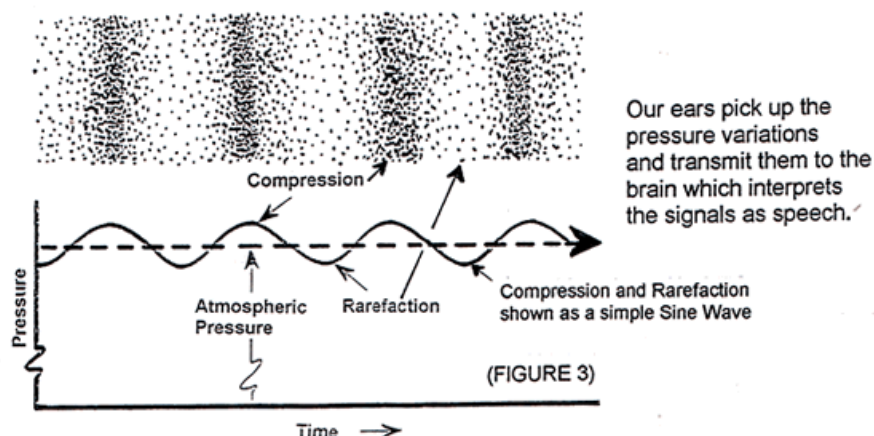# GLEEFUL 2014: Praat Workshop Notes
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1. *What is Sound?*
   a. A mechanical wave created by a vibrating object.
      i. Mechanical wave = A wave that propagated as an oscillation of matter.

   b. Sound propagates as a 'Longitudinal wave':
      http://www.acs.psu.edu/drussell/demos/waves/wavemotion.html

   c. Compressions and rarefactions.

   Our ears pick up the pressure variations and transmit them to the brain which interprets the signals as speech.

   Compression and Rarefaction shown as a simple Sine Wave

   (FIGURE 3)

   d. Frequency
      The number of occurrences of a repeated event per unit of time (Wikipedia).
      [Below: 3 cycles in 1 second. Frequency = 3 cycles per second = 3 Hz.]

NOTE: "C" stands for compression and "R" stands for rarefaction
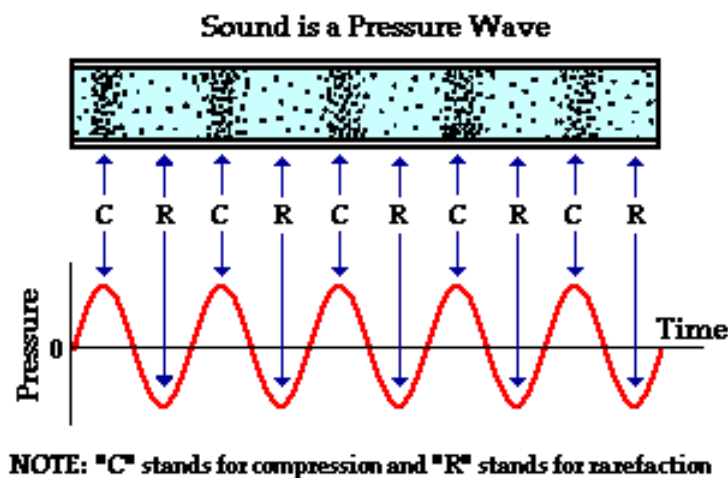
2. *Recording*

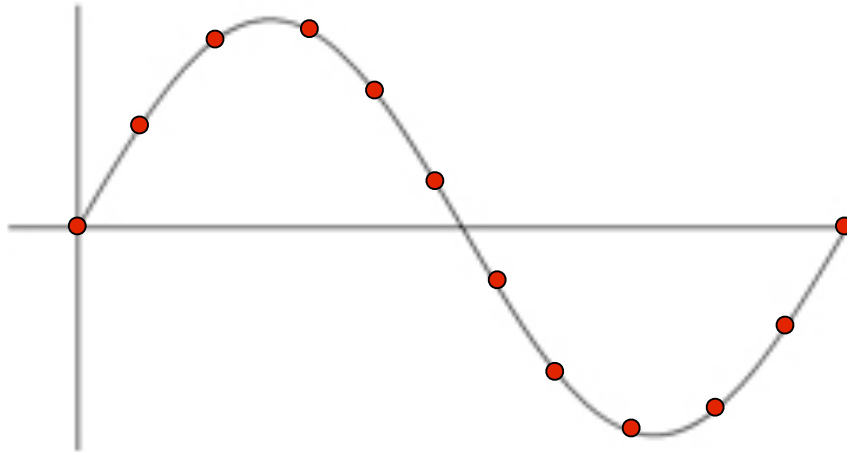   a. There are many different file formats (.wav, .aiff, .mp3…).

