Lab: Measuring Voice Onset Time (VOT)

One way to identify and describe contrasts in laryngeal settings is to measure voice onset time (VOT) – the length of time between a consonant release and the beginning of voicing. In this lab, you will use Praat to measure the VOT of word-initial stops in various languages, and then examine the distributions of contrasts within and across the sample languages. All questions will be answered on Canvas.

Materials

The 31 sound files for this lab are divided by language. Each file contains one word or a very short phrase that begins with an oral stop, spoken by a native speaker. The files are numbered, so you won't know from the filenames what the words mean or what their segments are.

You will need Praat and the Charis SIL font installed on your computer, as well as internet access (to Canvas). If you wish, you may use the Excel spreadsheet provided on the class webpage to enter your measurements and calculate your VOTs. Or, if you prefer to work on paper, print the VOT Records Table from the class webpage.

Tasks

1. Set up. Open your sound files in Praat. Open the Excel data table, or have your paper copy handy.

2. Praat settings. Click "Edit" (or "View & Edit") for the first sound file. Before you get started, make sure that "Spectrum > Show Spectrogram" is checked, so you can see the spectrogram. It may be helpful to have formants and pitch visible ("Formant > Show Formants" and "Pitch > Show Pitch") Showing formants will help you distinguish F1 from the voice bar. Start with standard settings ("Spectrum > Spectrogram Settings" … "Standards;" "Pitch > Pitch Settings" … "Standards;" "Formant > Formant Settings" … "Standards") but adjust Formant settings as needed for male vs. female voices: Maximum formant: 5000 Hz (males), Maximum formant: 5500 Hz (females).

3. Before you begin measuring a set of sound files, look at the questions on Canvas for that language, so you know what you'll be asked to do. Some question sets ask you to measure VOT very accurately and enter exact values (the most time-consuming task), while others allow you to match files to given measures or group files by ranges of VOT. You should follow the

measuring procedures below for all sound files, but high accuracy is only required for some of the questions.

4. Measurements. For each sound file:

a) Use the waveform and spectrogram to measure the duration between the consonant release and the onset of voicing. Zoom in enough so that you can place your cursor accurately, within 2 ms (remember that Praat displays in seconds, so look at the third decimal place). Tip: It may be easier to find the beginning and end of your selection separately, and then calculate the duration between them, as follows.

b) Place the beginning of your selection at the beginning of the stop release, as indicated by the beginning of the dark vertical striation on the spectrogram coinciding with a short increase in amplitude in the waveform. It's wise to record this time point in your data table, so you can more easily find it and check your work later if necessary. Even better would be to record measurements in a text grid, measure the interval directly, and then enter that number in the VOT Duration column of the spreadsheet (converting seconds to milliseconds, x 1000).

c) Place the end of your selection immediately before voicing begins, as indicated by a voicing bar and a sustained increase in amplitude in the waveform. The onset of the voice bar in the spectrogram should be close to the onset of periodicity in the waveform.: For positive VOT, voicing (of the vowel following the stop) coincides with the onset of dark formant structure in the spectrogram. **Important:** For negative VOT, voicing will appear before the consonant release, so you will see a voicing bar and moderate amplitude in the waveform. (This may be counterintuitive, because the 'end' of the selection is to the left of the 'beginning.') Record this time point in your data table (if you are measuring the interval from a textgrid, you won't need to keep track of time points).

d) If a boundary isn't clear, make a small selection around the boundary area and zoom in (the "sel" button in the bottom left corner of the window). The waveform of the portion between the release burst and voicing is aperiodic (it does not repeat in any pattern) and has a different shape than the release burst, which may have several sharp, narrow peaks, and the voiced vowel, which has a complex periodic (repeating) wave.

e) If the waveform and spectrogram indicators don't line up perfectly, defer to the waveform (remember: the spectrogram is derived from the waveform). To be more accurate, zoom in so you can see the pattern of the waveform change, place your cursor where you think it changes, and hit Ctrl+0, or from the menu: "Select > Move cursor

to nearest zero crossing." Now zoom out (the "out" button in the bottom left) until you can see the spectrogram clearly. If the cursor location is clearly off, zoom in and try another possible location from the waveform.

f) Once you've identified boundaries, find/calculate the duration between them (VOT), and record this or let your Excel sheet calculate it from the onset and release time points you entered from the steps above. (You may manually place your cursor at one edge and highlight the portion ending at the other edge, but this may be tedious and difficult to achieve accurately.) If you're not using the Excel sheet, remember to enter milliseconds for the VOT duration.

5. Submit your answers on Canvas. Do not turn in your records.