Workshop on Praat Applications for Research and Teaching

Rebecca CHEN & Bobbie WANG
hsuehchu@ied.edu.hk

~Supported by Teaching Development Grant, Faculty of Humanities

January 20, 2014

Outline

- What is Praat?
- Acoustic analysis with Praat
  - General Praat interface
  - Basic operations with Praat
  - Acoustic analysis with Praat
  - Creating graphical output
- Our current project

Part 1.

Introduction of Praat

What is Praat?

- "Praat" = "speak" (Dutch)
- Freeware program for the analysis and reconstruction of acoustic speech signals.
- Developed by 2 phoneticians from the University of Amsterdam, Paul Boersma and David Weenink

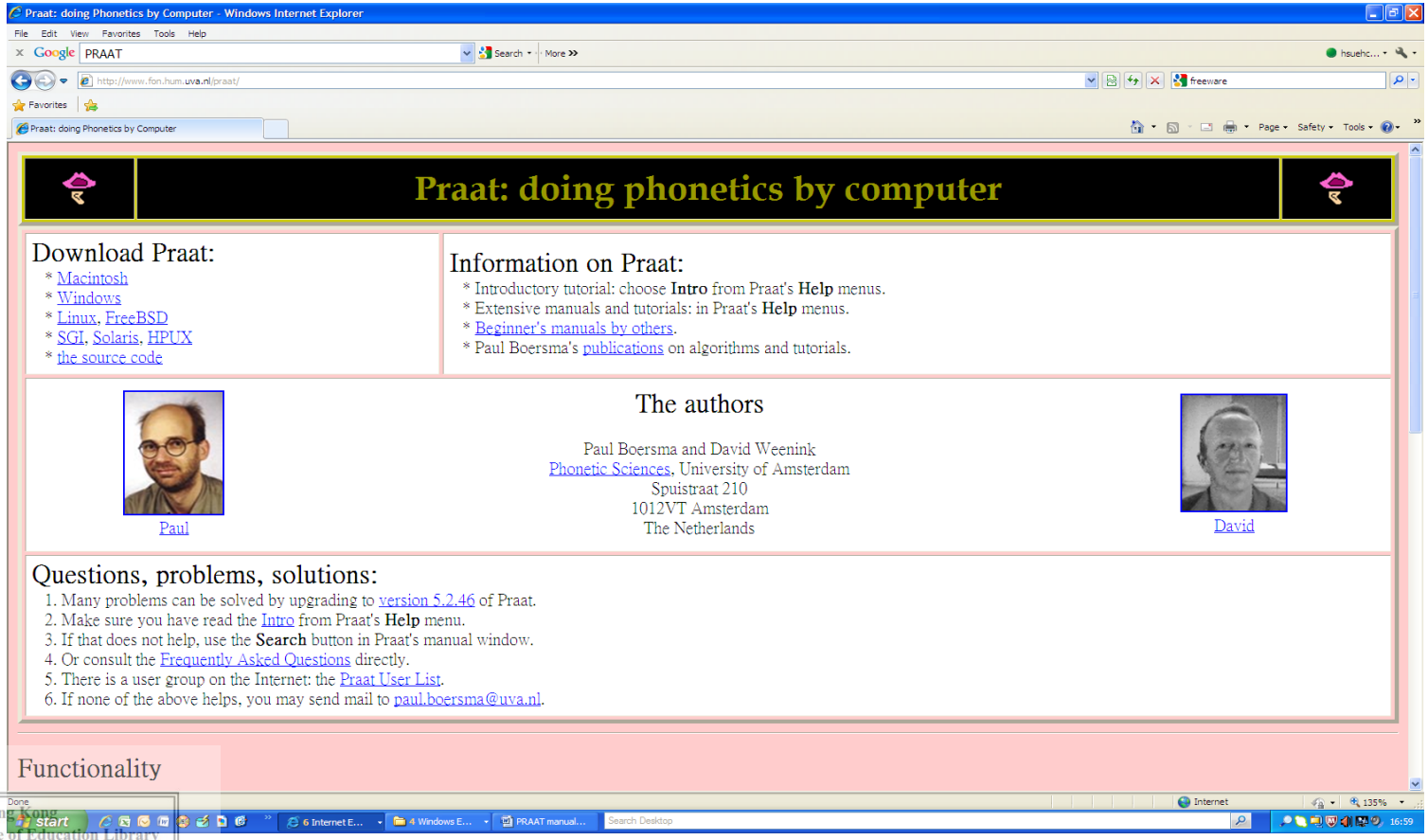
What we can do with Praat

You can …

- make and edit your recordings
- extract individual sounds for further analysis
- generate waveforms, wide and narrow band spectrograms, intensity contour and pitch tracks
- get information about pitch, intensity, formants, pulses, etc.
- segment and label words, syllables, or individual phonemes
- put your work in graphic form for printing

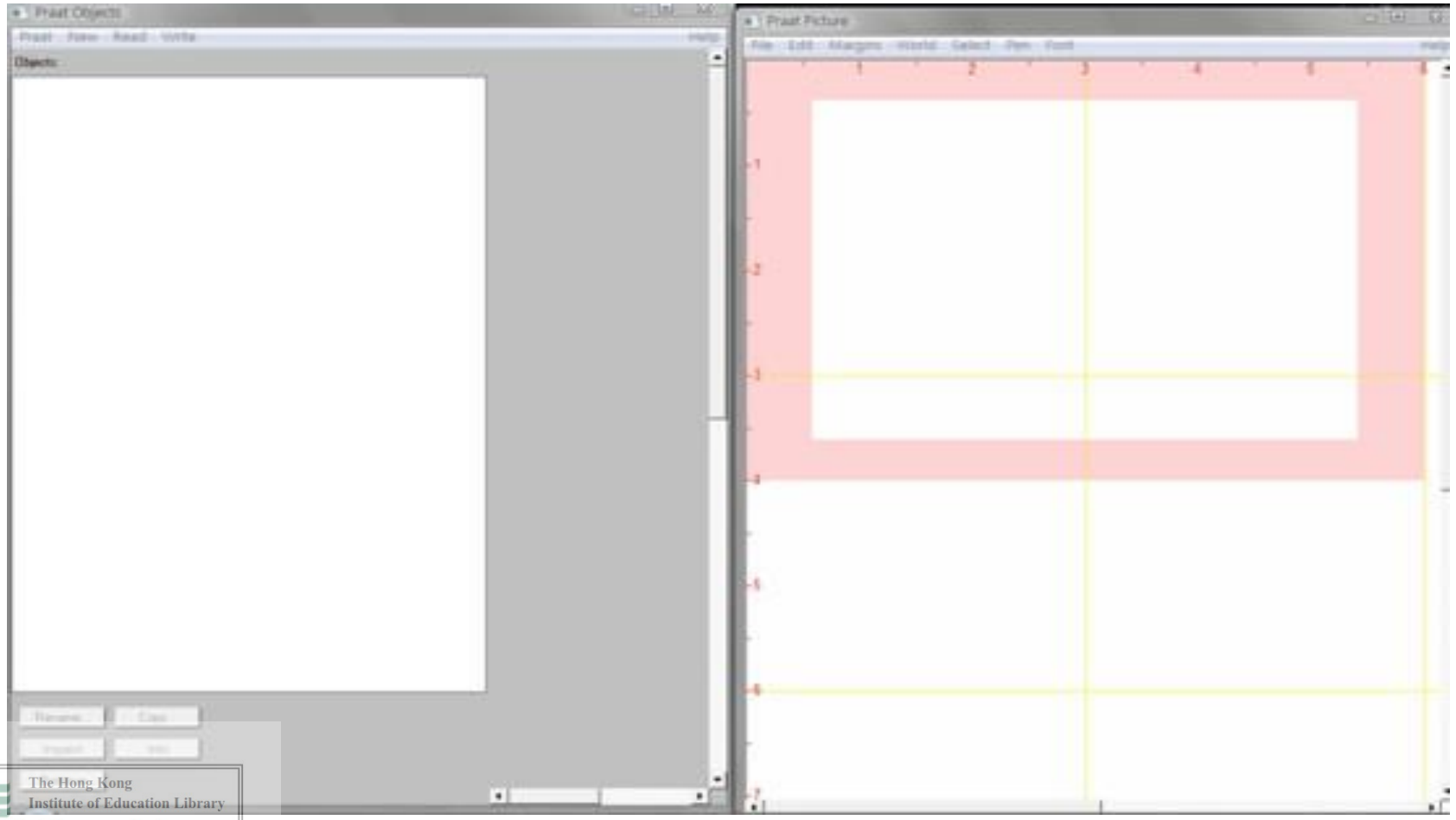
Where we can get it

It can be downloaded (for free) from http://www.Praat.org



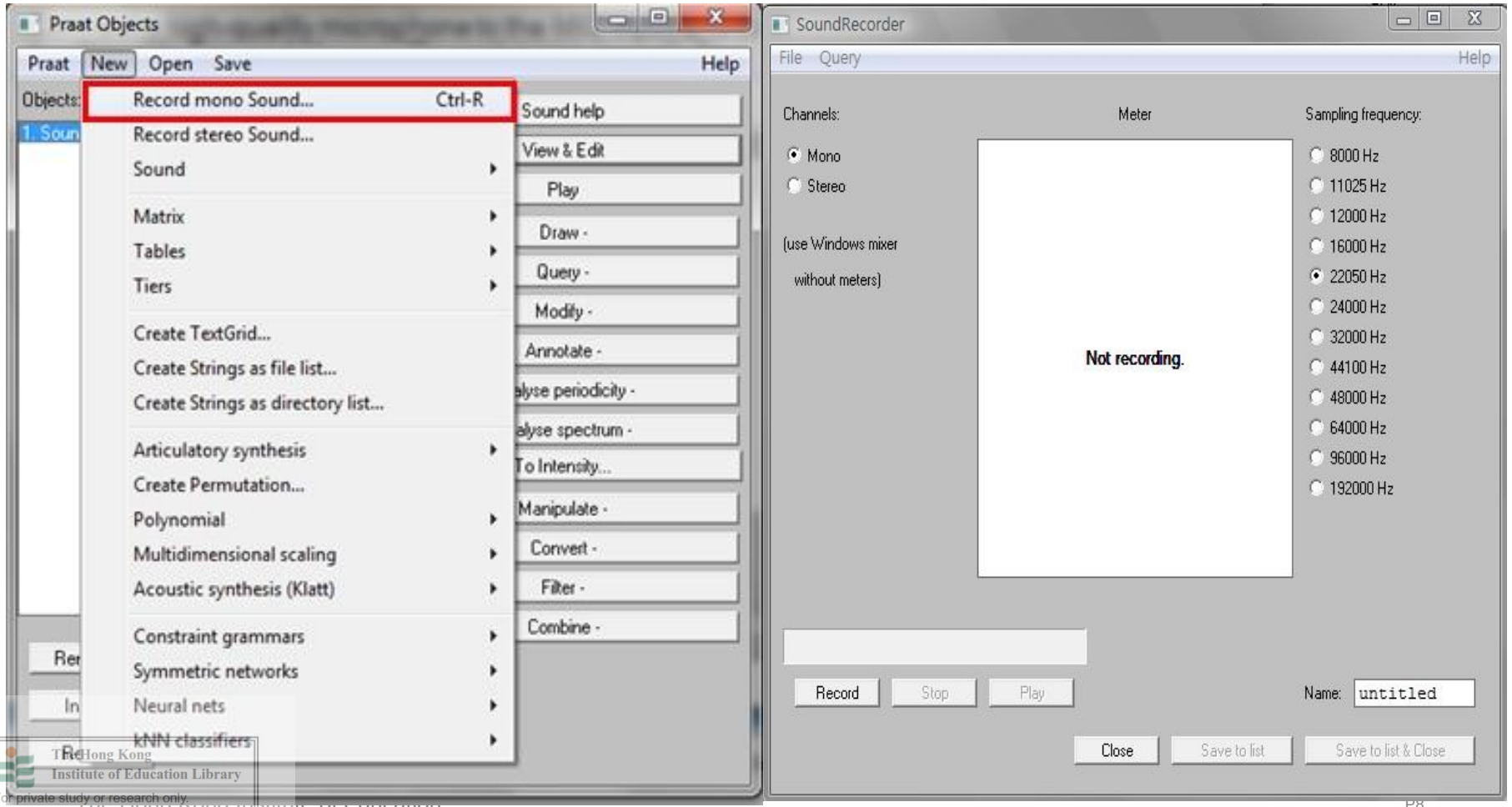
How to start

When you open the Praat, the following two windows pop out.



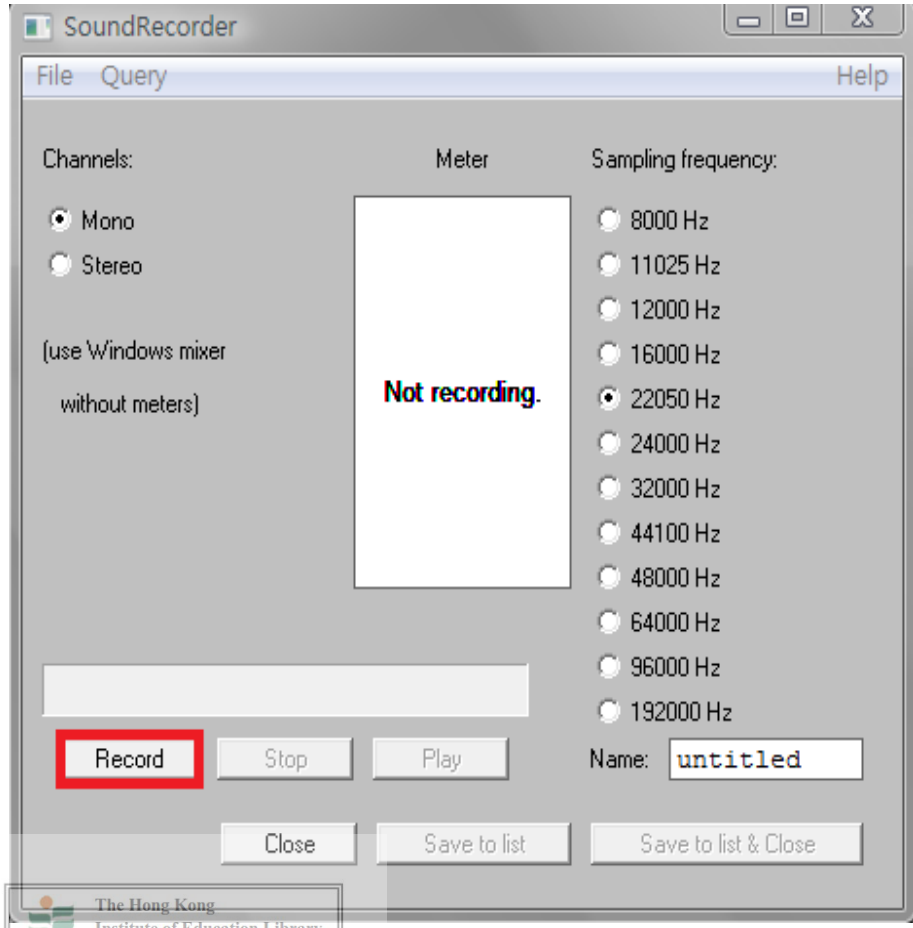
Make new recordings in Praat

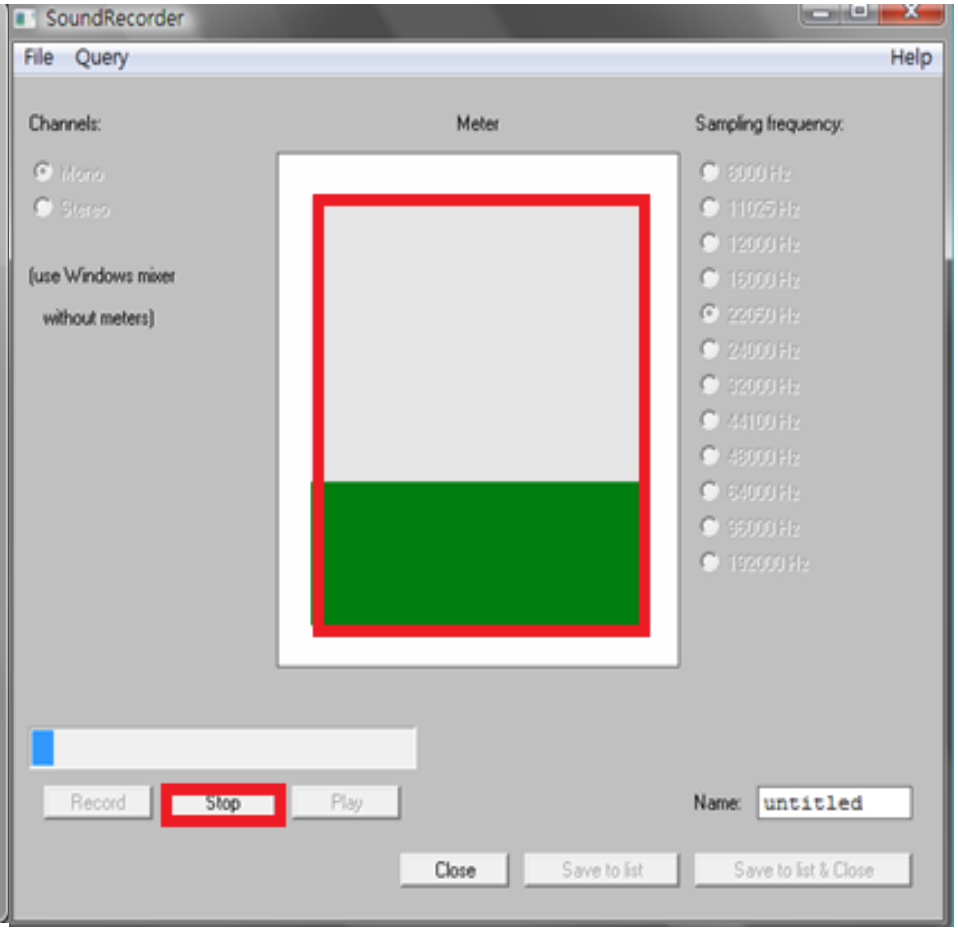
Go to “**New**” button and choose “**Record mono record**”. The Sound Recorder window appears.



Start your recording

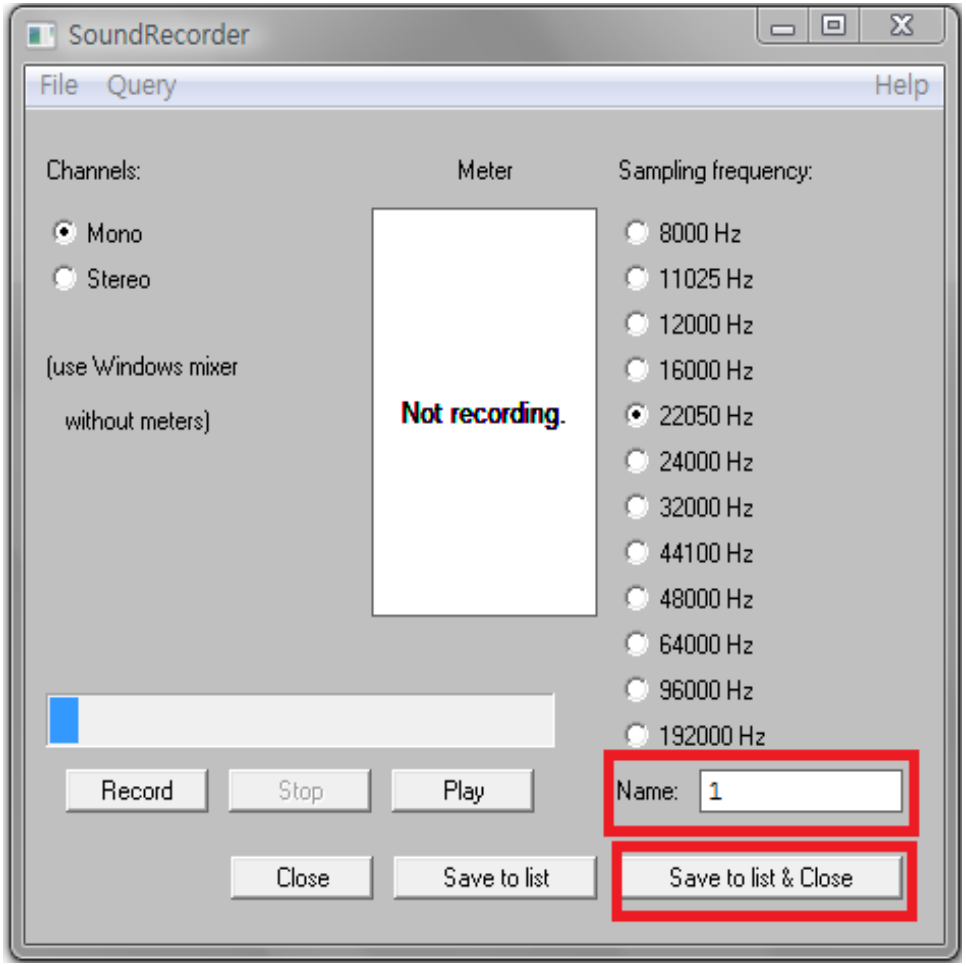
Set the sampling rate as **22050HZ** and then take a deep breath and click the “Record” button.





