Measuring Vowel Duration

From UW Phonetics/Sociolinguistics Lab Wiki

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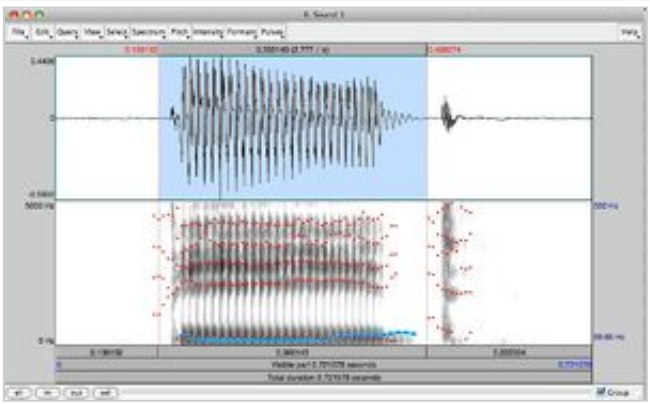
Guide

Open the file that you want to measure in Praat. See the handout "Opening a file in Praat" if you don't know how to do this.

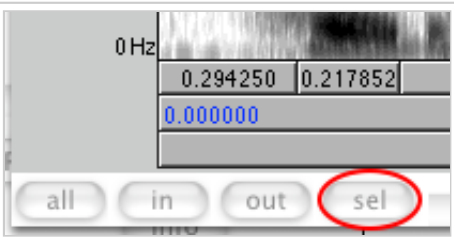
Zoom in on selection to see the details

Select from the approximate beginning of the vowel to the end of the vowel (the main high amplitude lump in the waveform with the corresponding formant structure in the spectrogram) as in Figure 1. Select by click-dragging or by holding down shift as you click (as you would in Word or other programs). Be generous in your selection so that you avoid accidentally excluding portions of the vowel.



Select from the approximate beginning to the end of the vowel

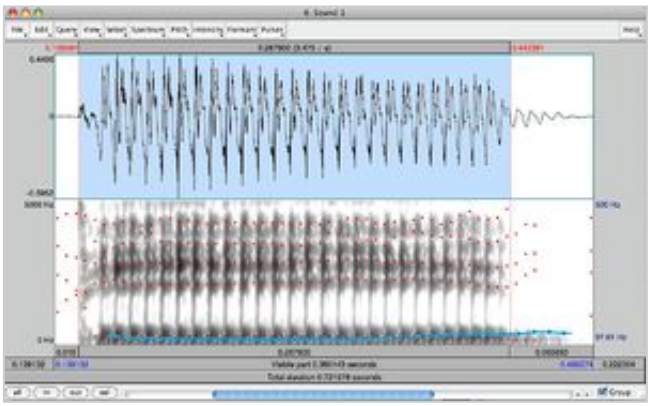
Next zoom in on the selection by clicking on the "Sel" button at the bottom of the spectrogram window as in Figure 2.



Zoom in on selection button

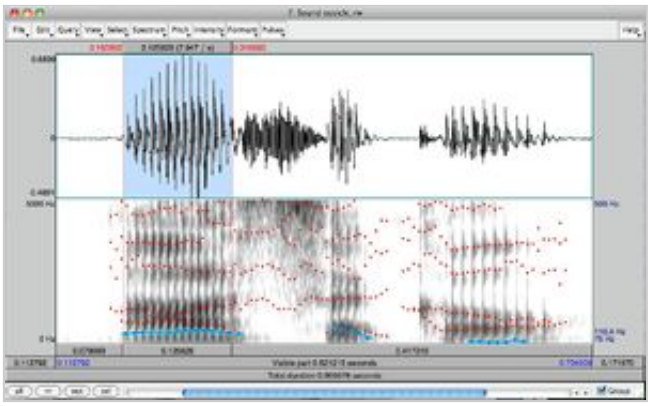
Once you're zoomed in, look again at the formants and try to distinguish the neighboring consonant from the vowel. In Figure 3 the selection includes the previous consonant release but excludes the following consonant closure and release in the word "bead". The number immediately below the selection is the

duration in seconds (0.2878 sec in this example). Most researchers include the consonant release burst and any aspiration following it as part of the vowel's duration since the onset of the release burst represents the transition point from the consonant closure into the vowel. There may be reasons for excluding the consonant release burst and aspiration depending on what you are trying to measure. For example if you are trying to measure the duration of laryngeal gestures related to voicing, you might exclude the release burst, but include the closure voicing of the following stop. Fricative noise is never included as vowel duration since fricative turbulence is only generated during the consonant's closure phase. When measuring around fricatives, look for the point where the fricative turbulence ends (or changes dramatically in intensity) and where higher formant structure becomes visible in the spectrogram (higher formants are F2, F3, and maybe F4). Similarly, when excluding the following consonant's closure, look for the point where there is a marked drop in intensity together with a loss of energy in the higher formants.



