

In this lab, you will be conducting detailed phonetic analysis of some of the consonants in the language you are studying for your final project. You can use your previously recorded material from Lab #1, re-record the Lab #1 material if your previous recordings were unsatisfactory, and/or record new material for the purposes of this lab. Whatever material you use (including old material) for your analysis should be burned to CD and submitted along with your write-up.

Be sure to take measurements from as many different similarly structured words as possible (at least five), rather than just one measurement from a single word. Be sure to describe your methodology clearly. As always, give units and report the mean and standard error for every set of measured data.

### Part I: Plosives

For each plosive in your language, determine its **place of articulation**, based on the references you used in Lab #1 and other suitable references, including confirmation with your speaker of what their mouth does. Use this information to help construct a full table of all consonants in your language showing place and manner of articulation, in the same style as we've used for English consonants.

*Optional: If you're feeling adventurous, you can follow the instructions at the end of this lab for palatography to make linguograms (pictures showing what part of the tongue is used in making a sound) and/or palatograms (pictures showing where the tongue touches the roof of the mouth) to include in your write-up, giving physical confirmation of the places of articulation for the plosives that make use of the tongue (palatography obviously won't work for labial consonants!).*

Pick at least six plosives in your language (or all of them, if there aren't more than six) to make measurements for. Select a range of both places of articulation and, if possible, phonation types. Choose plosives that contrast nicely: /p b t d k g/ is a good set, while /p b t<sup>h</sup> d k ɣ/ is less optimal because it's harder to make meaningful, systematic comparisons.

For each of your selected plosives, measure its **closure duration** in some environment which would make it easy to see where the plosive begins and ends (between vowels, between a fricative and a vowel, etc.). Use the same kind of environment for all of your plosives. For each plosive, get measurements from at least five different instances of the same environment (this could be from five completely different words, or from five different pronunciations of the same word). Be sure your environments are generally consistent (same stress pattern, same number of syllables, etc.). You do not have to use real words; the speaker could just repeat [a\_\_a] five times for each plosive.

For any of the selected plosives that are not fully voiced during closure, measure the **voice onset time (VOT)**, from the beginning of the plosive's release to the beginning of voicing in the following vowel (which is usually the first blue glottal pulse mark found by Praat (to get the glottal pulses to appear in Praat, select Show pulses from the Pulses menu in the sound's viewing window). Note that for partially voiced stops, the VOT will be negative.

For each of your selected plosives, measure the **maximum intensity of the release burst** by making sure that Show intensity is selected from the Intensity menu in the sound's viewing window. This will draw a yellow line across the spectrogram. Put the cursor at the peak of the yellow line, and select Get intensity from the Intensity menu to find the value of the intensity in dB (decibels) at the cursor (alternatively, you can use the shortcut key F8).

While keeping the cursor on the peak intensity of the release burst, obtain a spectral slice by selecting View spectral slice from the Spectrum menu. A spectral slice shows the intensity across all frequencies, giving you a profile of which frequencies are the loudest. In the spectral slice, locate the highest peak and measure the center frequency of this peak by zooming in until you can put the cursor on the peak, and then select Get cursor from the Query menu (F6 is the keyboard shortcut). Record this frequency as the **spectral frequency of the release burst**.

You should end up with a chart like the following for every selected plosive phoneme:

	closure duration (in sec)	VOT (in sec)	burst intensity (in dB)	burst frequency (in Hz)
#1				
#2				
#3				
#4				
#5				
mean				
s.e.				

## Part II: Fricatives

For all of the voiceless fricatives of your language, get recordings of the speaker using them in words in roughly the same environment (again, at least five instances), and measure their **duration**. While the duration is selected, get the **average intensity** over the entire duration. Finally, select a large region from the middle of the fricative (about 1/3 of the whole duration), get an average spectral slice for that region, and record the center frequency of the highest peak in the spectral slice as the **spectral frequency**. You should end up with a chart like the following for every voiceless fricative:

	duration (in sec)	average intensity (in dB)	spectral frequency (in Hz)
#1			
#2			
#3			
#4			
#5			
mean			
s.e.			