       i. Use .wav or .aiff

      ii. These are lossless, which means they maintain the audio quality of the original source.
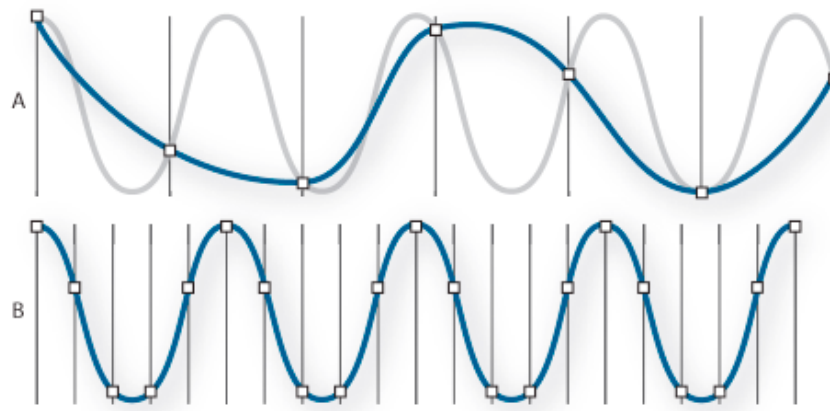
    b. Sampling rate

      i. Number of audio samples per second

      ii. Praat default sampling rate = 44.1KHz = 44,100 samples per second.

     iii. Sampling rate can't be too low

     iv. But, a higher sampling rate means more memory. So, it is not always practical to digitize at a high sampling rate.

3. *Praat interface*

   a. Objects window

      i. It is a copy of a file that is on your hard disk.

      ii. So, changes to it are not saved, unless you save it as a separate file.

   b. The Editor window

      i. This is where you can see the waveform and spectrogram (along with other information like Intensity, Pitch…)

   c. Picture window

     If you calculate some new set of values and want to display it as a plot, this is where it would be plotted.

   d. Help window.

      i. It is extensive. Lots of help links.

      ii. But, I would use the online Praat "Help" because you can copy and paste the text in it. This is very useful if you are scripting.

   e. Info window

      i. It prints out values and tables of values that you have measured/calculated. It is useful during scripting and measurement.

4. *Editor window and segmentation*

   a. Things to observe

      i. It is not easy to demarcate where one sound ends and another sound begins.

      ii. When we speak, we don't produce each "segment" separately. There is a lot of blending or *coarticulation*.

      iii. This means there is no precise point in time at which one sound ends and another begins.

      iv. Something we value in phonetics is consistency. So, as a general strategy, if were are "consistently wrong" in marking out segments, then that is something we could potentially work with.

      v. Lab 1: Look at *Appendix 1*

b. TextGrid & Annotation

    i. If you want to make sure that your segmentation and notes are available to someone else, it is worth annotation using a TextGrid.

    ii. Remember to save the annotations as a textfile after it is done.

5. *Splicing*
   a. Take a chunk of a sound file and insert it in another sound file or remove it from the original.

   b. Some things to keep in mind.
      i. Try to get as much of the sound chunk (segment sequence) as you can.

      ii. Since there is coarticulation, you will need to have some consistent criteria for identifying beginnings and ends of splice segments.

      iii. Splice from zero-crossing to zero-crossing.

   c. Lab 2:
      i. Make a copy of the original sound file in the Praat objects window.

      ii. Splice out the first two words into a separate file in the objects window.

      iii. Now, switch the vowels around by splicing.

      iv. Can anyone imagine/foresee some problems while splicing?

6. *Scripting*
   a. This is one of the nicest things about Praat. It makes your life much easier with boring measurements.

   b. Here is the link for what is possible in Praat: http://www.fon.hum.uva.nl/praat/manual/Scripting.html

   c. But remember, when we automate, we are asking a dumb machine to do something that requires a lot of human input.

d. So, if there is something wrong with the soundfile or with the measurement, the program won't "notice" it. We will have to explicitly program specific safeguards.

e. One more thing that is absolutely fantastic about Praat, it gives you the scripting command for whatever option you choose on the GUI.

f. "Clear History" and "Paste History" under Edit in the Scripting window are VERY useful options.

g. Lab 3:
   i. Let's try to write a script that will get us the duration and pitch of the first vowel (Look at *Appendix 2* for help, if needed).