Vowel duration in the word "bead"

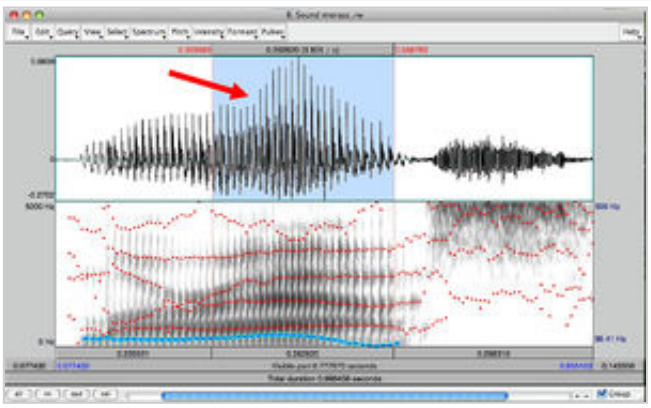
Measuring the beginning and end of the vowel can be very hard in some contexts such as in onsetless syllables or word final open syllables, or vowels preceded or followed by glides or liquids. Figure 4 shows the duration of the primary stressed vowel /a/ in the word "ossicle" using the criteria of looking for an abrupt change in energy and a loss/onset of energy in F2 and F3.



Vowel duration of /a/ in the word "ossicle"

Note how the change from glottal stop to the vowel is marked by a relatively abrupt increase in energy. It isn't always this clear since some glottal stops are realized as creaky/laryngealized voicing. In this latter case you should decide whether or not to include the creaky voicing in your duration measure based on your hypothesis. The end of the vowel is marked by three co-occurring events: 1) a dramatic change in amplitude in the waveform, 2) a change in the energy in the formants accompanied by a change in complexity in the waveform indicating a loss of energy in F2 and F3, 3) the onset of aperiodicity. Often

before voiceless fricatives there is a change in voice quality to a breathier voice or even aspiration that can complicate the vowel offset measure. You can see a little of this change in F4 at about the 75% point in Figure 4. In measuring the duration of vowels flanked by approximants such or approximant /l/ /ɹ/ /j/ /w/ and approximant allophones of voiced stops and voiced fricatives, you have to make a decision about where the vowel ends and the consonant begins and be consistent in your measures. The spectrogram can help you make your decision; look for a change in intensity in the higher formants that coincide with a point where the formants (especially F2 or F3) change abruptly. This may exclude portions of the formant transitions that would normally be considered part of the vowel when measuring vowel duration around stops, nasals, and fricatives; therefore, it is very difficult to consistently compare vowel durations around approximants to vowel durations around other manners. Figure 5 illustrates a vowel duration measure following /ɹ/ in the word "morass". Here I've used the point where the formants begin to change rapidly out of the peak of stricture in the /ɹ/ combined with change in intensity in the F4 region as a guide. I've done this because I want the measure to be most comparable with my consonant measures where consonant duration is defined as the duration of closure. Others might have measured later where there's a more dramatic change in the overall amplitude (as seen in the waveform and indicated by an arrow) but this would be less comparable to the other consonant definitions I've used since it would exclude almost all of the formant transitions from the vowel's duration. In the end, decisions about exactly what to include or exclude from durations should be determined by two things: 1) the methodology dictated by the hypothesis you are trying to test, 2) established standards in the field. What I mean by "dictated by the hypothesis" is you must choose a measure which introduces as little experimenter bias as possible. If you cannot be consistent with one measure, then the odds of experimenter bias creeping in are very high. Likewise, if your hypothesis crucially refers to differences in manner, then you should pick a methodology that is as neutral as possible in regards to manner.



Vowel duration of /æ/ in the word "morass" (arrow indicates an alternate vowel onset)

- This page was last modified on 4 December 2014, at 12:24.