*Optional: Again, if you're feeling adventurous, you can include images of the entire spectral profile for each fricative. If you're really clever, you could even concoct a way to get an average spectral profile for all five instances of the same fricative by cutting and pasting the middle third of all five, immediately adjacent to each other into the same sound file.*

## Part III: Oddities

Describe in clear, coherent prose any 'odd' sounds from the consonant phonemes in your language that you have trouble identifying precisely. Give as much detail about these sounds as you can, including whatever acoustic information you have been able to glean with Praat from the recordings you've taken.

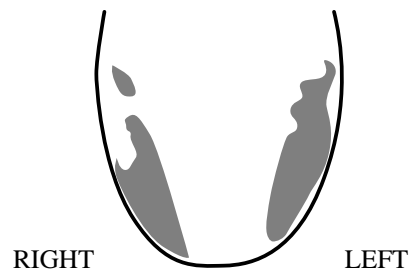
## Palatography (Optional)

Be sure to test out this methodology on yourself (or your friends) first, before using it on your speaker. You don't want to be surprised or inept when trying to collect real data. You should also assure your speaker of the safety of your procedure, by demonstrating it on yourself and showing them that you have clean (even sterilized!) equipment. Also, be sensitive of your speaker's culture and respect their personal space. For example, it may not be appropriate for a male to be close enough to an unrelated female to be conducting such an intimate activity as peering into her mouth!

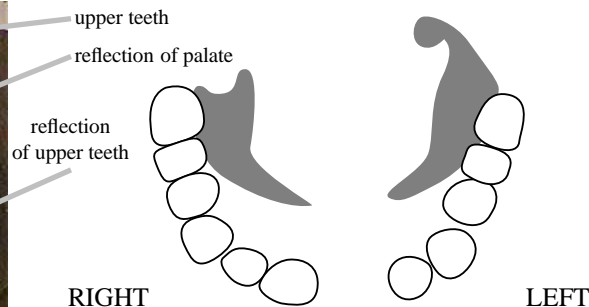
Make a mixture of equal parts olive oil (or any other edible cooking oil, like canola, corn, etc.) and powdered cocoa (or activated/digestive charcoal powder, a tasteless pharmaceutical powder). Using a cotton swab or a wide (clean!) artist's paintbrush, coat the hard palate and alveolar ridge of the speaker's mouth (for a linguogram) or their tongue (for a palatogram) with the mixture. To avoid messes, you may want to cover your speaker's torso with a towel before applying the mixture.

Ask the speaker to say a word containing the plosive in question, making sure that the word used doesn't contain any other consonants in the same region of the mouth. This will cause the oil mixture to transfer between the roof and the tongue, making a mark on the other surface.

For a linguogram, have the speaker stick their tongue out to see where the tongue touched the roof of the mouth. To make a permanent record, take a picture of the tongue and trace an outline of the areas of contact, as in the following sample linguograms. Pay careful attention to the orientation of the images with respect to the speaker—the left and right sides are as labeled:



For a palatogram, you will need a mirror (5 cm × 15 cm is a perfect size) inserted into the mouth at a 45° angle in order to see and photograph the roof of the mouth. The mirror should be placed so that you can see as far back as the upper molars. A light may be necessary to ensure there are no shadows. Again, note where the right and left sides are located in the palatogram (despite the mirror, the right and left for the palatogram are on the same side as they are for the linguogram!):



Before making the next linguogram or palatogram, have the speaker rinse their mouth out with lemonade to remove the previous oil mixture. You will also want to do all linguograms before any palatograms, because the tongue is more absorbent than the roof of the mouth, and after multiple coatings of the tongue, you may be unable to get a clear contrast.