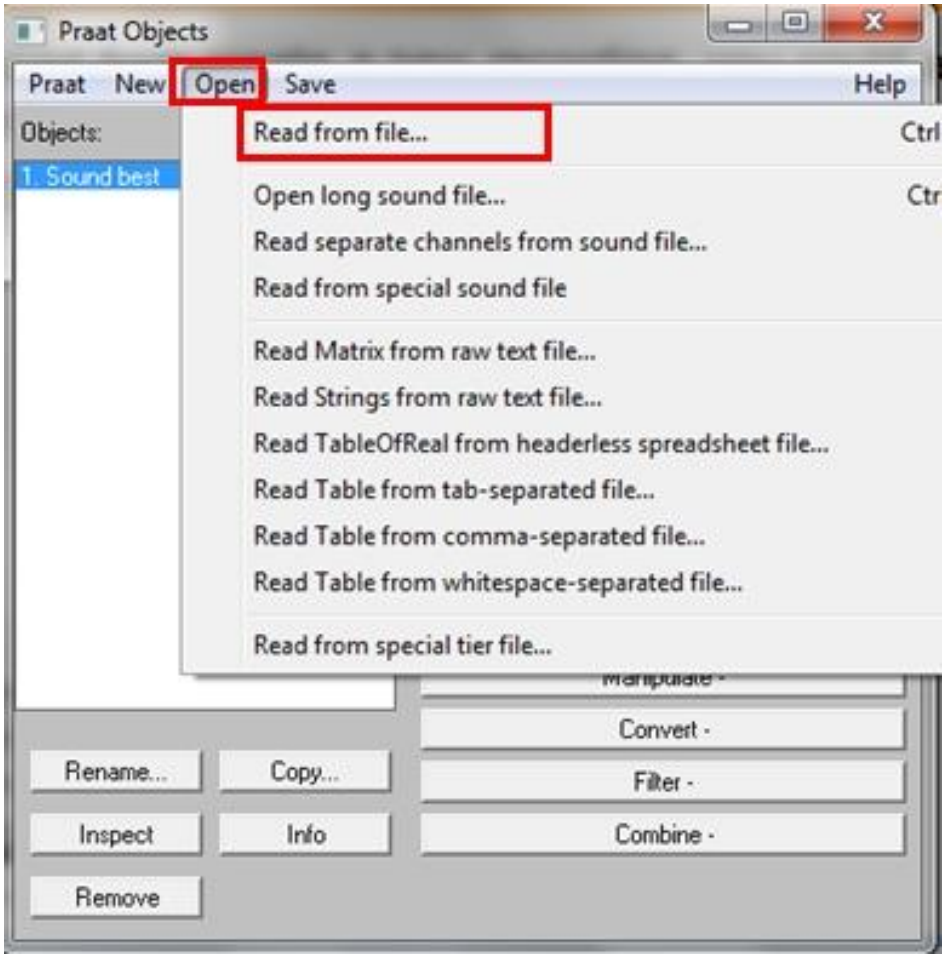
Save your recording

If the recording is to your satisfaction, you can give it a name after **“Name”** and click on the **“Save to list & Close”** button. This will put your recording in the **“Objects window”.**



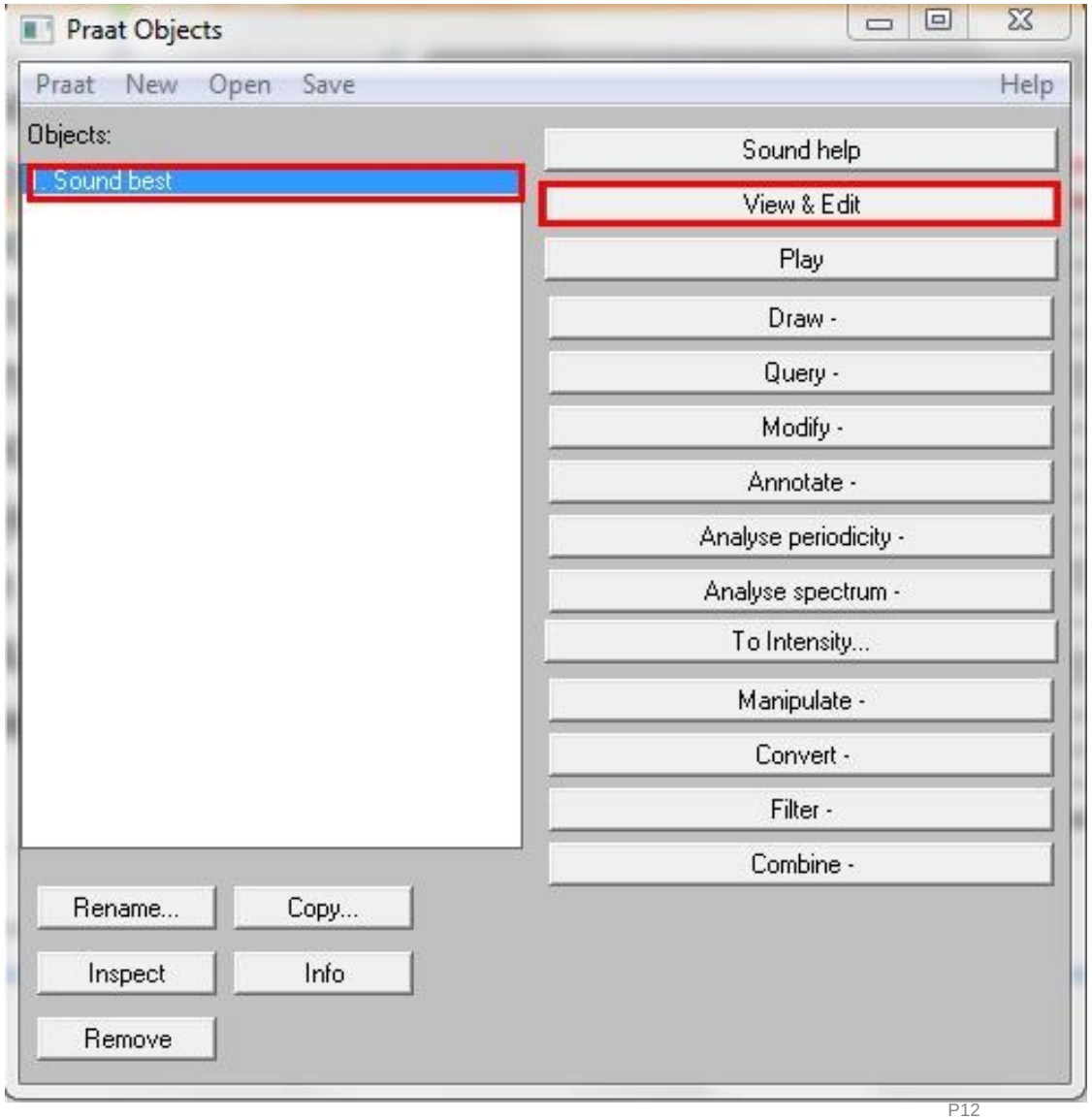
Load existing files

Apart from creating a new recording, you could also read an existing sound file from your computer.



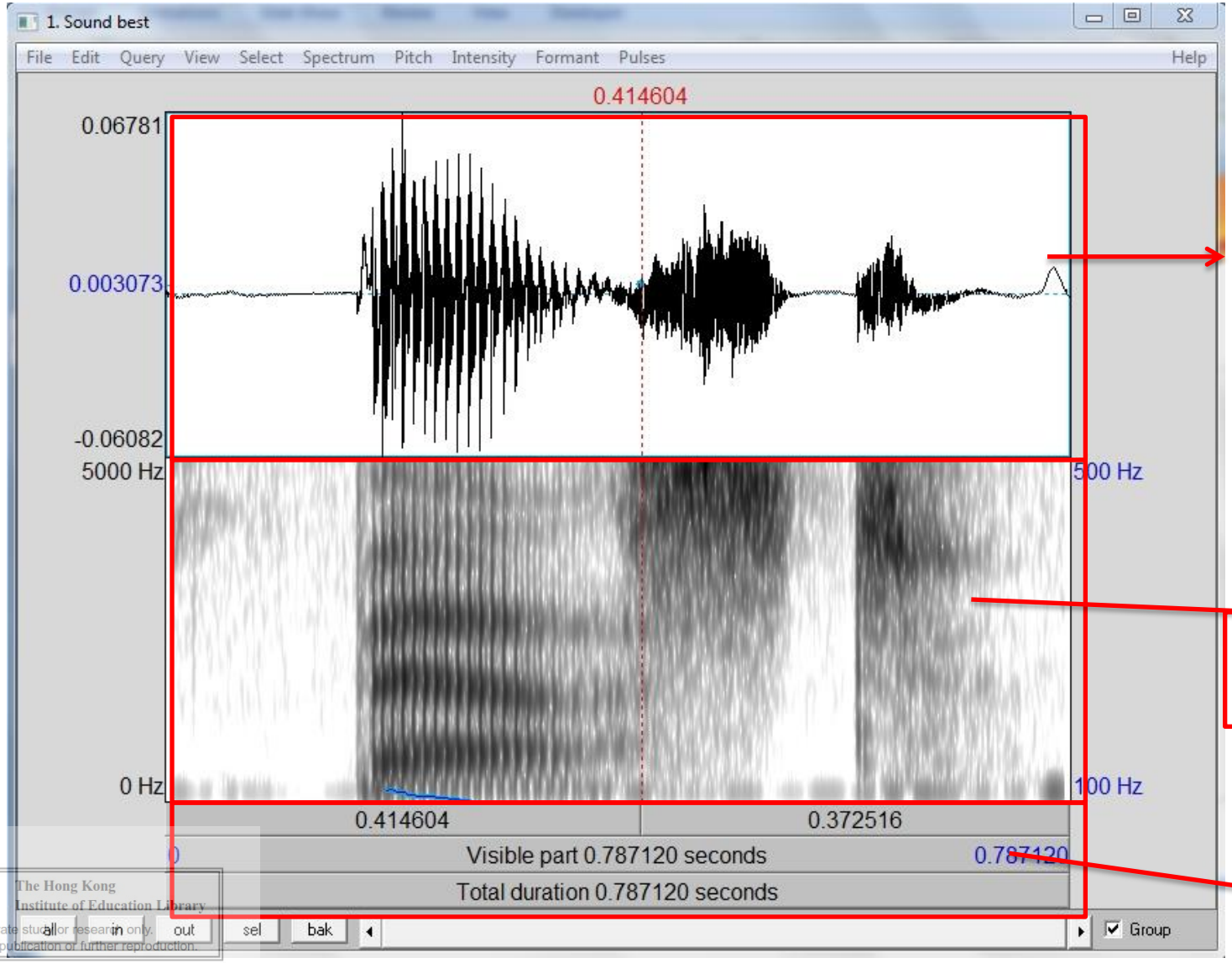
View&Edit

Select the speech object and then choose “View &Edit” from the main menu on the right-hand side of the “Objects window”.



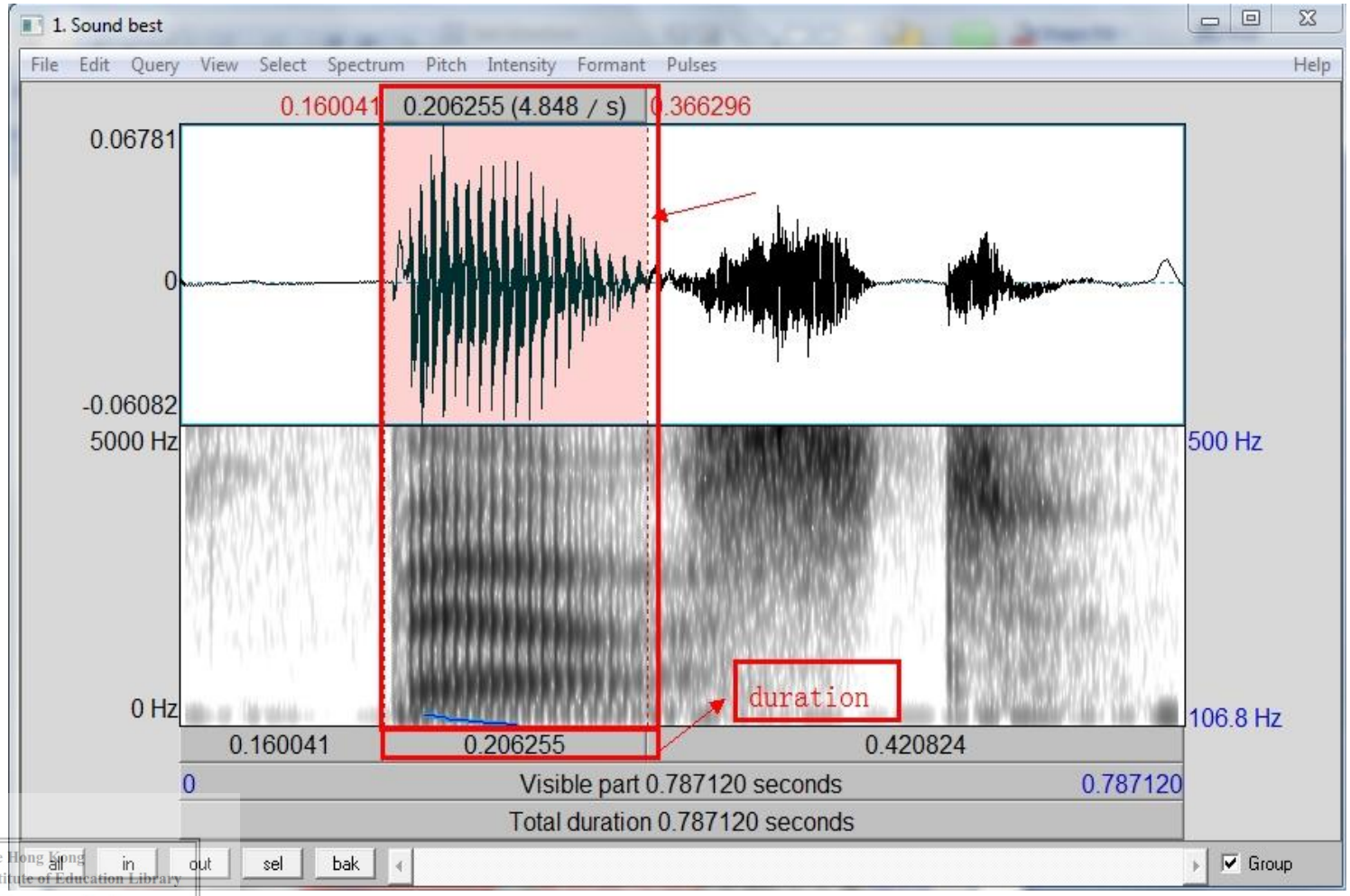
Editor window

The “Sound Editor window” appears



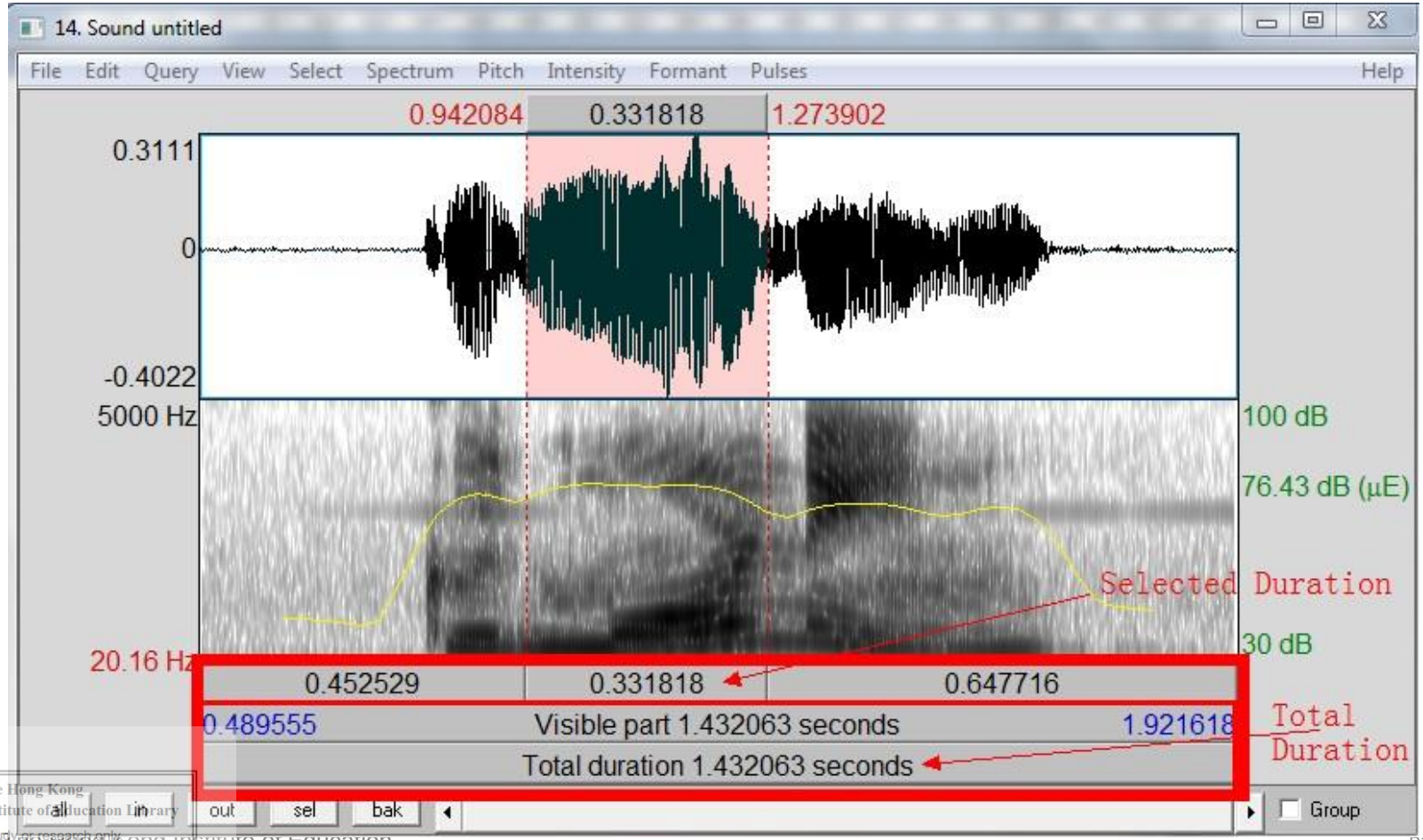
Select the recording

You can move the red dash line to change the scope of recording.



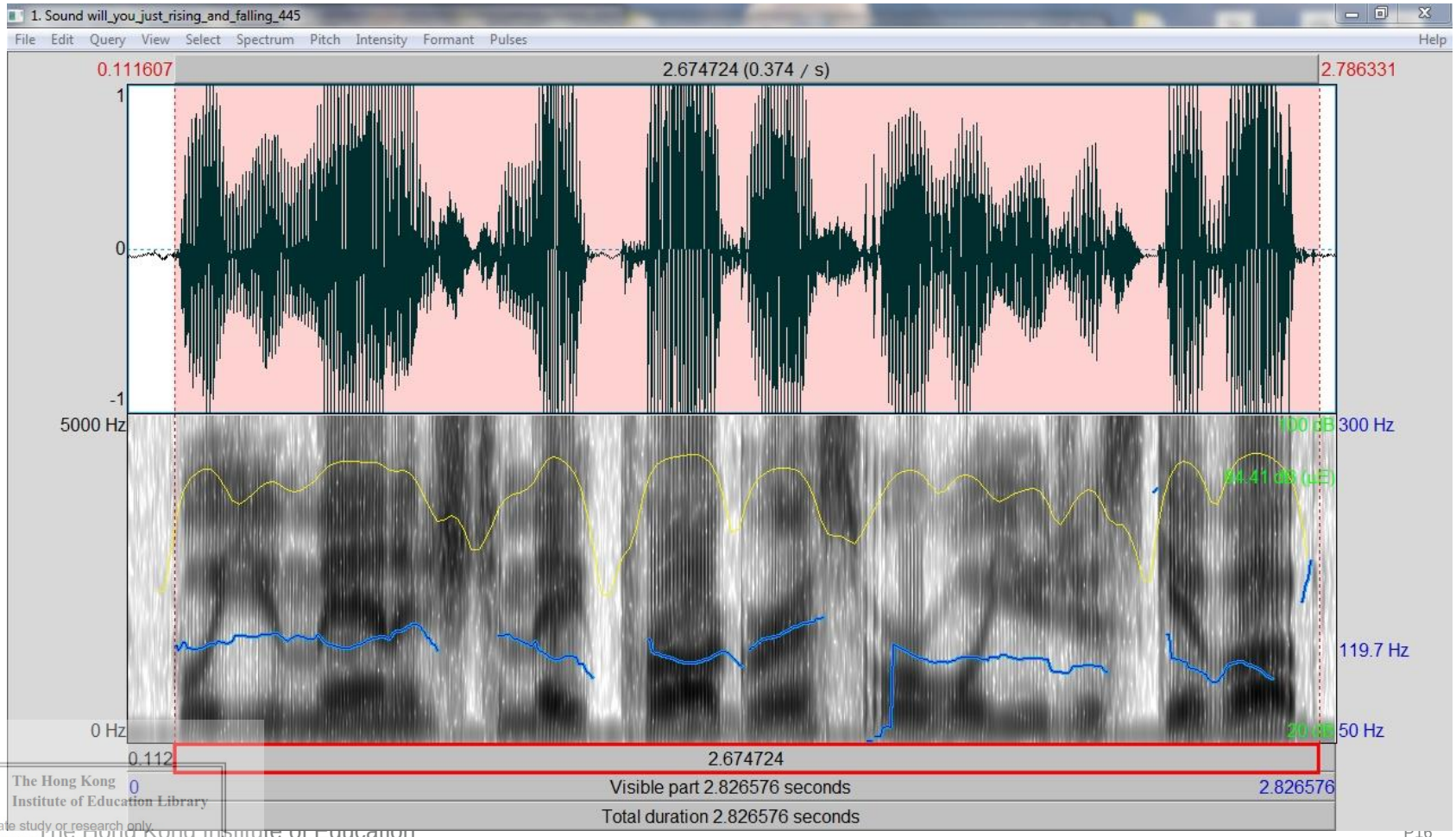
Play the selected recording

You can play the chosen part by clicking the rectangle below and get the duration of the selected parts.

