Plotting your vowels

For this assignment you record yourself saying some words illustrating vowels and then you produce a graph of your vowel space and answer some questions about the acoustics of vowels.

1. Digitize (at a sampling rate of 11025 Hz) directly into the computer your own productions of the vowels in the following English* words:

   heed  hid  aid  head  had  odd  awed  hud  herd  owed  hood  who’d  
   [i]  [ɪ]  [eɪ]  [ɛ]  [æ]  [ʌ]  [ʌ]  [ɔ]  [o]  

*If English is not your native language, it would be preferable for you to substitute similar example words from your own native language.

2. Make spectrograms and use an automatic formant formant tracker to measure the formants in the words.

3. Keep a table of vowel formant measurements for each of the vowels in the word list.

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
</tr>
</thead>
<tbody>
<tr>
<td>heed</td>
<td>hid</td>
<td>aid</td>
</tr>
</tbody>
</table>

4. Plot the vowel formant measurements on an F1 vs. F2 chart, perhaps using Microsoft Excel or some other graphics package (e.g. the free statistics package R [www.r-project.org] has a simple plot() command). Try plotting the vowel formant measurements on both linear and logarithmic axes, and be sure to label the points in the plot with the IPA vowel symbols - by hand is fine.

5. Answer the following questions:

Q1: Is there any advantage to the logarithmic scale? (if you have an intuitive or auditory/perceptual notion of the shape of the vowel space, which type of display conforms more to that intuition?)

Q2: Does omitting F3 in these plots cause any important vowel-specific information to be neglected? If so, specify what might be lost.
Q3: Which vowels have the most mouth movement over the duration of the vowel? To answer this you have to go back and stare at the spectrograms.

In addition to answering these questions, turn in your table of formant values and your vowel plot.

Some screen shots - using Praat to measure vowel formants.


For vowels you'll want to look at a “view range” from 0 to 5000 Hz. I find that my spectrograms look better with a somewhat longer window length and a smaller dynamic range, than is given by default.

I changed the “maximum formant” to match my spectrogram view range. The main parameter here than can really change how well the automatic formant tracker works is the number of formants. Look at the spectrogram and count how many dark bands you see. With a frequency range of 0 to 5000 Hz the number will generally be about 4 or 5.

Here is what it looks like when I track my pronunciation of “Don” with number of formants set to 4 versus 5.

Note how the red dots (the formant tracks) line up with the dark bands when I ask Praat to track 5 formants, and how the dots do not track the dark bands in the spectrogram when I ask for 4 formants. So, be careful and don't necessarily trust the formant tracker to get the right answer – you have to judge – is it correctly putting the formant tracks on the formants.