   ii. Now, let's try to write a script that will get us the duration and pitch of any the vowels.

   iii. Now, let's try to write a script that will give us the above details ONLY if the interval has a label. You will need "Jumps" or If-conditions to do this [http://www.fon.hum.uva.nl/praat/manual/Scripting_5_3__Jumps.html]

   iv. Now, let's try to write a script that will give us the above details for EVERY interval, ONLY if the interval has a label. You will need "Loops" or a "For loop" to do this [http://www.fon.hum.uva.nl/praat/manual/Scripting_5_4__Loops.html]

7. **Suggested Readings:**
   a. A good very good primer for Praat: Will Styler (2014). Using Praat for Linguistic Research.

   b. A repository of other good tutorials: Praat Tutorials

   c. A good primer on advanced Praat/Phonetic Analysis. Paul Boerma (2013). Acoustic Analysis.

   d. And finally, Praat's own help files. Praat: Intro

Appendix 1: Lab 1 – Measuring Duration and Pitch

1. Introduction
   This lab is to study the effect of stress on vowel pitch and vowel duration.

2. Experimental Material
   The following test items have been recorded and uploaded to the weblink:
   a. seed (i)   d. sued (u)
   b. stayed (eɪ)   e. bode (oʊ)
   c. sad(æ)   f. sod (ɒ)
   d. sud (ʌ)   g. surd (ə)

3. Carrier Phrase
   You should use a carrier phrase for such recordings in an experiment to avoid "list effects". For example:
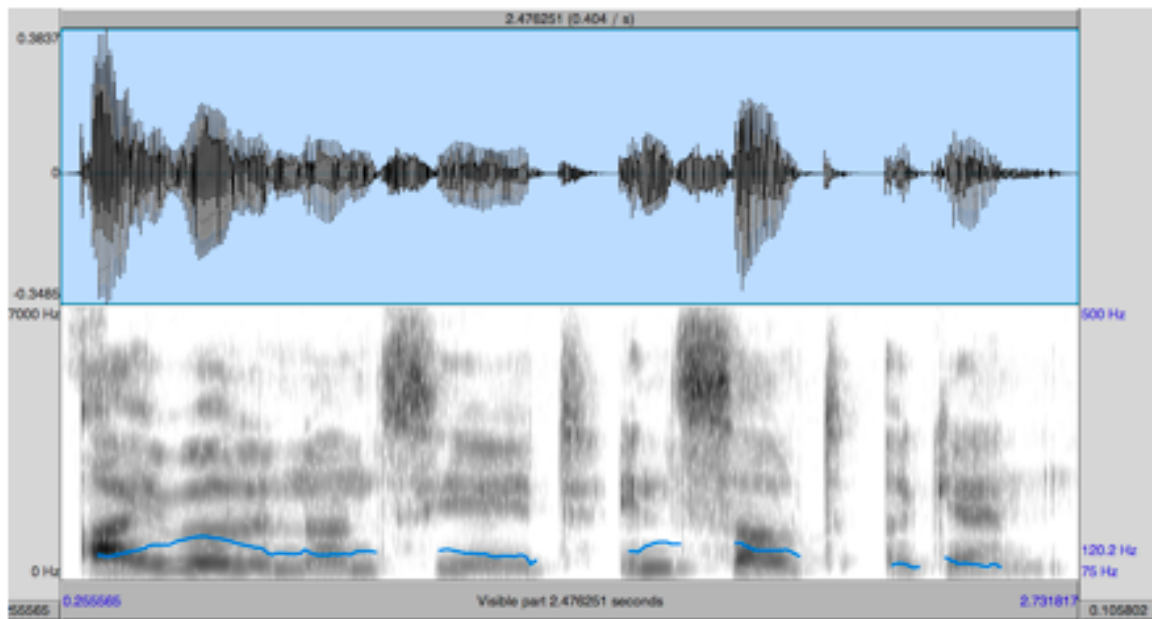   "I will enunciate _____ again",

4. Task
   For each test item measure & record the following:
   a) The F0 (pitch) at the center of each vowel.
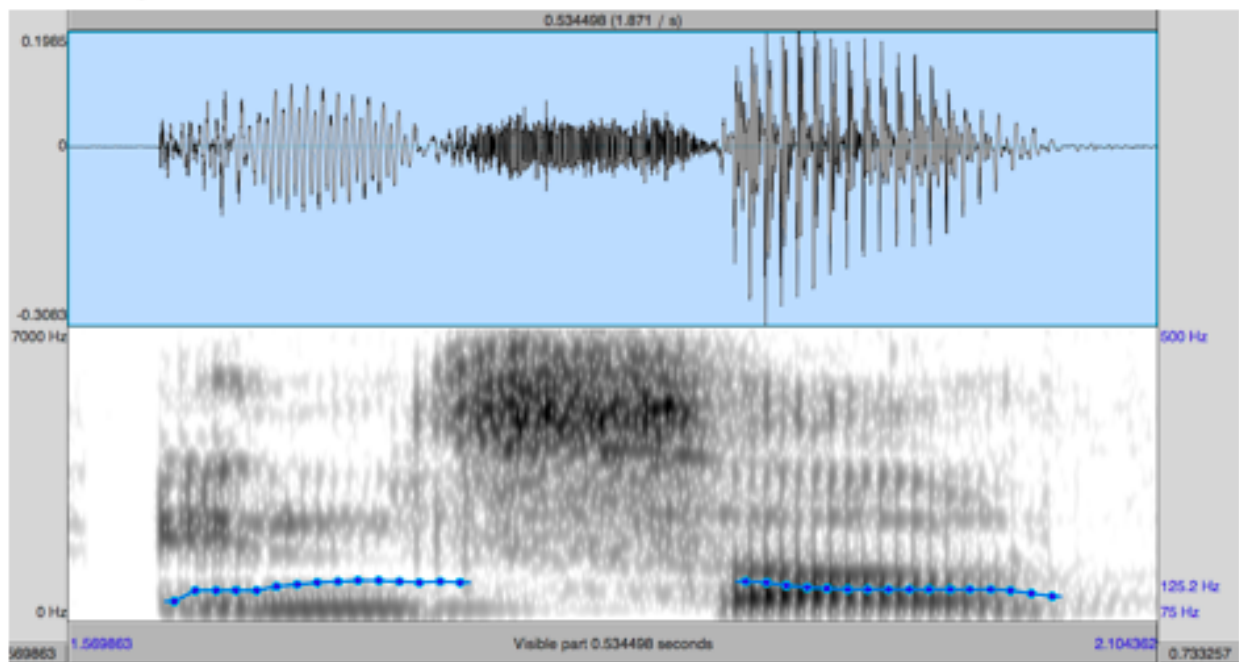   b) The duration of the entire vowel

	Vowel Pitch (Hz)	Vowel Duration (ms)
i		
eɪ		
æ		
ʌ		
u		
oʊ		
ɑ		
ɚ		

5. How to measure

The following is the recording for one token of "I will enunciate ínsult again"


zooming into 'insult'

The highlighted portion in the following spectrogram/waveform (can be seen to be shaded in blue) is the portion of the vowel that needs to be measured.

How to identify the vowel?
Note that in the waveform, the sound changes slightly at the point where the end of the vowel is marked.

Note in the spectrogram, the energy suddenly decreases in all the formants [the horizontal bands of darkness (energy) that you see through the spectrogram]

In general, you should also hear it to make sure.
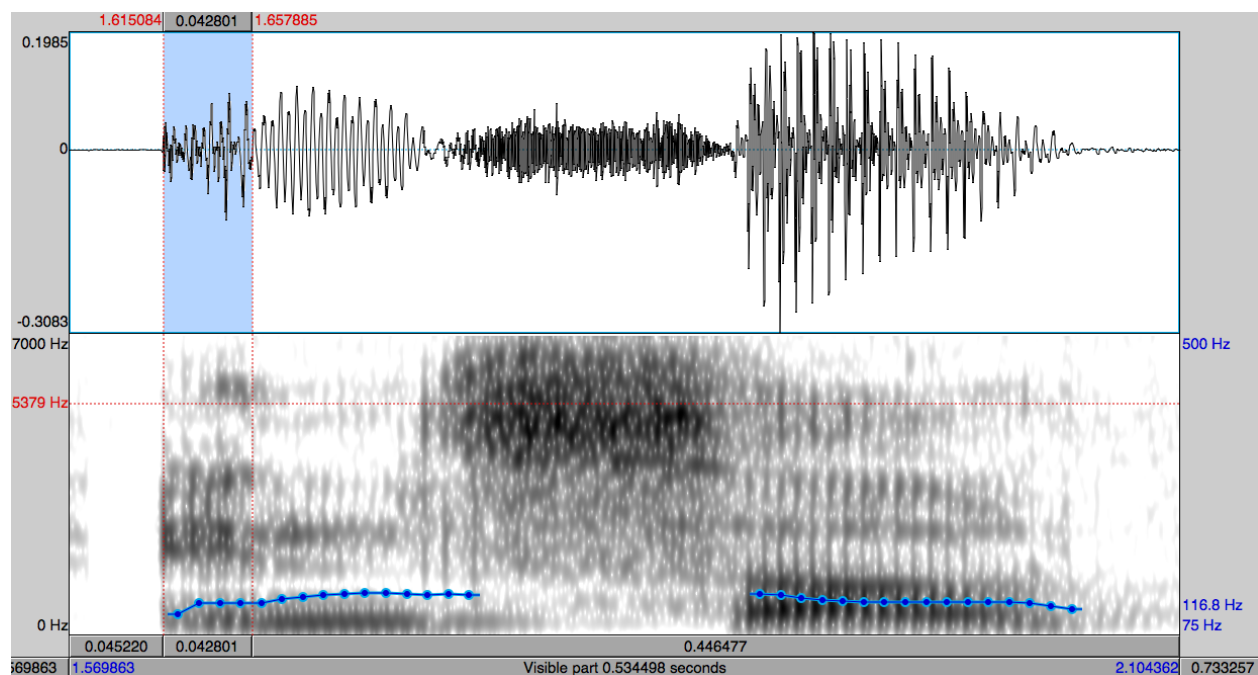
Vowel duration: the length of the whole vowel
[in the above case, duration = 0.042 seconds = 42 milliseconds = 42 ms]

Vowel pitch: The value of the blue line at the center of the vowel (or use F5 by clicking at the middle of the vowel)
[in the above case, pitch = 120.5 Hz]

Appendix 2: Lab 3 – Scripting

1. Basic Script: Gets duration and pitch for one interval

```
#clears the info window
clearinfo


#selects the relevant Textgrid and gets the start
#and end points of an interval (interval #2, in the first tier)
selectObject: "TextGrid Recording"
x=Get start point: 1, 2
y=Get end point: 1, 2
duration = y-x


#Gets the label of the interval
label$ = Get label of interval: 1, 2


#Prints times and label
print 'label$' 'newline$'
print Duration = 'duration' 'newline$'


#Gets pitch at mid-point and prints it out
pitch_time = (y+x)/2
selectObject: "Sound Recording"
To Pitch: 0, 75, 600
pitch=Get value at time: pitch_time, "Hertz", "Linear"
print Pitch = 'pitch'
```

2. Script v.2: Let's try to get the relevant values only if the segment is labeled.

```
#clears the info window
clearinfo

#selects the relevant Textgrid and gets the start
#and end points of an interval (interval #2, in the first tier)
vowel_interval = 2
selectObject: "TextGrid Recording"
label$ = Get label of interval: 1, vowel_interval

#Print out the values only if there is a label
if label$ <> ""
    selectObject: "TextGrid Recording"
    x=Get start point: 1, vowel_interval
    y=Get end point: 1, vowel_interval
    duration = y-x

    print 'label$' 'newline$'
    print Duration = 'duration' 'newline$'

    #Calculating and printing out pitch
    pitch_time = (y+x)/2
    selectObject: "Sound Recording"
    To Pitch: 0, 75, 600
    pitch=Get value at time: pitch_time, "Hertz", "Linear"
    print Pitch = 'pitch'
endif
```

3. Script v.3: Let's try to iterate through all the intervals, and get the relevant values only if the segment is labeled.

```
#clears the info window
clearinfo

#Prints the first row of the info window (names of the columns)
print Vowel 'tab$' Duration 'tab$' Pitch 'newline$'

#We want to get the Pitch Object just once at the beginning
selectObject: "TextGrid Recording"
num_intervals=Get number of intervals: 1
selectObject: "Sound Recording"
To Pitch: 0, 75, 600

#selects the relevant Textgrid and gets the number
#of intervals
selectObject: "TextGrid Recording"
num_intervals = Get number of intervals: 1

#Loops through each interval in tier 1
for vowel_interval from 1 to num_intervals
    selectObject: "TextGrid Recording"
    label$ = Get label of interval: 1, vowel_interval

    #Print out the values only if there is a label
    if label$ <> ""
            selectObject: "TextGrid Recording"
            x=Get start point: 1, vowel_interval
            y=Get end point: 1, vowel_interval
            duration = y-x

            pitch_time = (y+x)/2
            selectObject: "Pitch Recording"
            pitch=Get value at time: pitch_time, "Hertz", "Linear"

            print 'label$' 'tab$' 'duration' 'tab$' 'pitch' 'newline$'
    endif
endfor
```