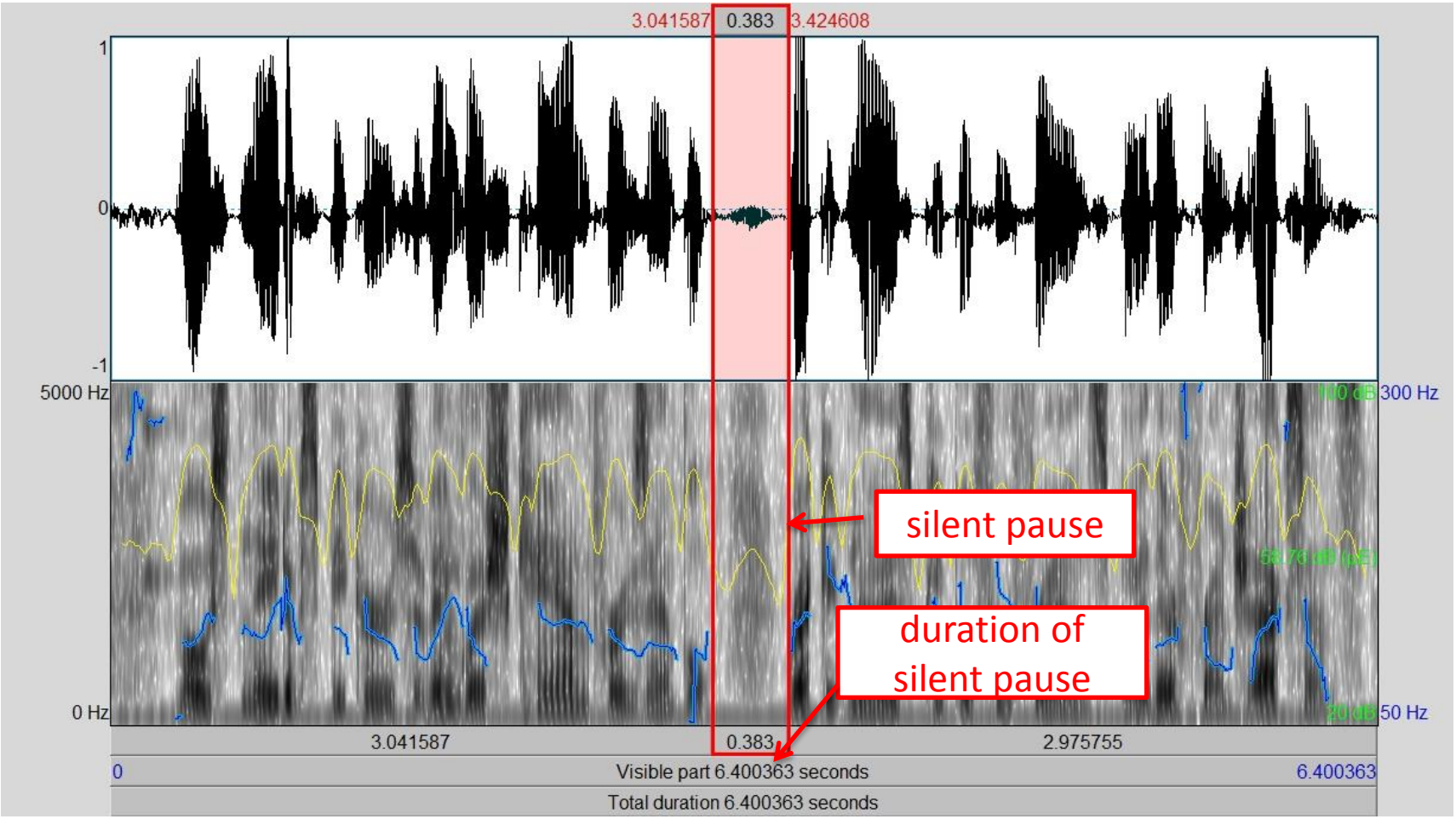


Measure speaking rate

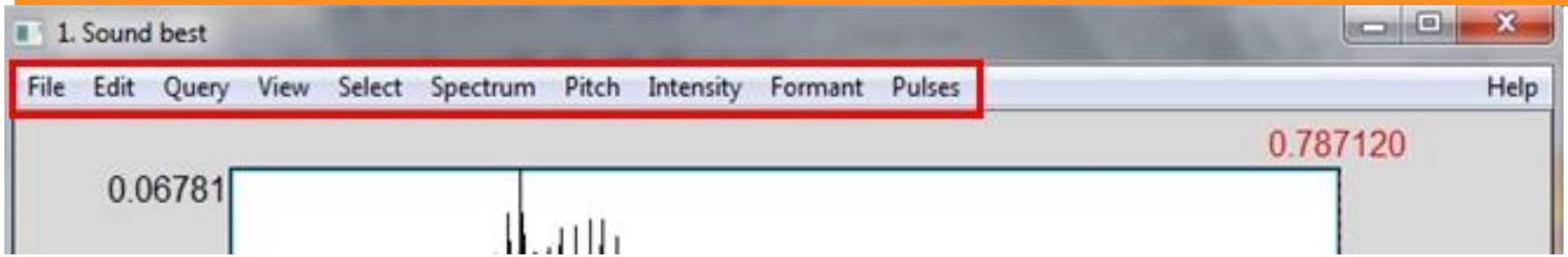
Speaking rate (spm) = Total syllables / number of minutes (duration of the utterance)



Measure silent pause



Top menu of Editor window



File (to draw, save, and extract selections of speech sounds, etc.)

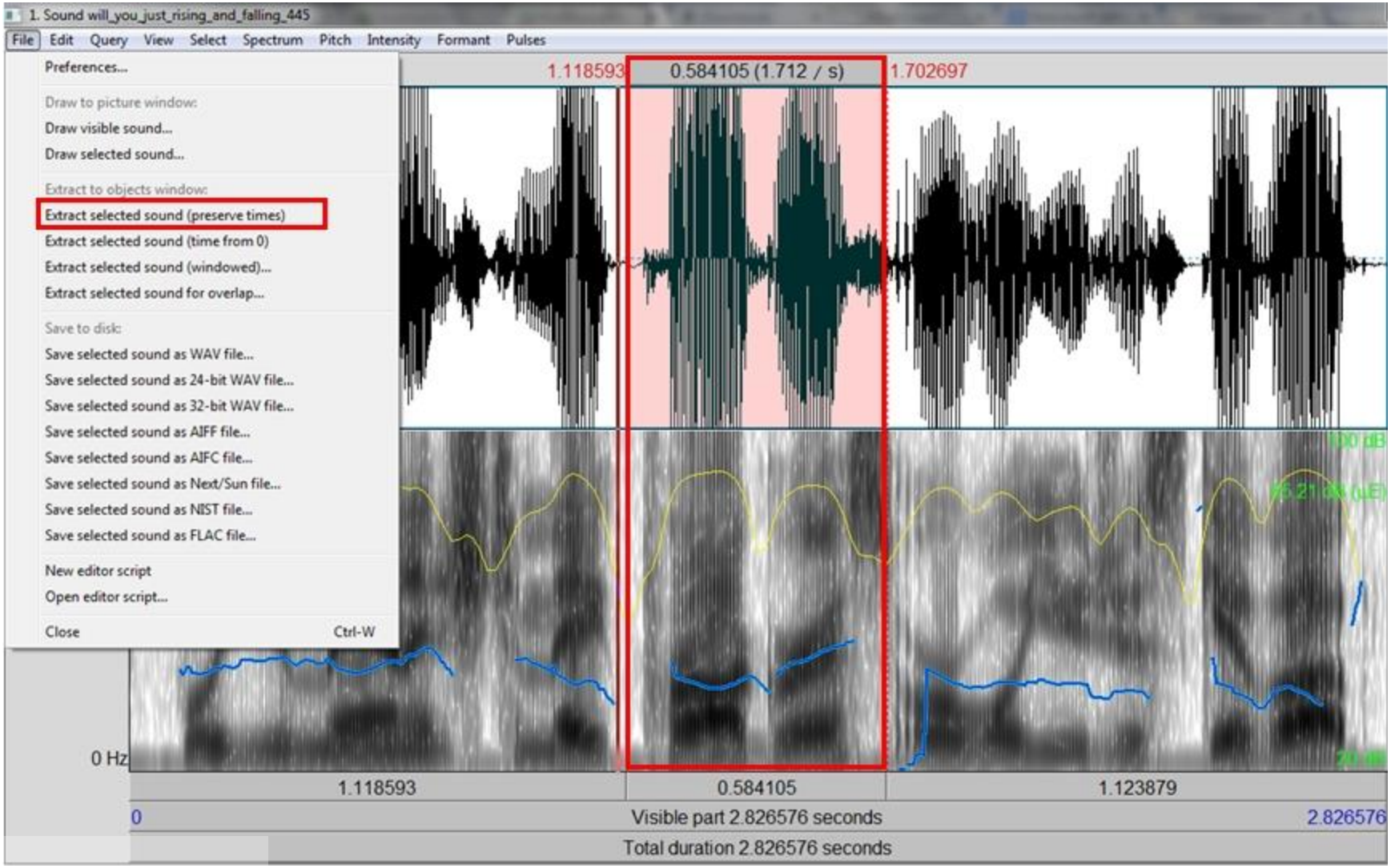
Edit (to copy or paste parts of a speech etc.)

Query (to get information on the cursor position, selection boundaries, define settings for logs and reports etc.)

View (to select the contents of the window (spectrogram, pitch, intensity etc.) and control zoom settings)

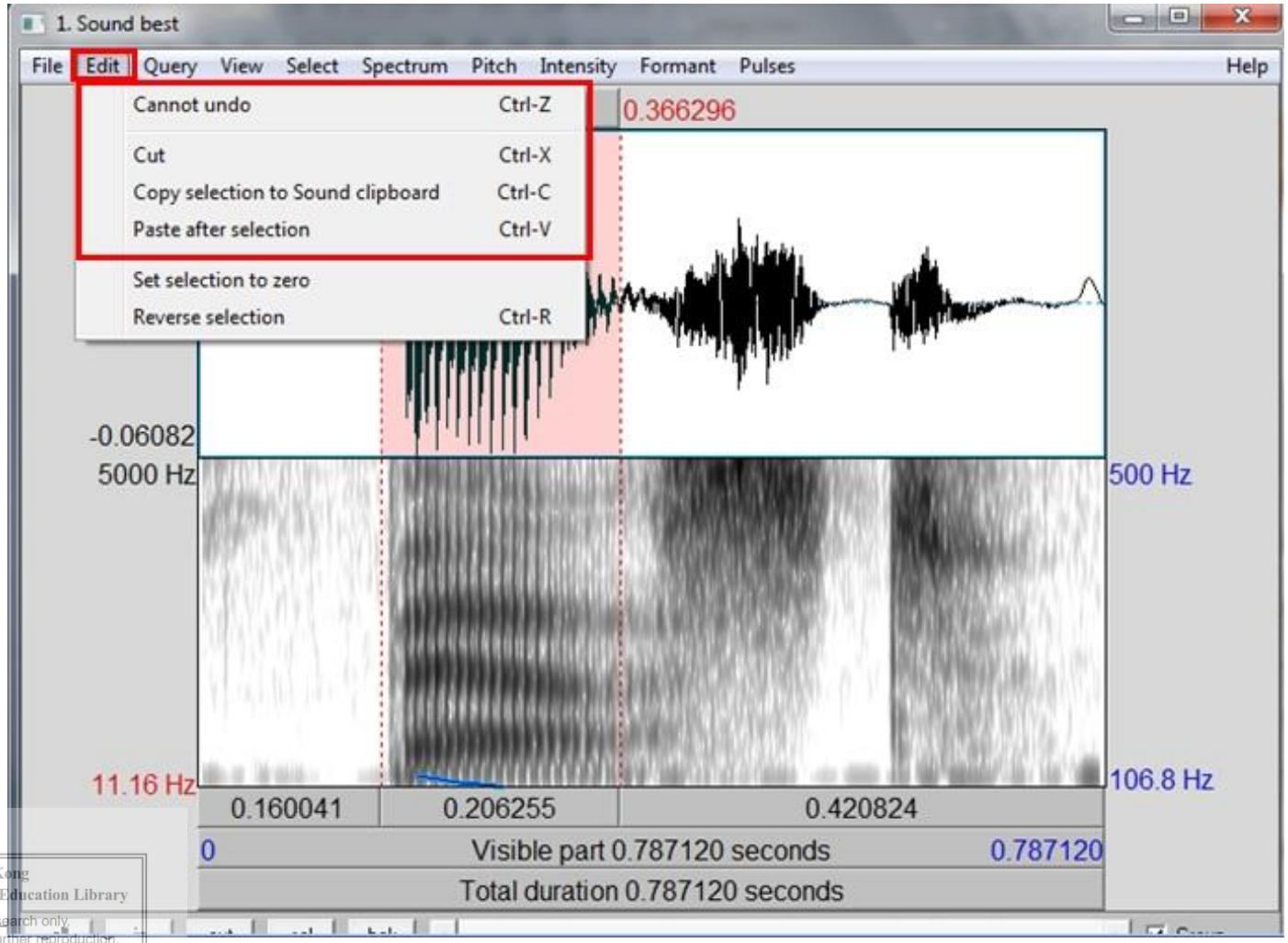
Select (to control cursor positions)

Extract one part from an utterance



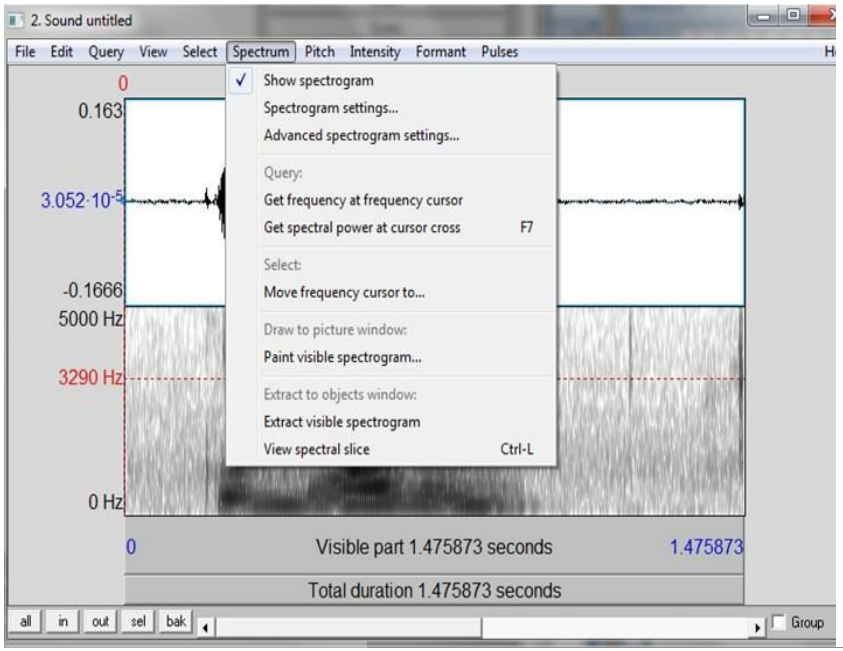
Pull-down menu of Edit

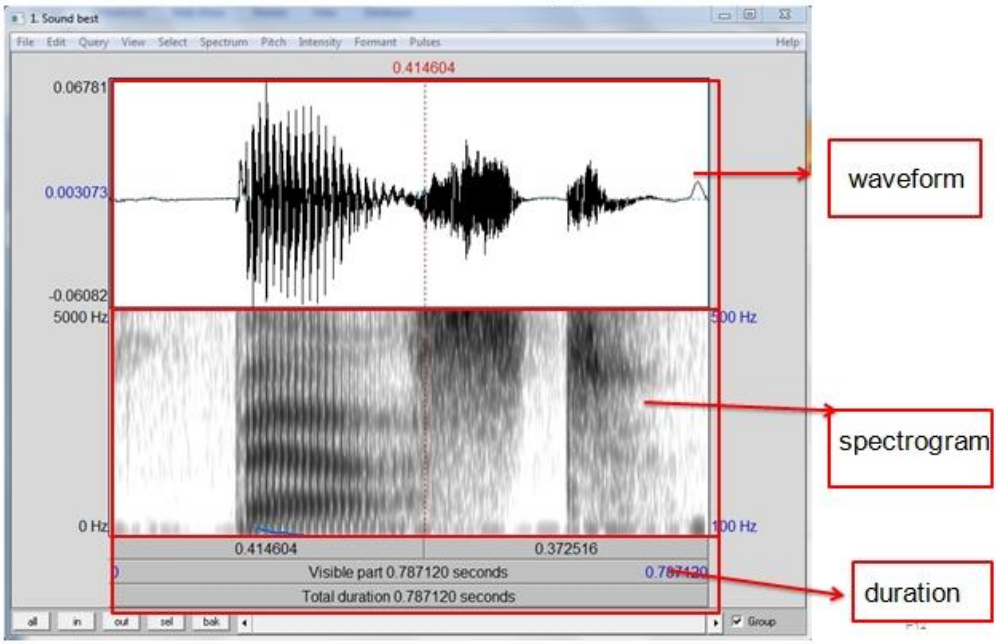
You can open more than one sound, and then cut, copy, and paste between the sounds.



Spectrum

Spectrum: to control the spectrogram settings and extract information. The frequency value at the cursor position is indicated on the left hand outside of the panel in a red font.

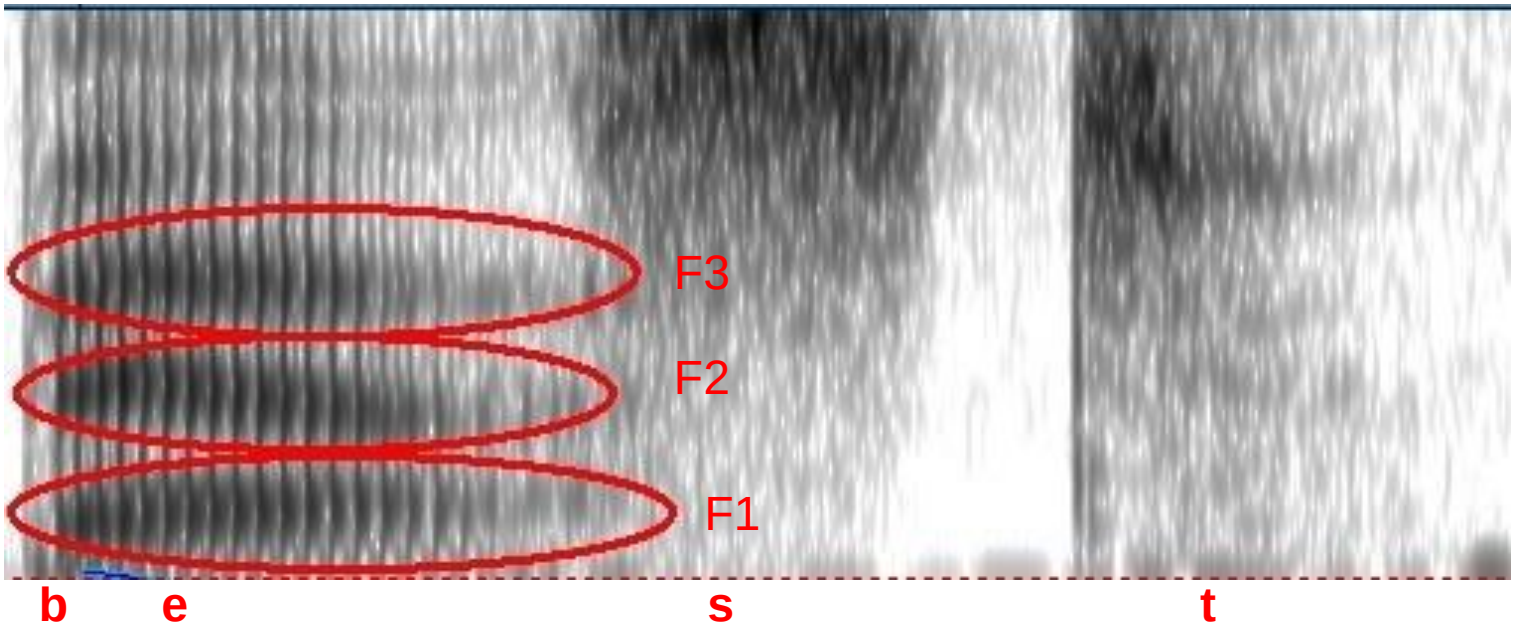




Dropdown menu of Spectrum

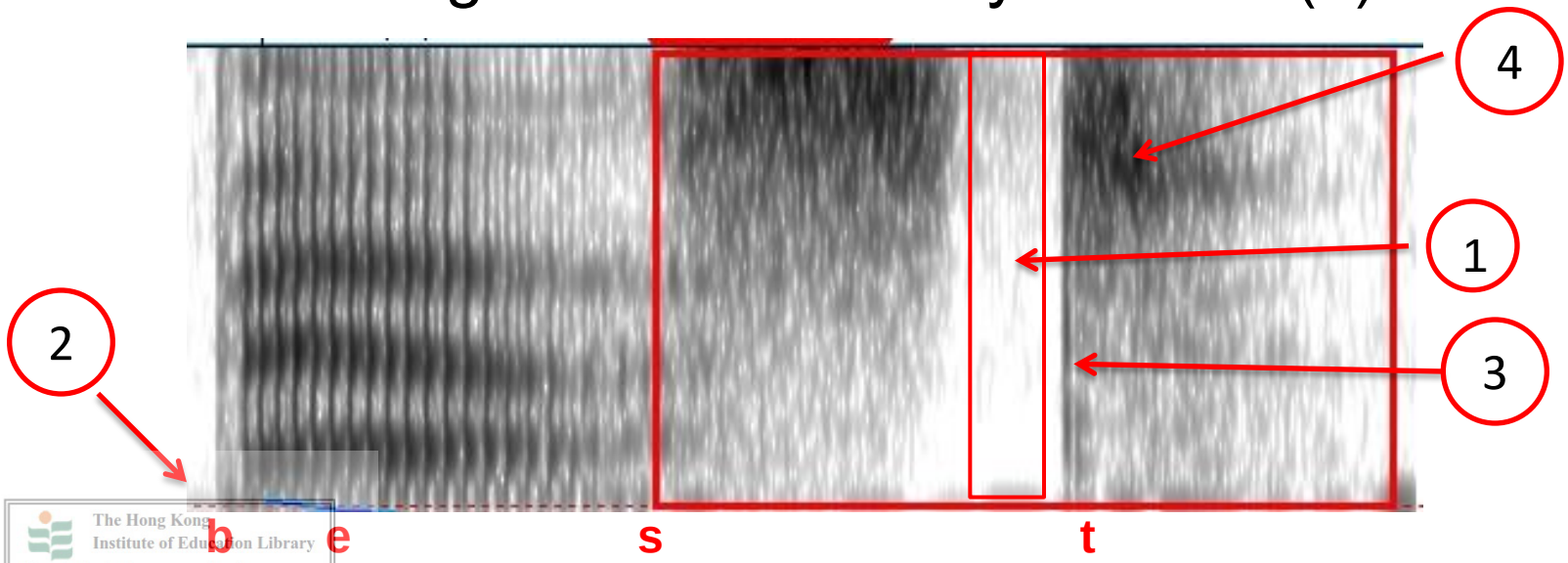
Formant (major acoustic property of vowels)

These concentrations of acoustic energy in vowels are called "**formants**" or natural resonances.



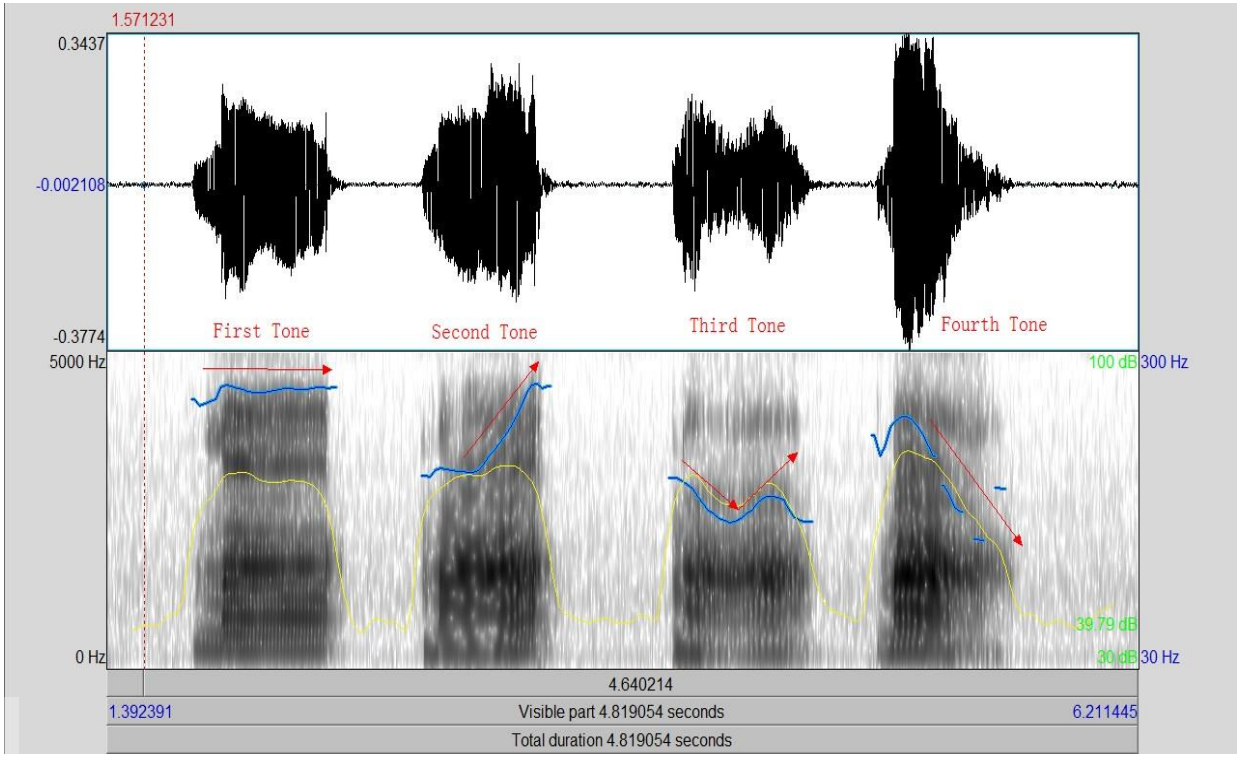
Four acoustic properties of plosives

- ***Duration of stop gap*** – silent period in the closure phase (1)
- ***Voicing bar*** – a dark bar that is shown at the low frequencies and it's usually below 200Hz (2)
- ***Release burst*** – a strong vertical spike (3)
- ***Aspiration*** – a short frication noise before vowel formants begin and it is usually in 30ms (4)



What is pitch?

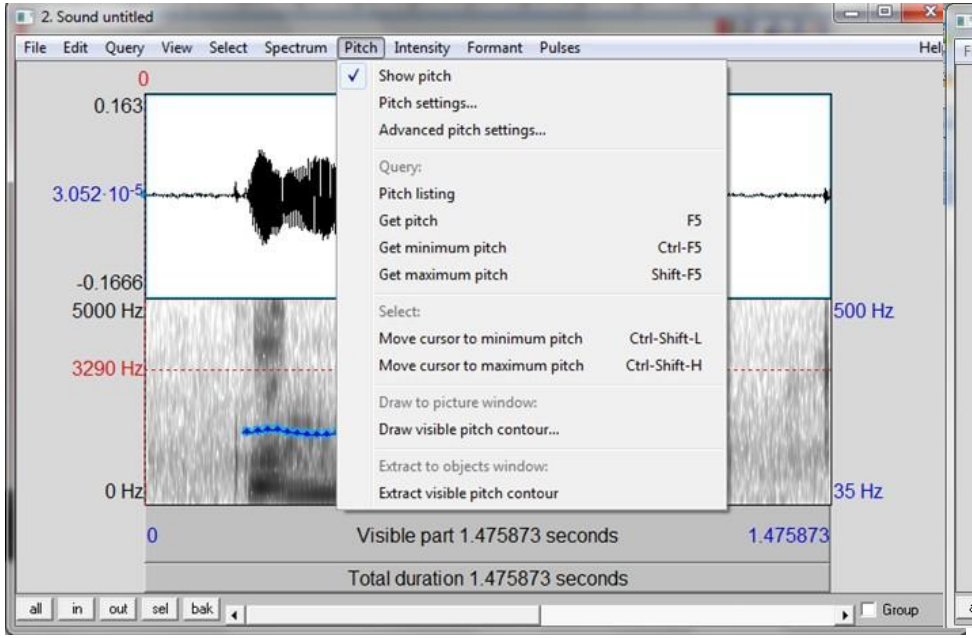
Pitch is a term used to refer to variations in fundamental frequency (F0), which serves as important acoustic cue for tone, lexical stress, and intonation.



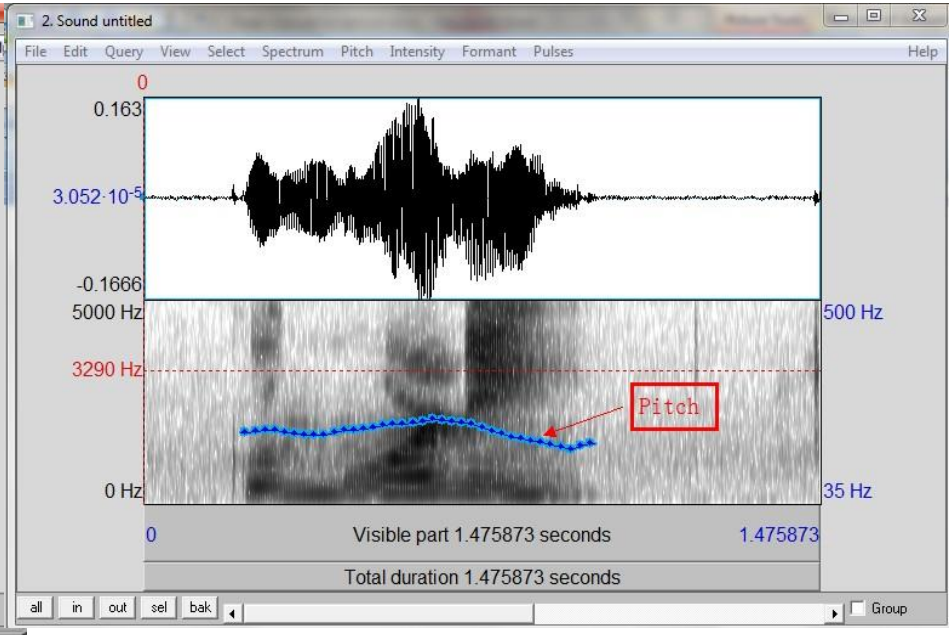
Four Chinese tones in Praat

Pitch

Pitch: to control the pitch settings and extract information



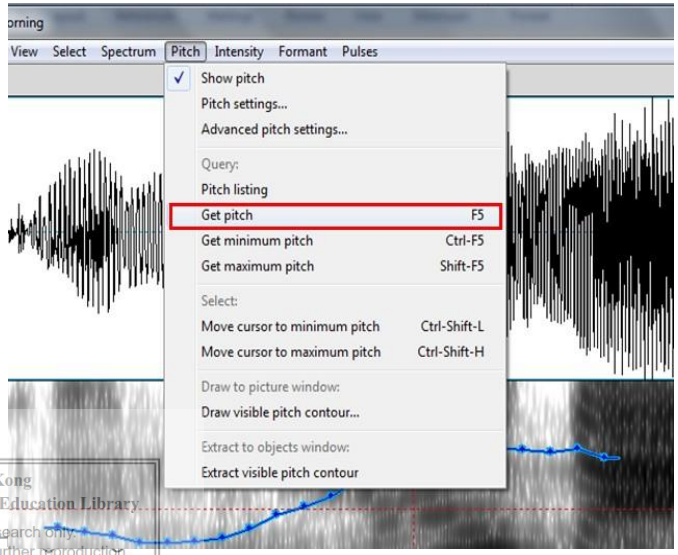
Dropdown menu of Pitch

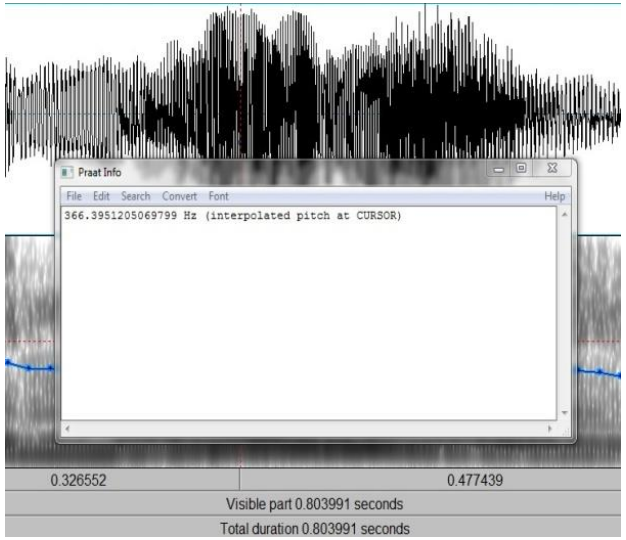


Pitch contour in Praat

a. Extracting information about pitch

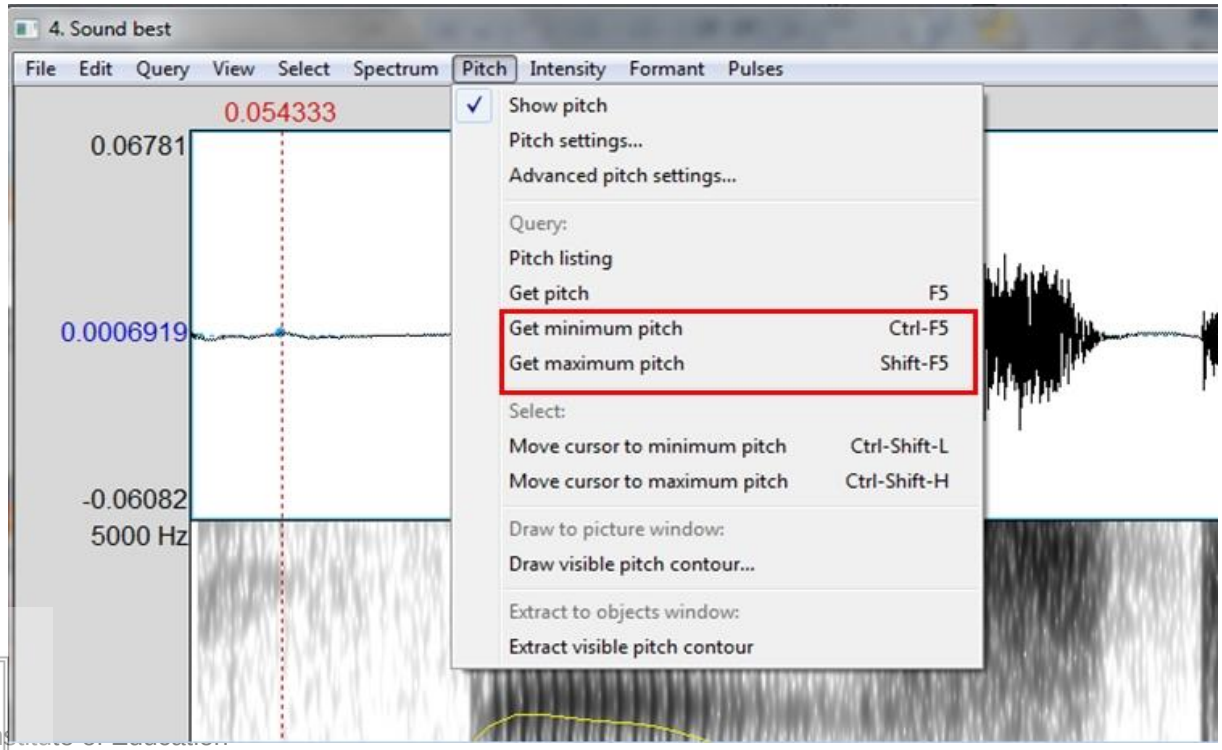
1. Display the pitch track: Pitch→Show pitch
2. At this point, you can place the cursor at the point and read **the blue number on the right side** of the window.
3. Or you can position the cursor in a stable middle part of the blue track and click “Pitch"→ “Get pitch”. A local pitch value will be displayed in a separate window.





b. Getting Maximum/Minimum pitch for a section of speech

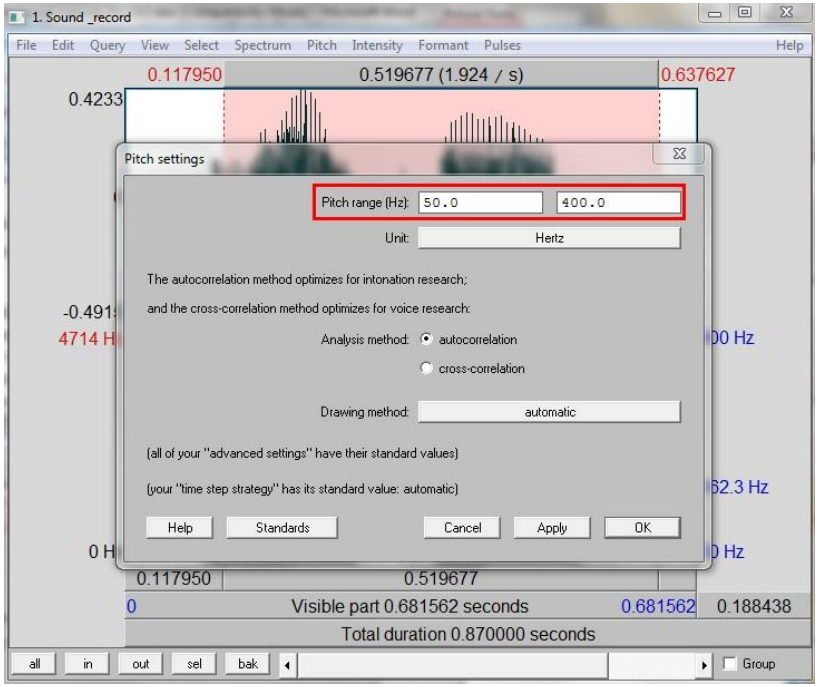
1. Select the portion of the sound for which you'd like the Maximum, Minimum or Average Pitch
2. Select the proper command for your task from the top menu: Pitch→Get Pitch/Get Maximum Pitch/Get Minimum Pitch



c. Adjusting the pitch settings

The fundamental frequency of the voice (pitch) usually varies according to different speakers:

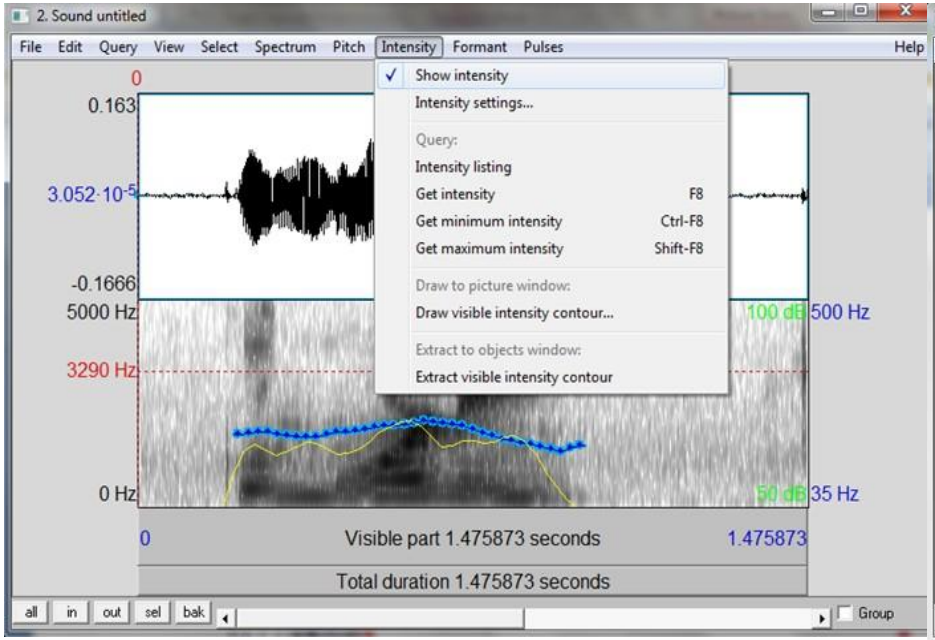
- Males' pitch ranges: 50-180Hz
- Females'pitch ranges:80-250Hz
- For general usage: 50-400 Hz



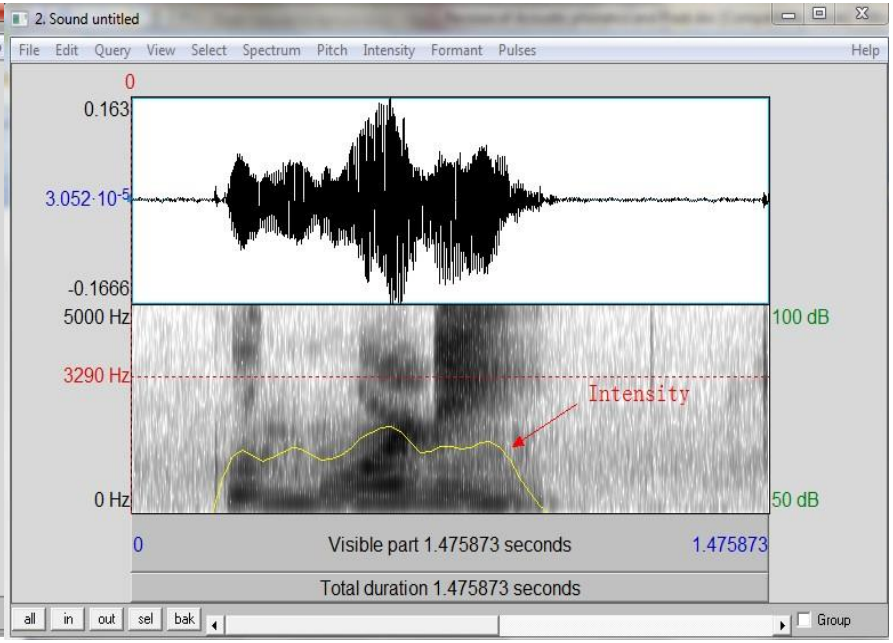
If the pitch contour is too low in spectrogram, you can increase the maximum value of the pitch range (e.g. increase from 400 to 500); if the pitch contour is too high, you can decrease the maximum value of the pitch range (e.g. decrease from 400 to 300).

Intensity

Intensity: to control the intensity signal settings and extract information



Dropdown menu of Intensity

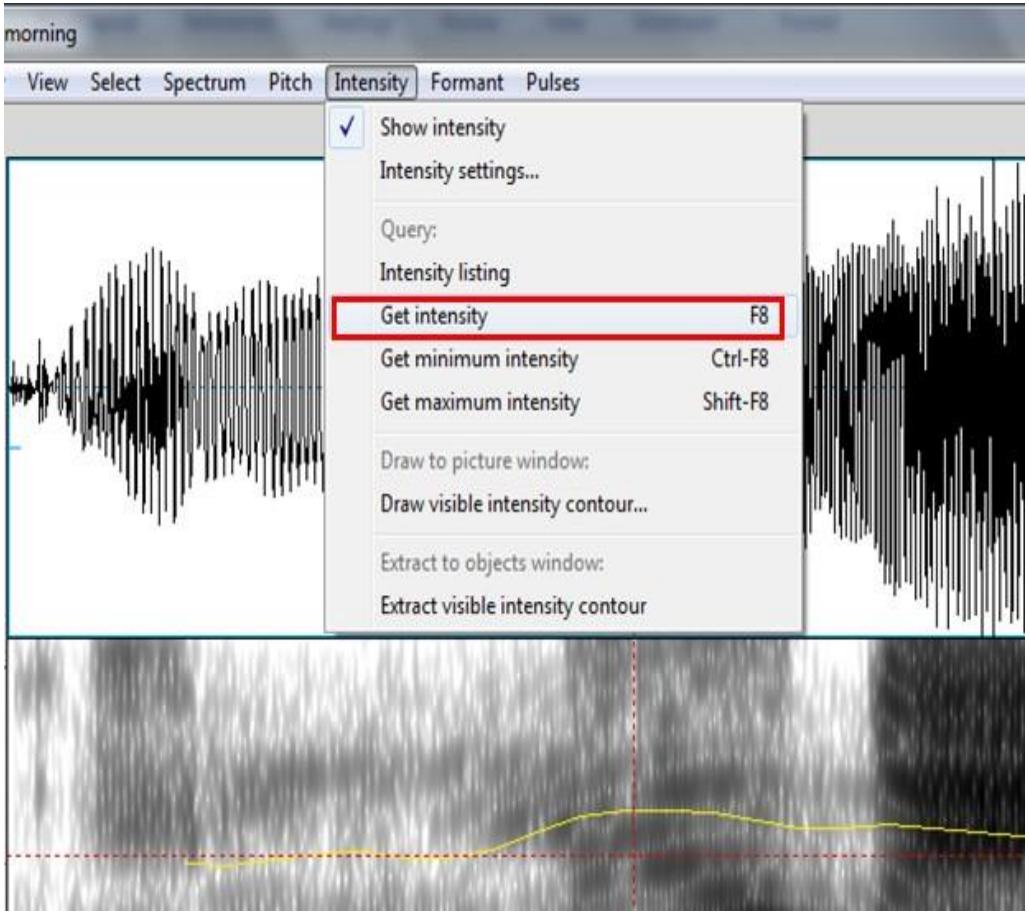


Intensity contour in Praat

Extracting information about intensity

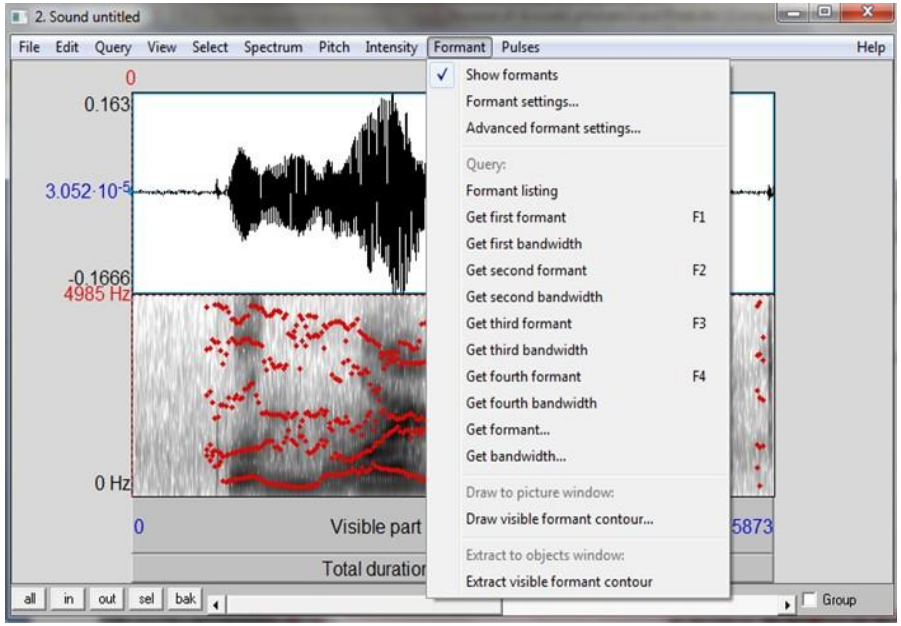
1. Position the cursor in a stable middle part of the sound .

2. Go to “Intensity” and select “Get intensity”. A local intensity value will be displayed in a separate window.

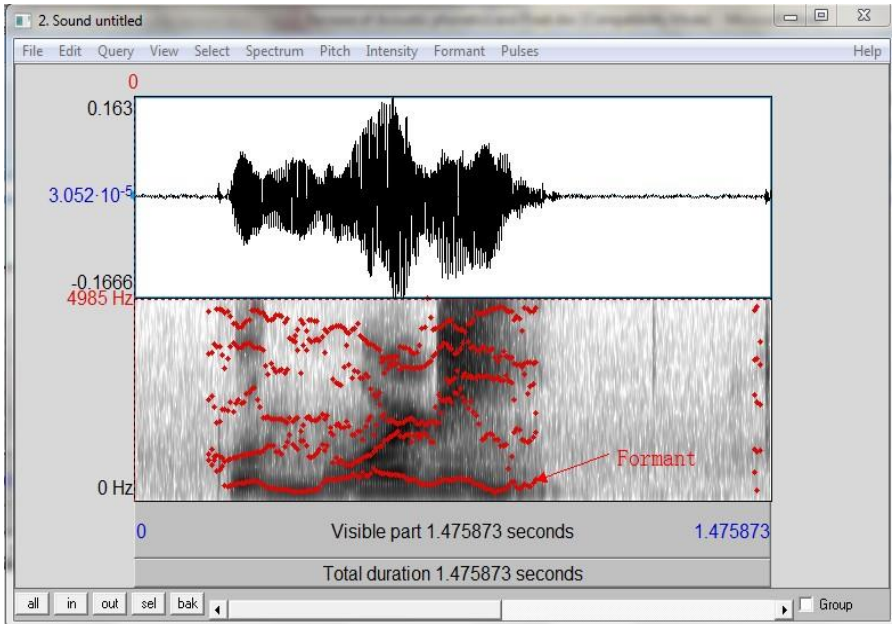


Formant

Formant: to control the formant settings and extracts information; by default the formants are shown in red dotted lines.



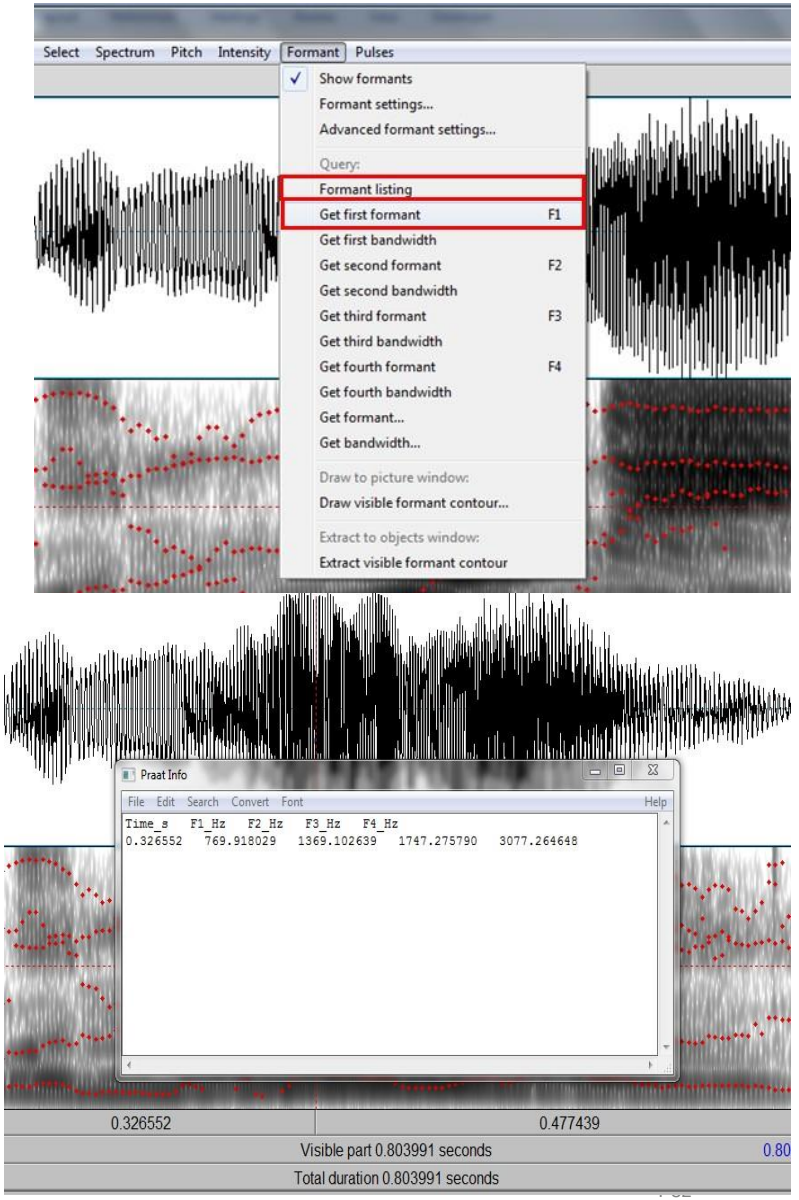
Dropdown menu of Formant



Formant contour in Praat

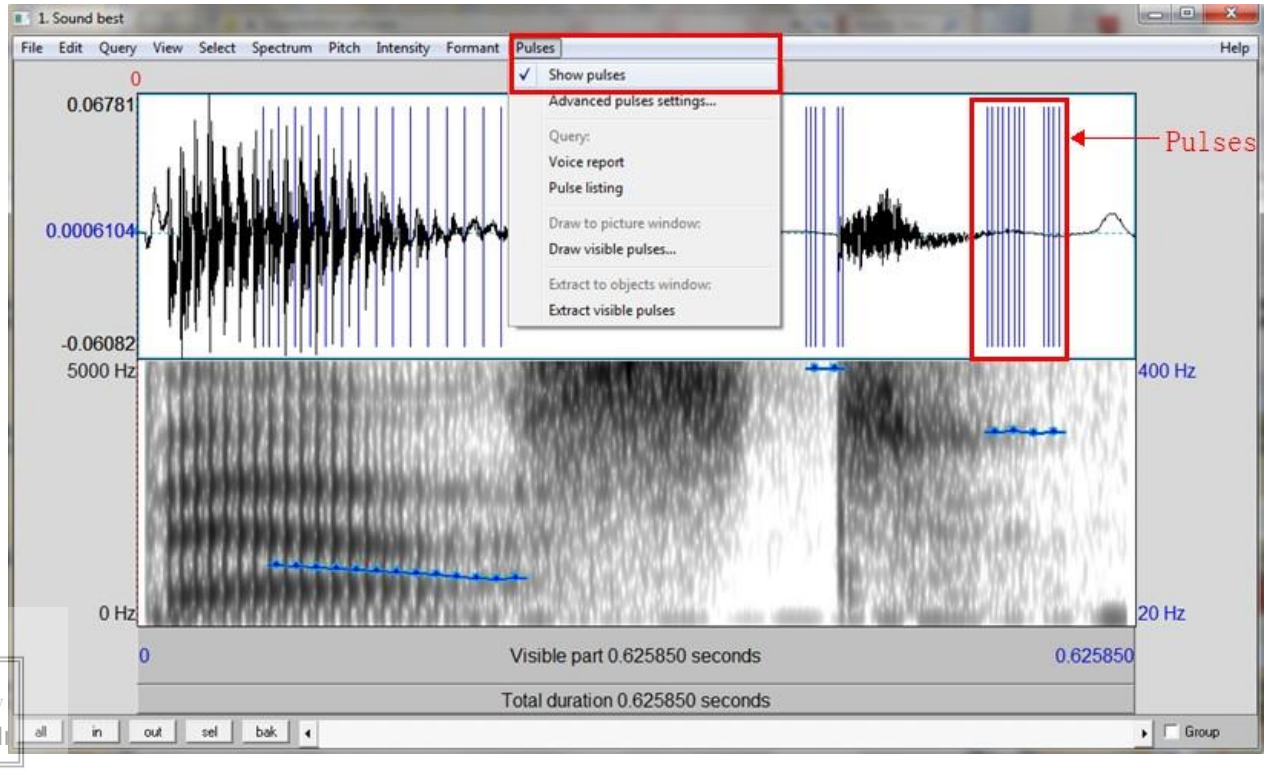
Extracting information about formant values

1. Position the cursor in a stable middle part of the sound.
2. Go to ‘Formant’ and select ‘Get first formant’ (F1).The local first formant value will be displayed in a separate window.
3. Do the same for the second formant (F2), third formant (F3), and fourth formant (F4).



Pulses

Pulses: to set pulses (necessary for e.g., pitch analysis) and to extract specific information on voice parameters like jitter and shimmer; pulses are indicated in the top panel with vertical blue solid lines



Draw pictures in Praat

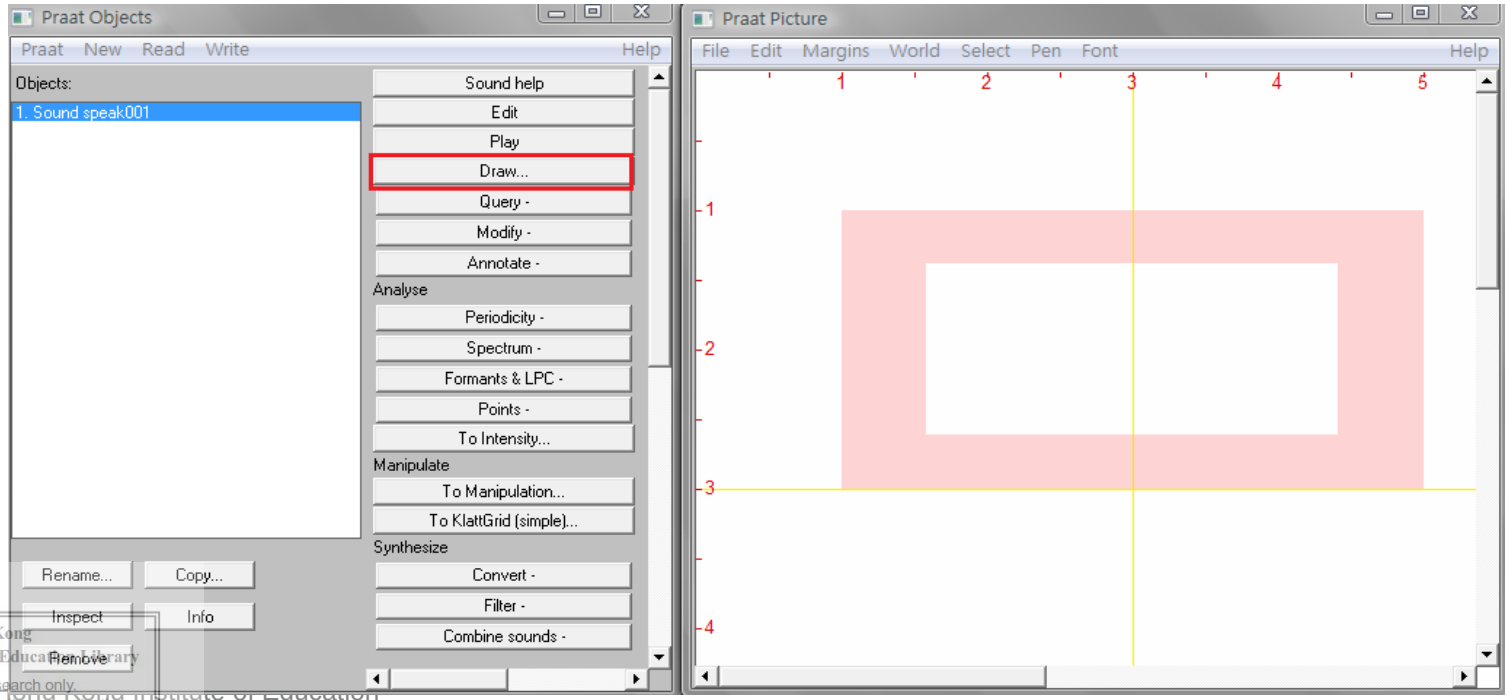
Using the Praat picture window can be thought of as a **five step** process:

1. *Create an object*
2. *Choose your size*
3. *Draw your object into the picture window*
4. *Garnish*
5. *Export*

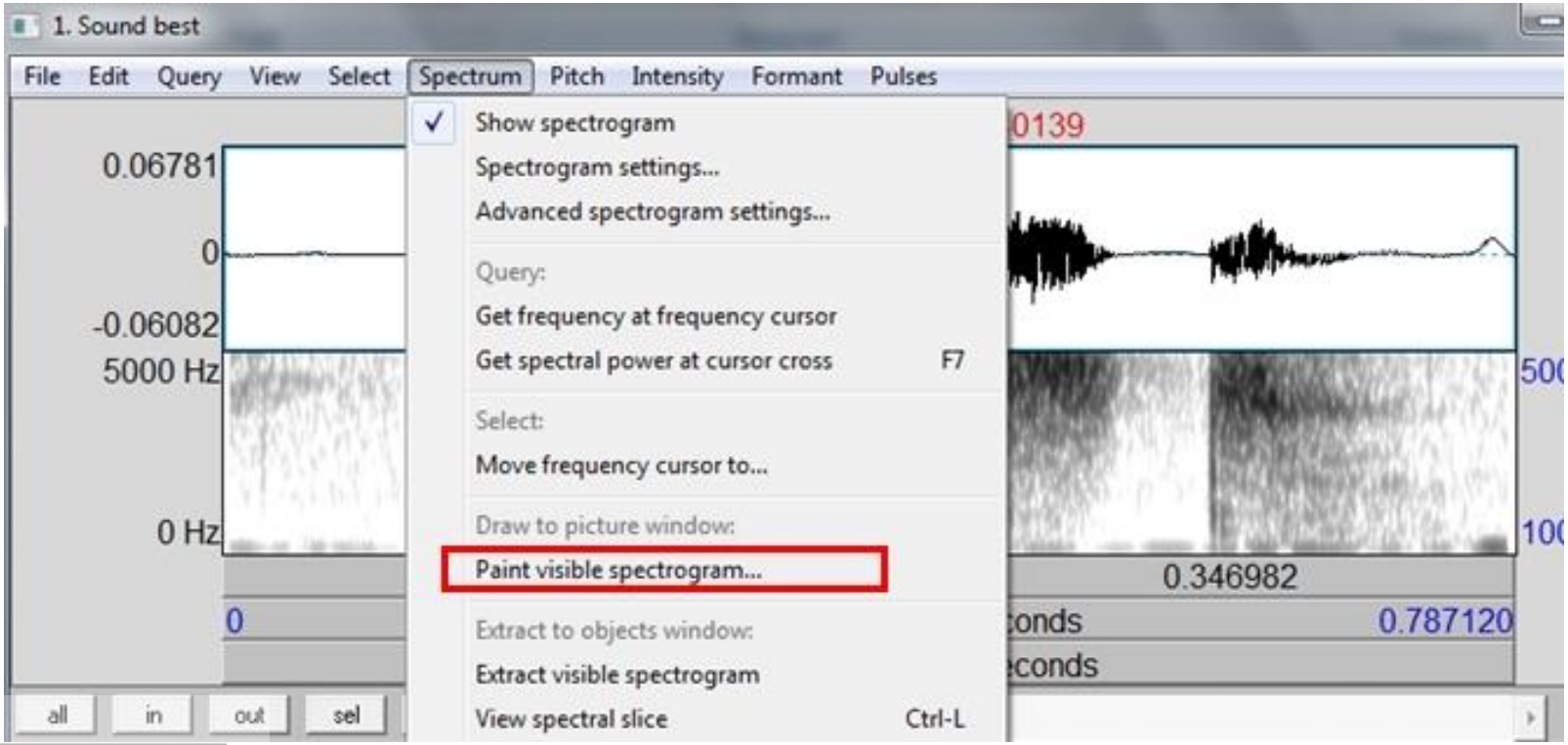
(Styler 2012 :41)

Example: draw spectrum in Praat.

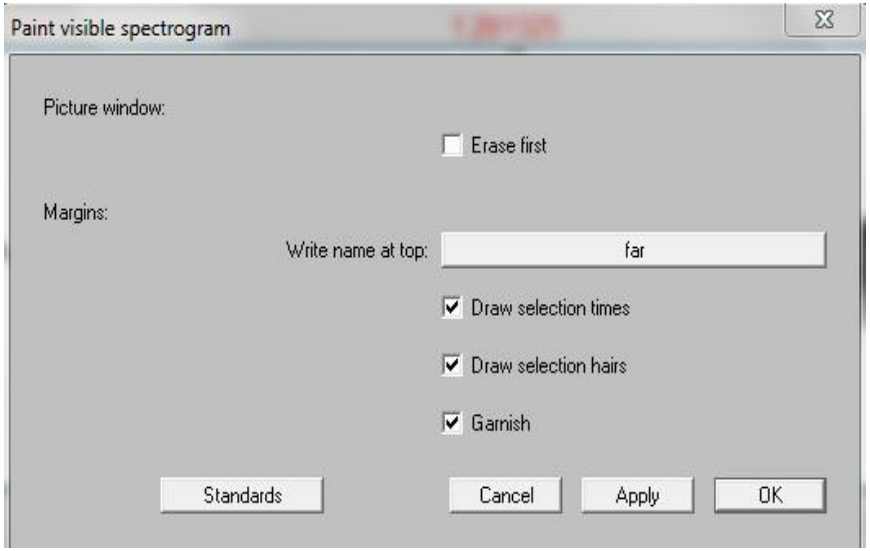
1. Open the Editor window,
2. Determine the physical size of the plot by changing the selection in the ‘Praat picture’ window (pink rectangular shape) before you draw the graph.

