000 Hz, 4000 Hz, and 10,000 Hz, won't give you too much n useful information, but you can see the finer detail of your hearing. After you have done the graph, you have a handy graphic chart for your home stereo.

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3.) Graph data:

Input data in *Mathematica* by first opening the example Mathematica notebook **`/dist/PsychoAcoustics/Labs/Labs95/Lab2/EqualLoudness.ma`**. and follow the instructions.

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Here is an example of what your final product should look like: