Workshop on Praat Applications for Research and Teaching

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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”.

![Sound Recorder Interface]

*Image of the Sound Recorder interface with highlighted save options.*
Load existing files

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

- Waveform
- Spectrogram
- Duration
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.

Total duration 1.432063 seconds
Measure speaking rate

Speaking rate (spm) = \frac{\text{Total syllables}}{\text{number of minutes (duration of the utterance)}}
Measure silent pause

- Duration of silent pause

[Diagram showing a waveform with marked silent pause and its duration]
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
You can open more than one sound, and then 
cut, copy, and paste between the sounds.
**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.
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**: 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: to control the intensity signal settings and extract information.
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**: to control the formant settings and extracts information; by default the formants are shown in red dotted lines.
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.
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

(Ladefoged 2006:185-187)
Spectrograms of vowels

The spectrograms show the frequency spectrum of different vowels. The frequency axis (Hz) is shown at the bottom of each column, and the time axis (ms) is shown at the top of each row. The vowels are indicated by the labels at the bottom of the column:

- [i]: High F1
- [I]: Low F1
- [ε]: High F1
- [æ]: Low F1
- [ɑ]: High F1
- [ɔ]: Low F1
- [ʊ]: High F1
- [u]: Low F1
Spectrograms of vowels

- [ɪ]
- [ɪ]
- [ɛ]
- [æ]
- [ɑ]
- [ɔ]
- [ʊ]
- [u]
Vowel chart of NE
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

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A spectrogram of "a pam, a tan, a kang"
The Hong Kong Institute of Education
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

Lexical stress

**reCORD** (v.)

**REcord** (n.)
Pitch contours

reCORD (v.)

REcord (n.)
Tone

Four Chinese tones in Praat
Will you manage to make progress, ↑ or will you just give up? ↓
The effects of English language learning experiences on prosody and fluency: evidence from acoustic measures and perceptual judgments
I used Praat for measuring the four aspects of suprasegmental features 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=EDNhmsOXS0XcM&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
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）
11. Speech Analysis using PRAAT-A brief guide prepared by Pranav Jawale
Our Praat Beginner Manual

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

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