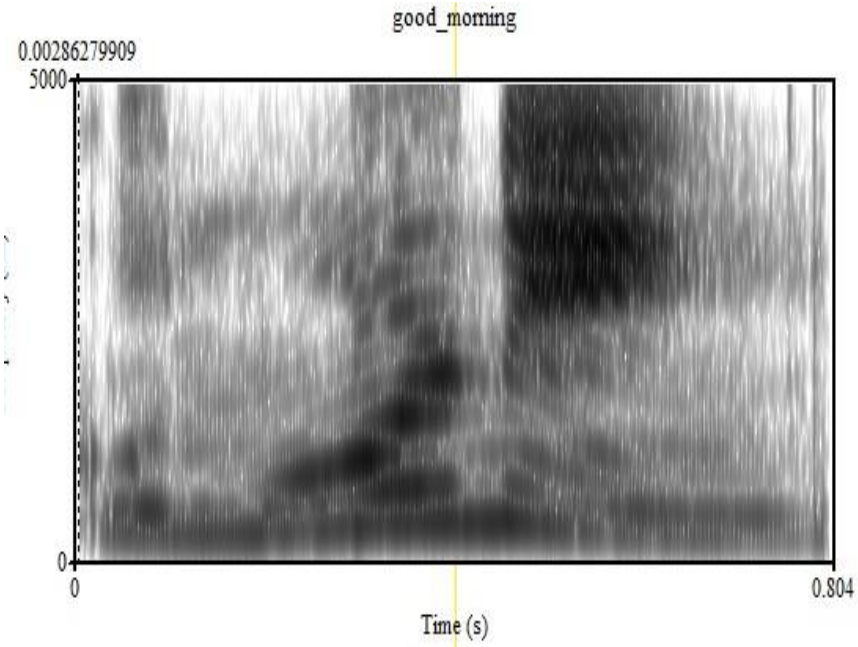


3. Click the Spectrum and find “Paint visible spectrogram”, then click it.



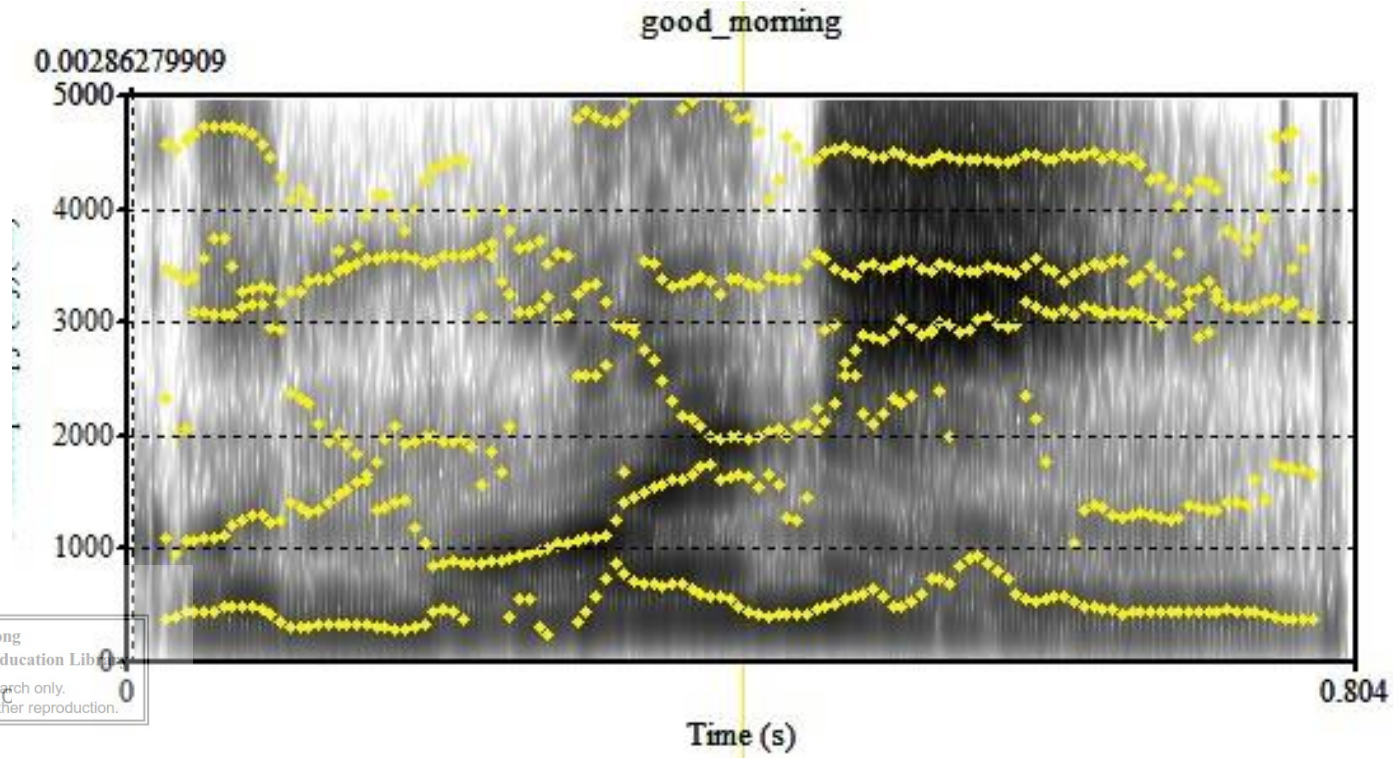
4. When the Paint window pops up, just click OK, and the Spectrum will be drawn.





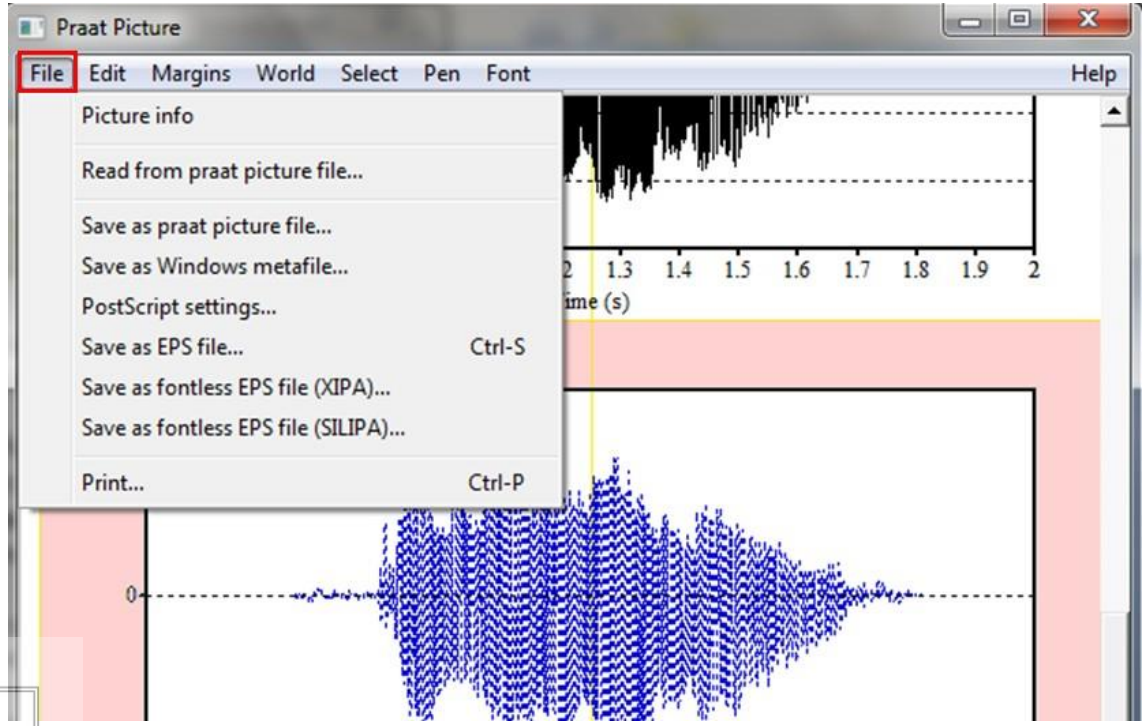
Draw formant contours

Formant contours can also be drawn by using the same steps. If you still select the same area in **Picture window**, the formants that are newly drawn will overlap with the old spectrum.



5. Export your pictures

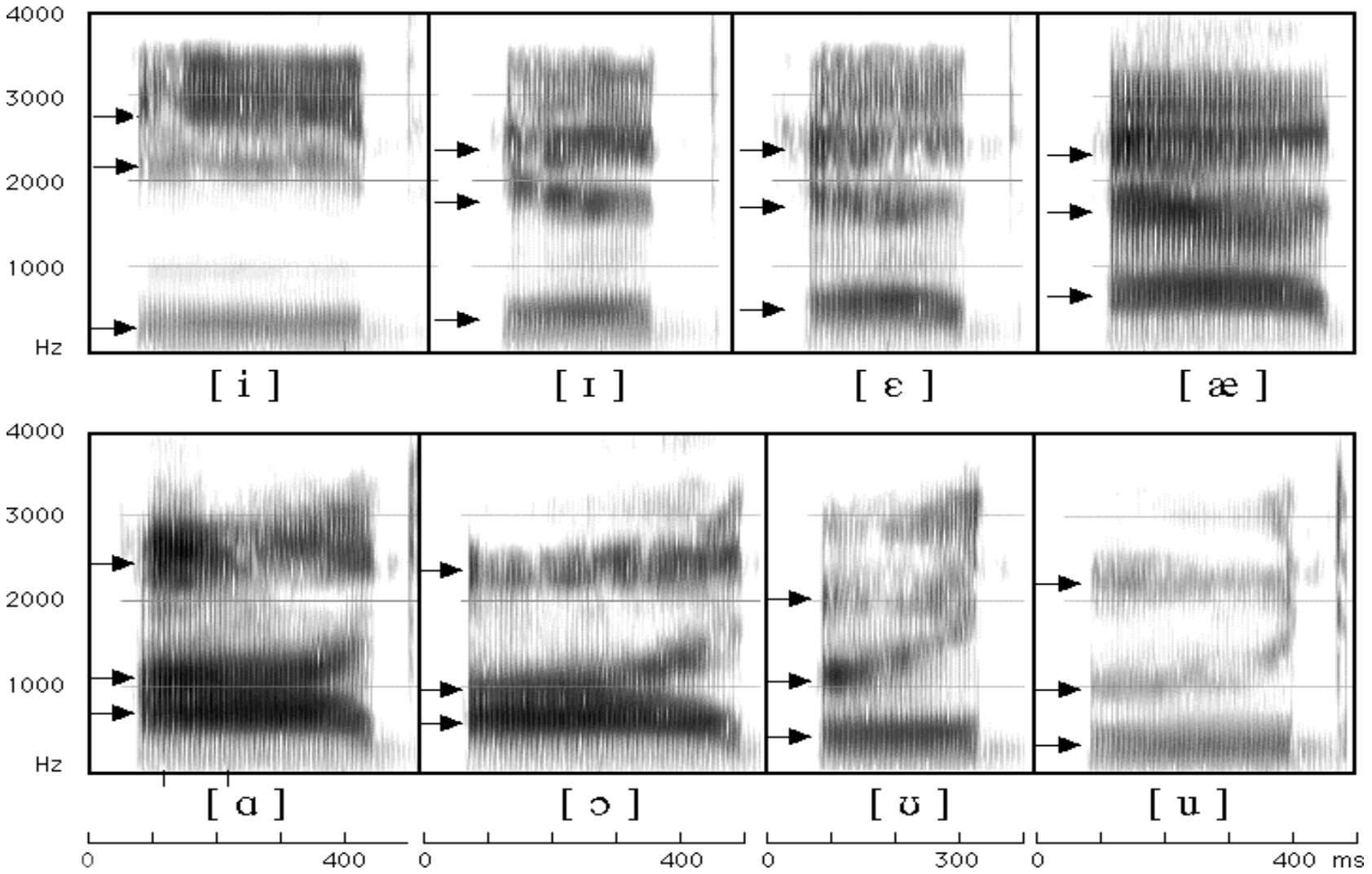
First, you should make sure you have selected what you want, and then click File to choose the format you want to save as.



Part 2.

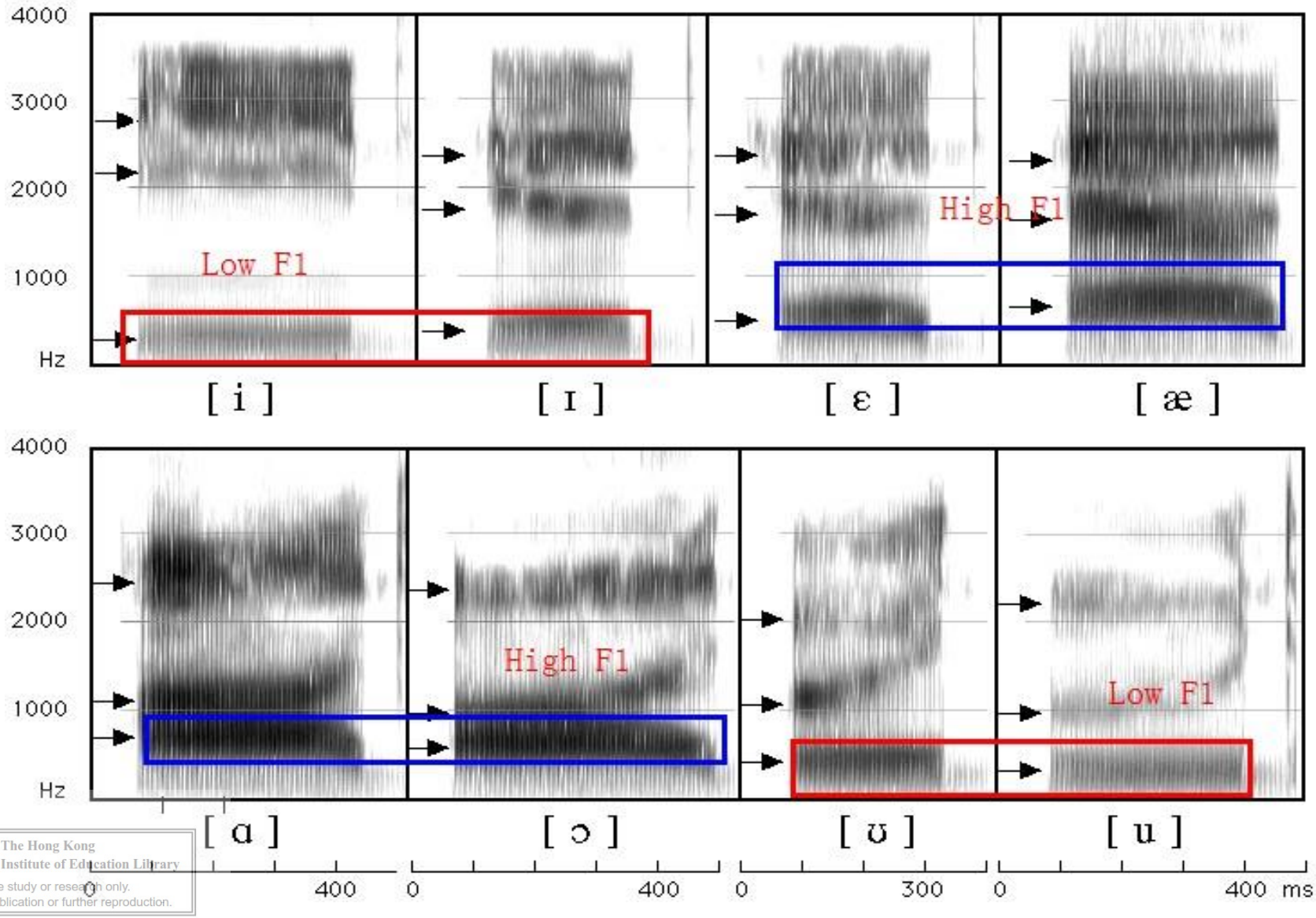
Using Praat in acoustic analysis of speech sounds

Spectrograms of vowels

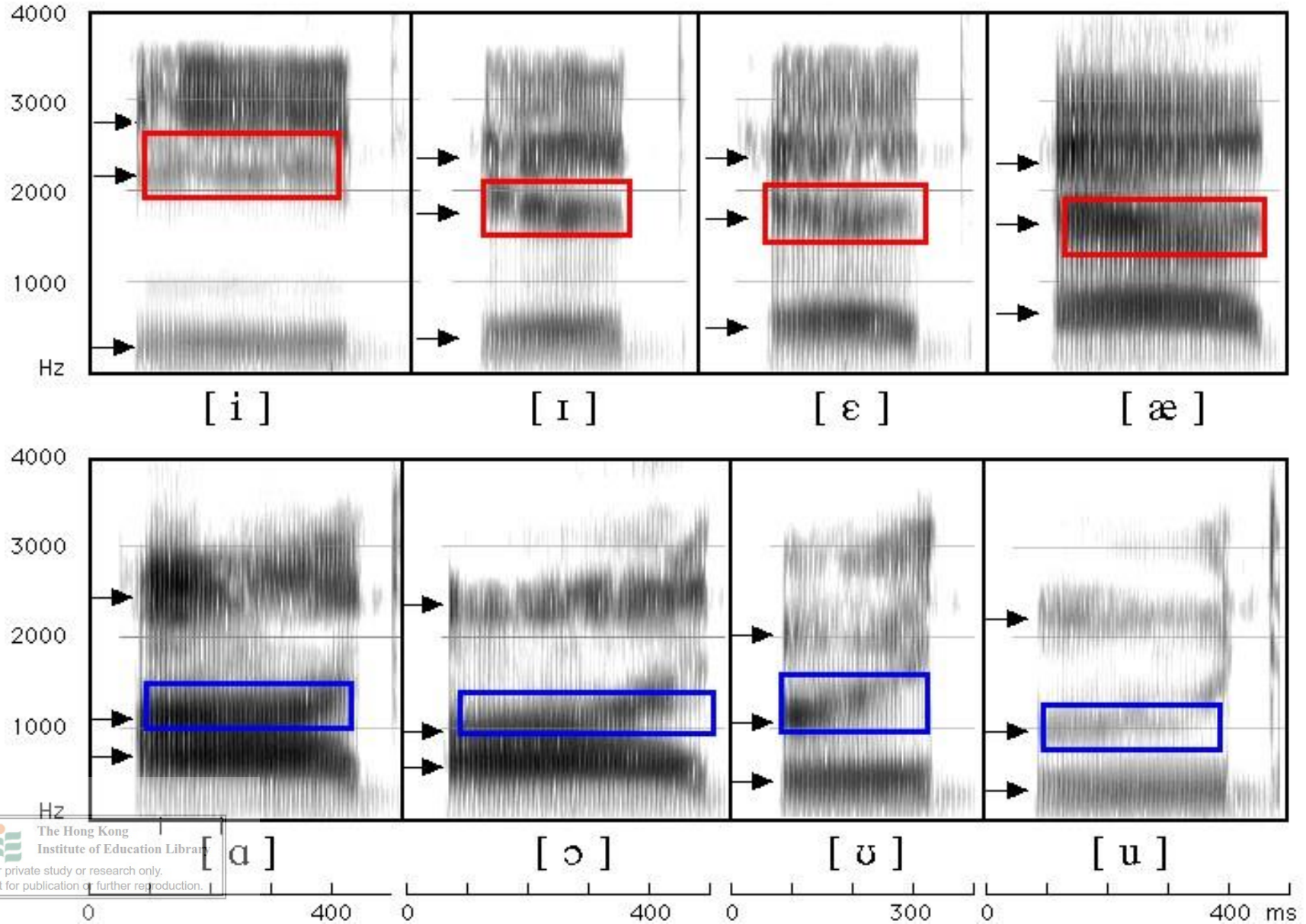


(Ladeforged 2006:185-187)

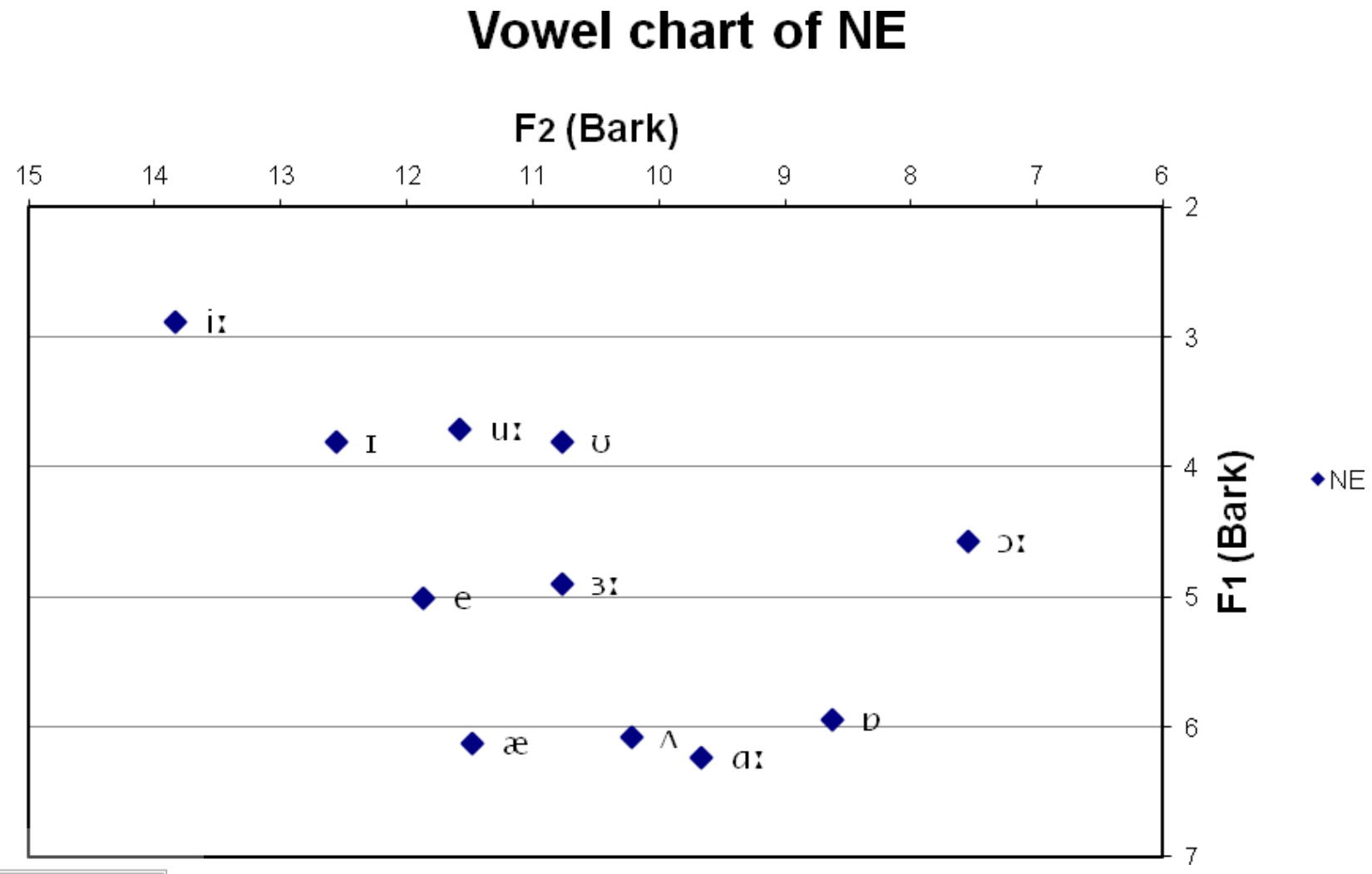
Spectrograms of vowels



Spectrograms of vowels



Vowel Chart



Measuring and plotting vowels

In the following, you can find a very useful website prepared by David Deterding (2006) for measuring and plotting vowels

http://videoweb.nie.edu.sg/phonetic/vowels/measurements.html.

empty template

Wolf RP values

Spectrograms of consonants

Four acoustic properties of plosives

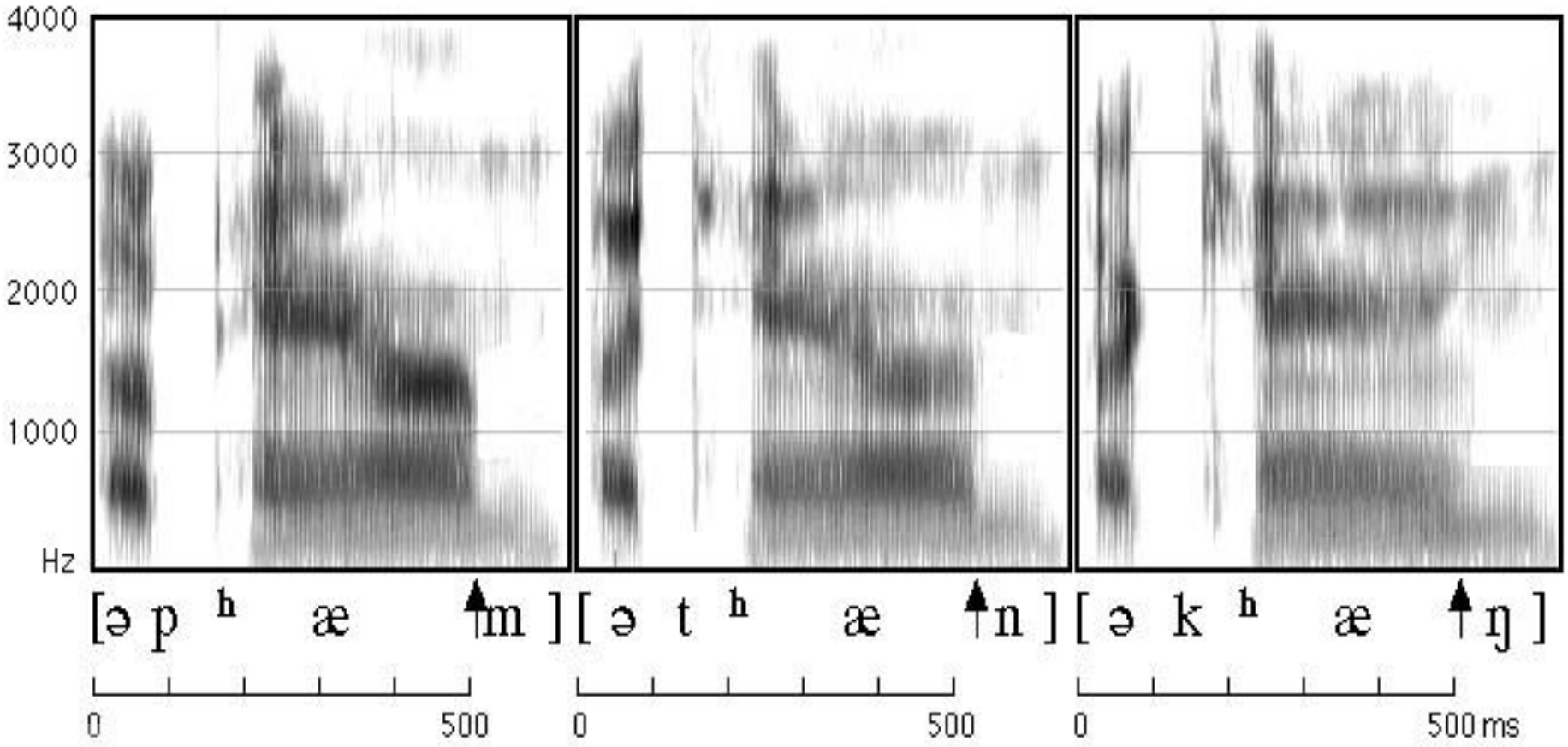
Duration of stop gap – silent period in the closure phase

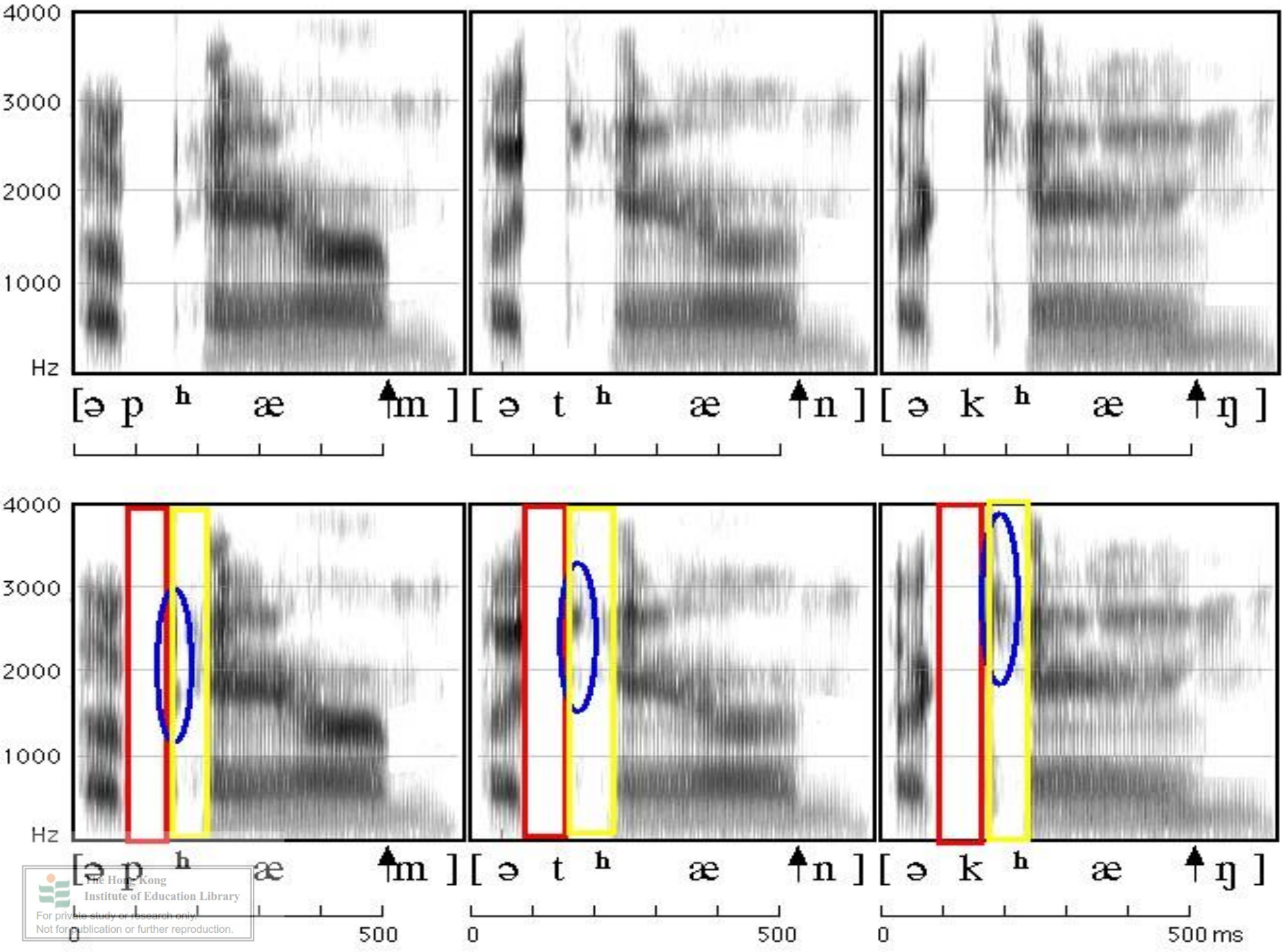
Voicing bar – a dark bar that is shown at the low frequencies and it's usually below 200Hz

Release burst – a strong vertical spike

Aspiration – a short frication noise before vowel formants begin and it is usually in 30ms

A spectrogram of "a pam, a tan, a kang"



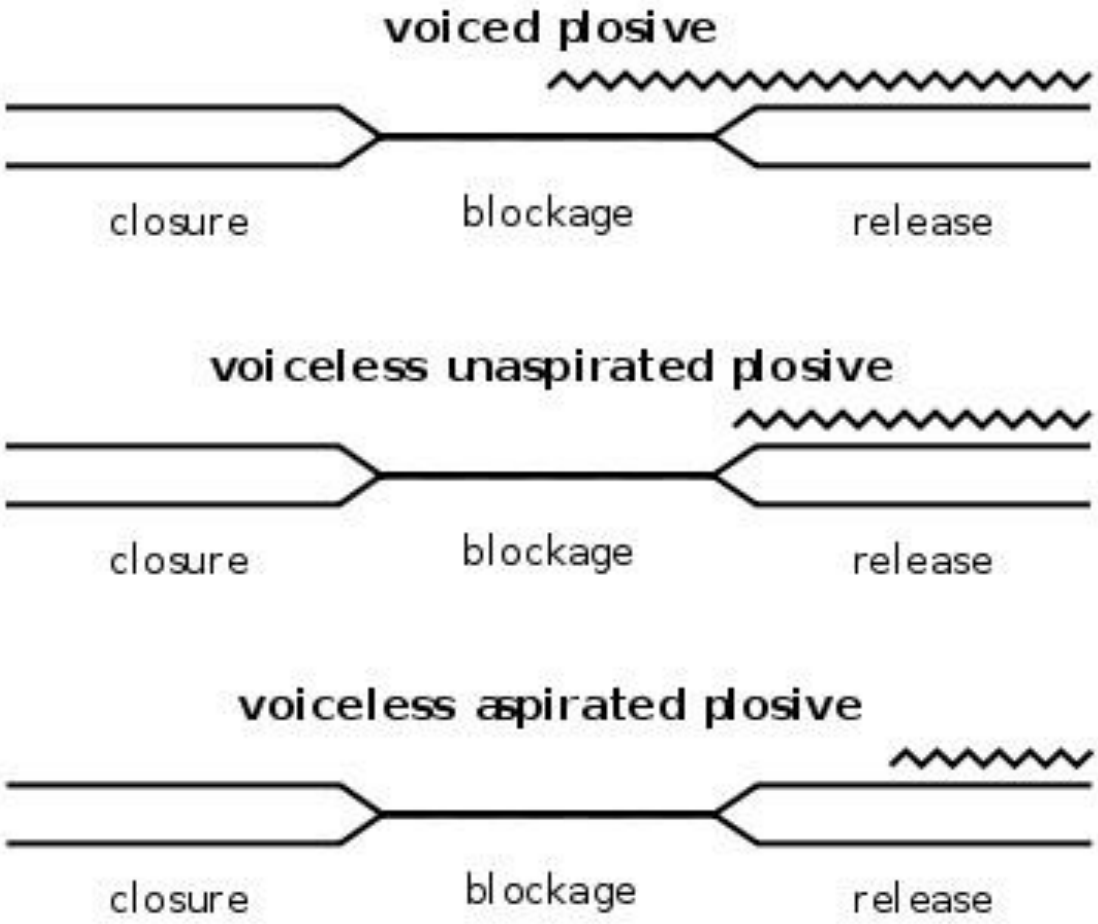


Voice onset time (VOT)

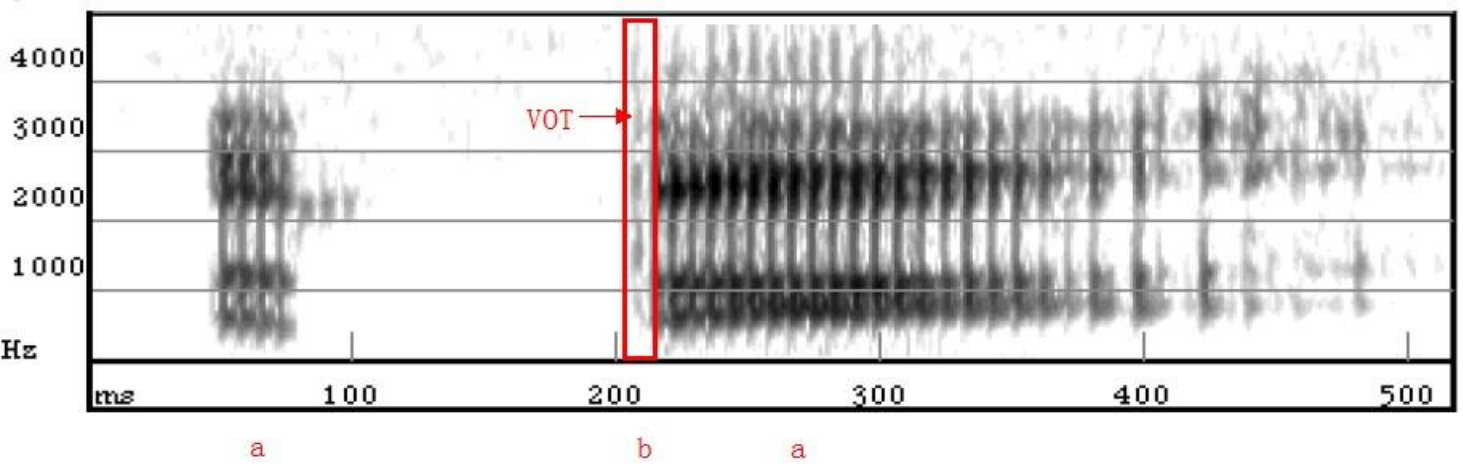
Voice onset time (VOT) is a feature of the production of plosive (stop) consonants.

It is defined as the length of time that passes between the **release of a plosive (stop) consonant** and the **onset of voicing**

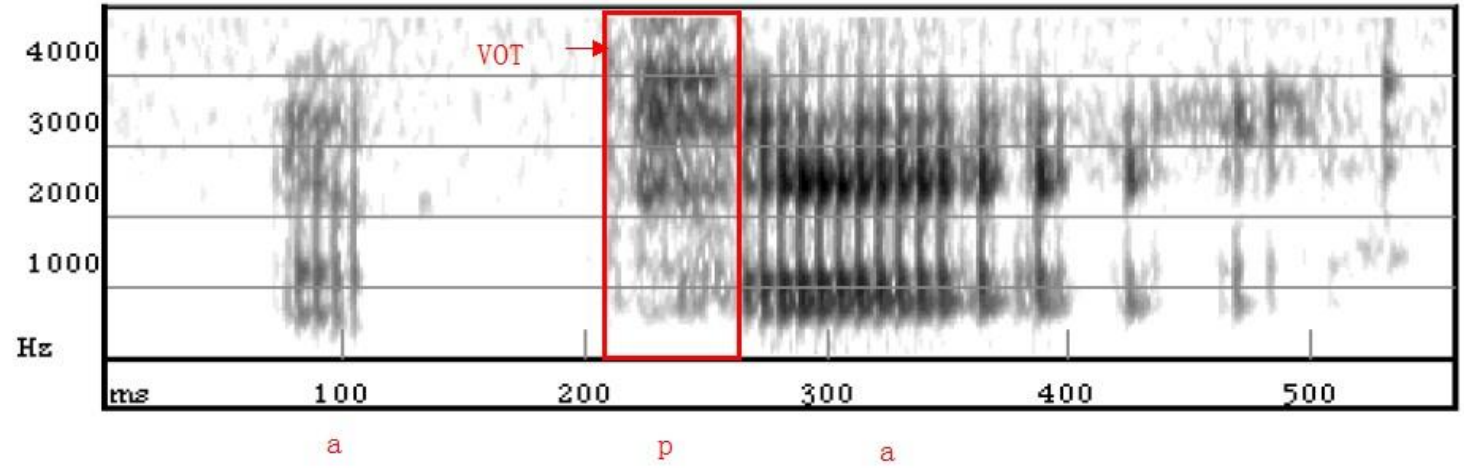
Graphical representation of the VOT



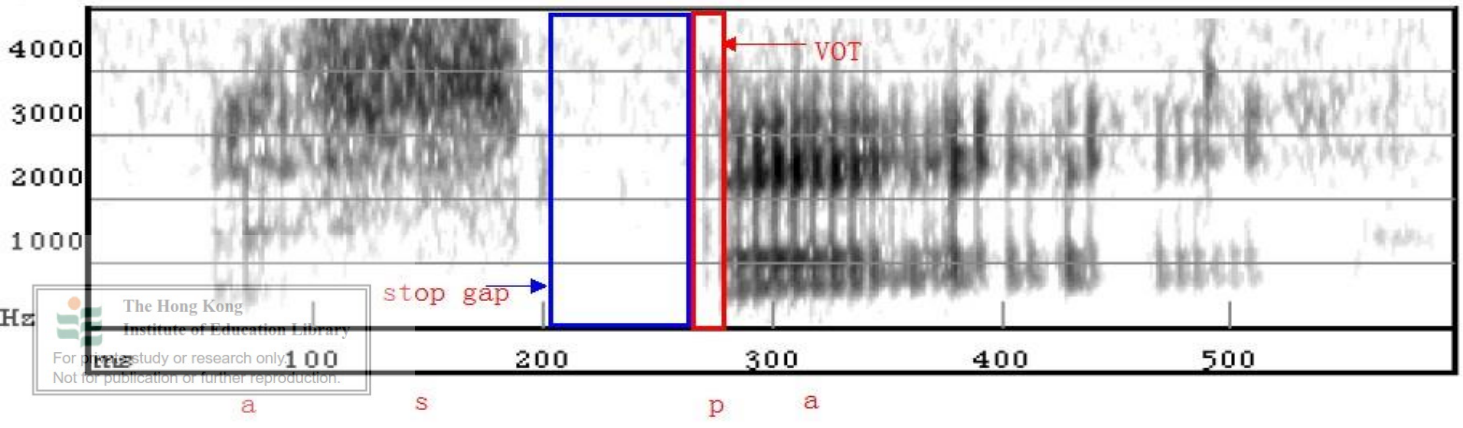
(Revised from http://en.wikipedia.org/wiki/Voice_onset_time)



‘aba’



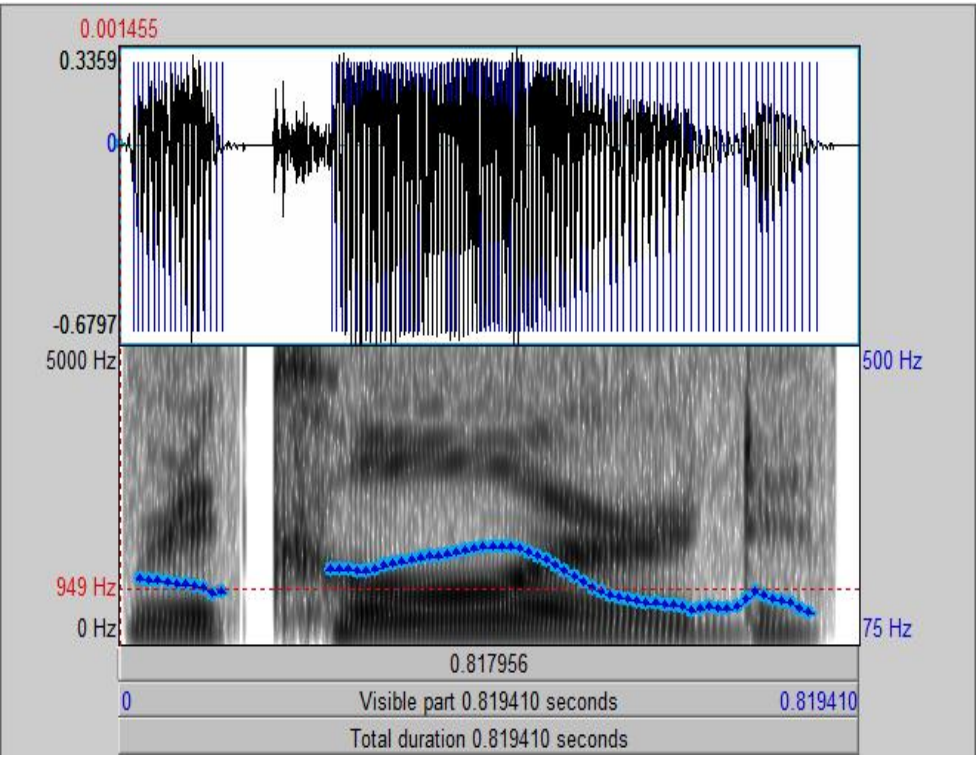
‘apa’



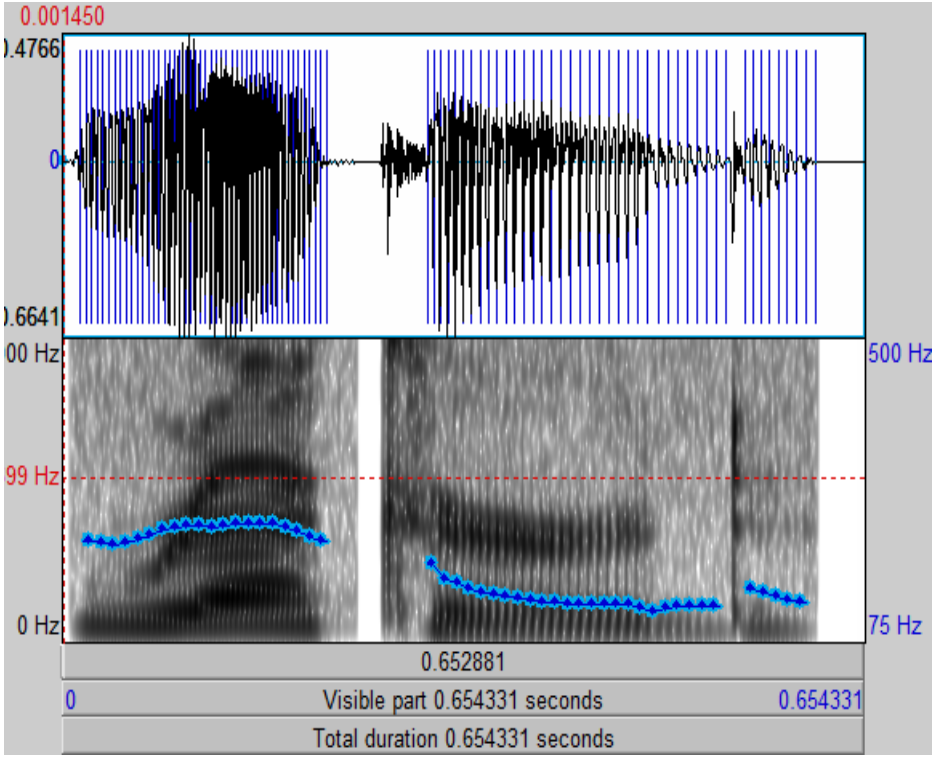
‘aspa’

Lexical stress

reCORD (v.)

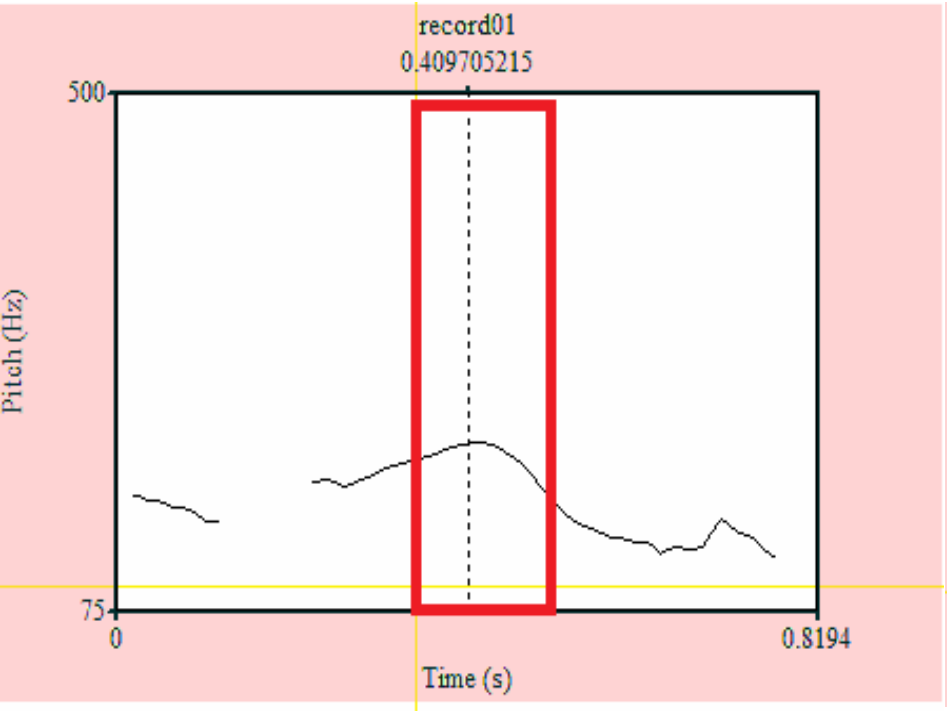


REcord (n.)

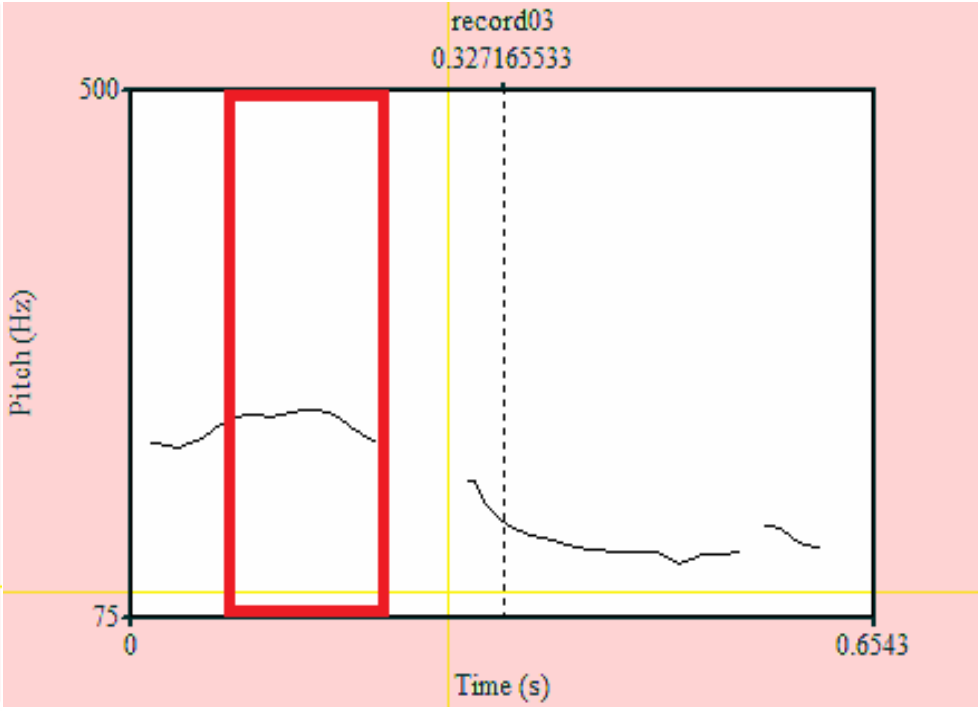


Pitch contours

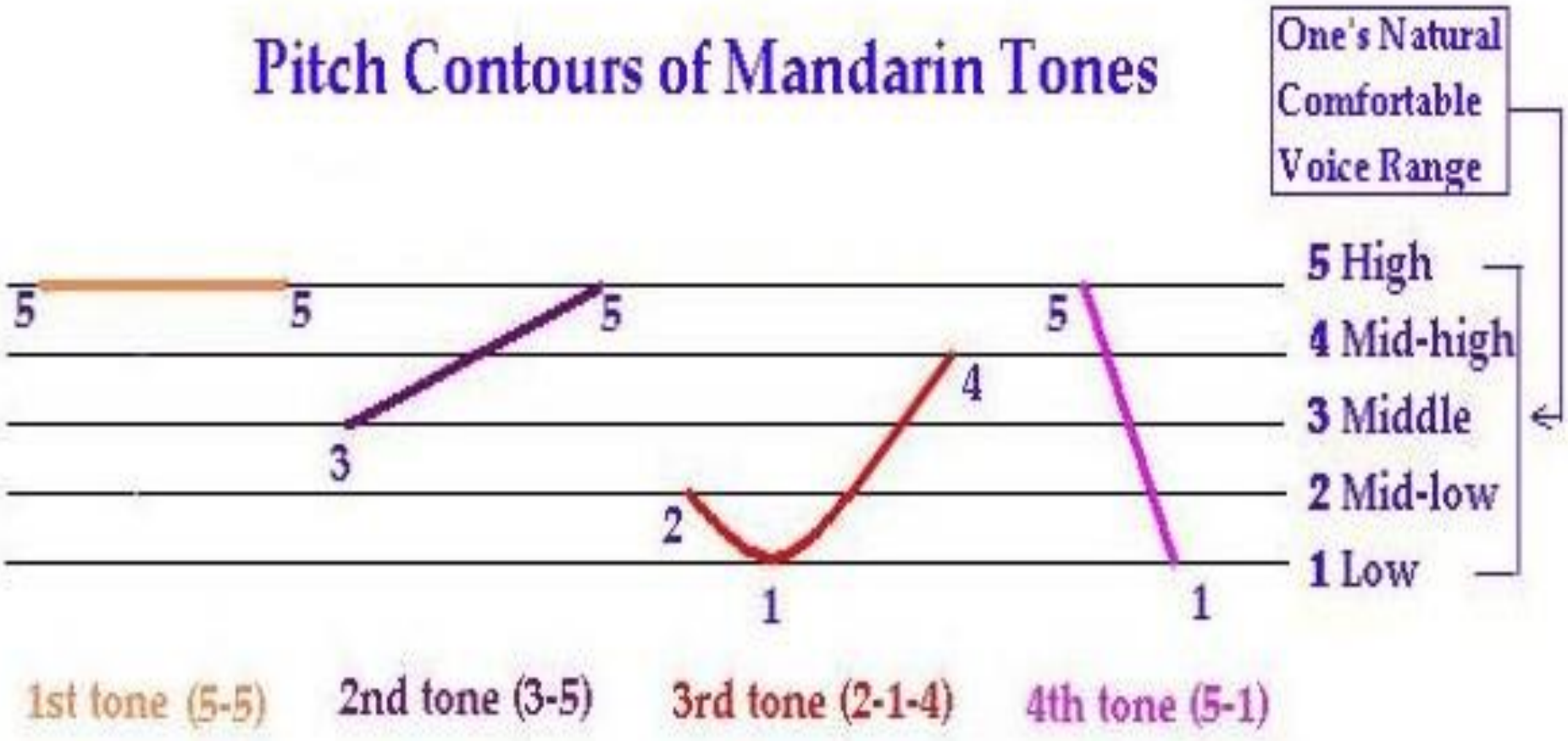
reCORD (v.)



REcord (n.)

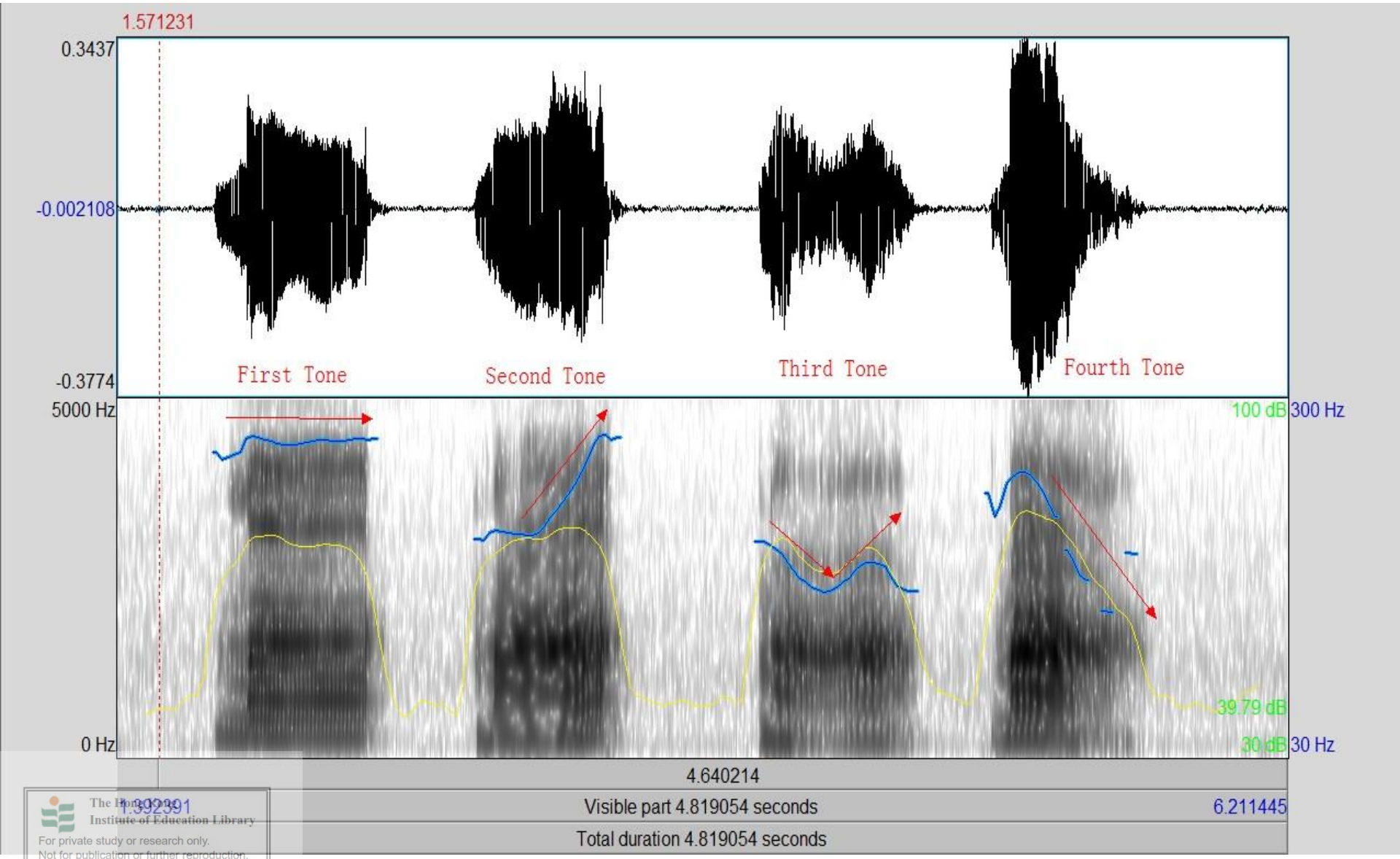


Tone



Excerpt from http://web.mit.edu/jinzhang/www/pinyin/tones/

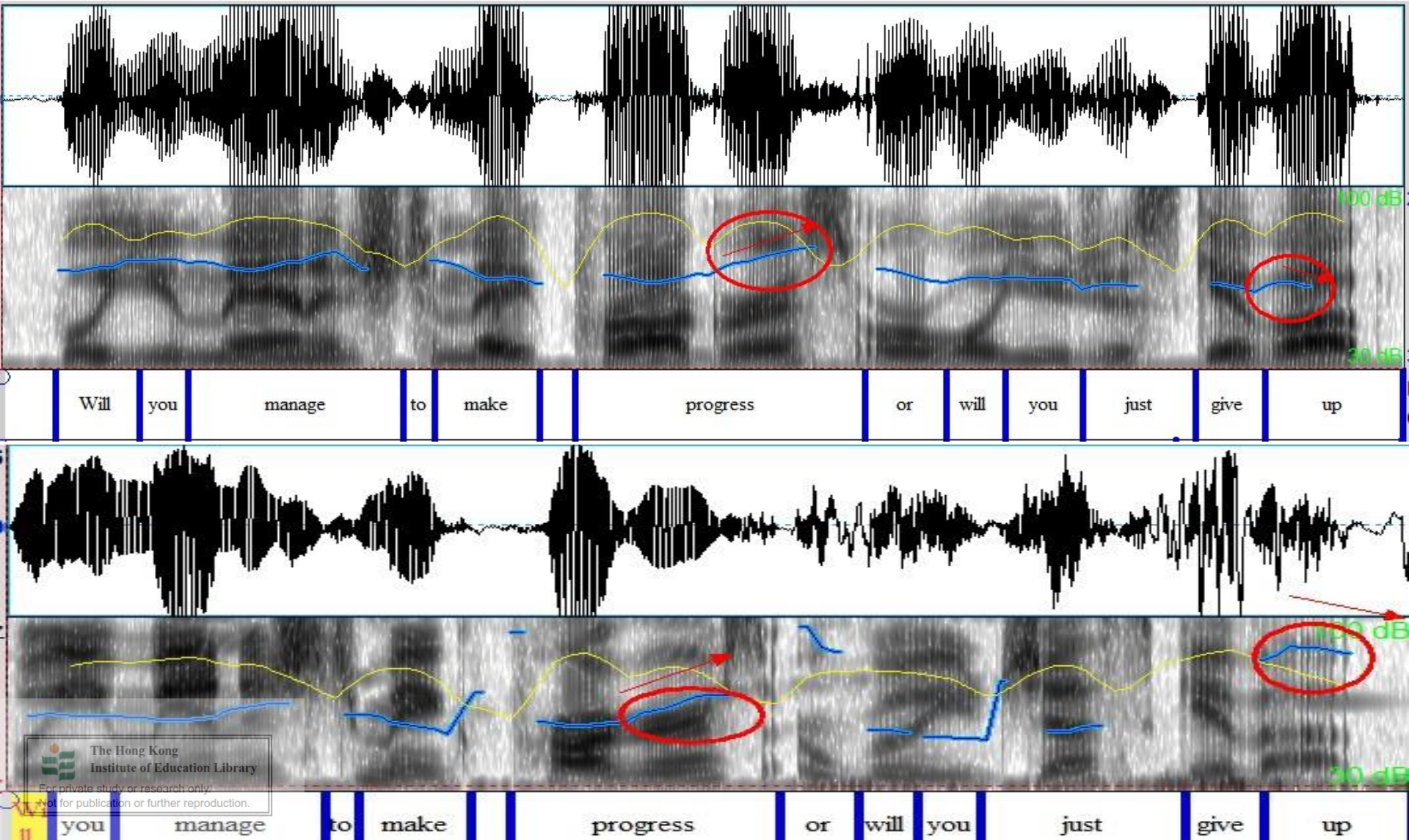
Four Chinese tones in Praat



Intonation

http://corpus.ied.edu.hk/phonetics/ViewPassageOne.aspx?id

Will you manage to make progress, ↗ or will you just give up? ↘



The current project

The effects of English language learning experiences on prosody and fluency: evidence from acoustic measures and perceptual judgments

Acoustic study of the suprasegmental features

I used Praat for measuring the four aspects of suprasegmental featuers of the English production of college students from Hong Kong and Mainland China, including

- Speaking rate measures---duration
- Pause measures ---duration
- Prominent stress measures---pitch
- Overall pitch range measures (intonation)

Stress measures

- number of stressed words per minute(Pace)
- proportion of prominent words(Space)

Pause measures

- number of silent pauses,
- mean length of silent pauses,
- number of filled pauses,
- proportion of atypical topic boundary pause

Speaking rate measures

- articulation rate
- mean length of run
- phonation-time ratio

Recommendation of video

Praat tutorial 1. Introduction of Praat

http://www.youtube.com/watch?v=EDNhmBsOXcM&feature=related

Praat tutorial 2. Download and use Praat

http://www.youtube.com/watch?v=UkeOC9lmTS4&feature=related

Praat tutorial 3. Sound Analysis with Praat

http://www.youtube.com/watch?v=BHzkO1jaL7Y

Other recommended Praat tutorials

1. Praat Tutorial - Stanford University
2. Praat Language Lab (2006).
3. Praat short tutorial: An introduction. (Version 4.3)-van Lieshout, Pascal (2005).
4. Beginners guide to Praat-Wood, Sidney (2005).
5. Praat 初學者使用手冊 –台灣高雄師範大學英語研究所 黃耀煌 編譯 (2003)
6. Praat 语音软件使用手册-中国社会科学院语言研究所-熊子瑜（2004）
7. Praat tutorial and resources-Goldman, Jean-Philippe (2004).
8. Praat scripting tutorial basics (IE only) -Jaeger, Florian (2004）
9. Praat tutorial -Welby, Pauline, & Ito, Kiwako (2002).
10. Praat tutorial-Yoon, Kyuchul(2002).
11. Speech Analysis using PRAAT-A brief guide prepared by Pranav Jawale
12. Praat Tutorial(2002) made by Pauline Welby and Kiwako Ito in The Ohio State University, retrieved from http://public.tfh-berlin.de/~mixdorff/tsv/files/praat-tutorial.pdf

Our Praat Beginner Manual

http://ec-concord.ied.edu.hk/phonetics_and_phonology/wordpress/

~Supported by Teaching Development Grant, Faculty of Humanities, HKIEd