

**The Music of Speech**

**Acoustic Phonetics**

***A Brief Introduction to Praat***

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# Objectives

At the end of the course, participants should be able to

- extract duration and fundamental frequency information from a speech recording, using Praat

## Part I: Annotation

- Basic knowledge of signal analysis with Praat.
- Basic knowledge of syllable annotation with Praat.
- Practical application to the recorded data of course participants.
- 

## Part II: Syllable timing analysis

- Examination information in Praat annotation file.
- Analysis of Praat annotation file with Time Group Analyser.

# Praat

- Praat is a phonetic workbench application developed in Amsterdam by Paul Boersma and David Weenink.
- “Praat” means ‘talk’ in Dutch.
- The basic functionality of Praat includes:
  - Input: speech recordings
  - Methods:
    - analysis of properties of speech signals such as spectral analysis, pitch analysis, annotation of signals with transcription labels
  - Outputs:
    - files with information about the speech signal
- The annotation information files which Praat produces
  - can be re-structured, and analysed with other means,
    - with Excel or Calc
    - with the online tool Time Group Analyser, for efficient analysis of timing relations in the speech signal.

# Praat Input

# Praat Input

## Pre-recording phase:

- definition of purposes for which the data will be used
- scenario: domain, activities, speakers
- equipment and technical operator:
  - general: digital audio (recorder / laptop), digital video
  - specialised: laryngograph, etc

## Recording phase:

- negotiate scenario with chiefs, elders, speakers
- ensure the recording location is quiet
- if possible ensure the microphones, video tripod etc. can be stably positioned

## Post-recording phase:

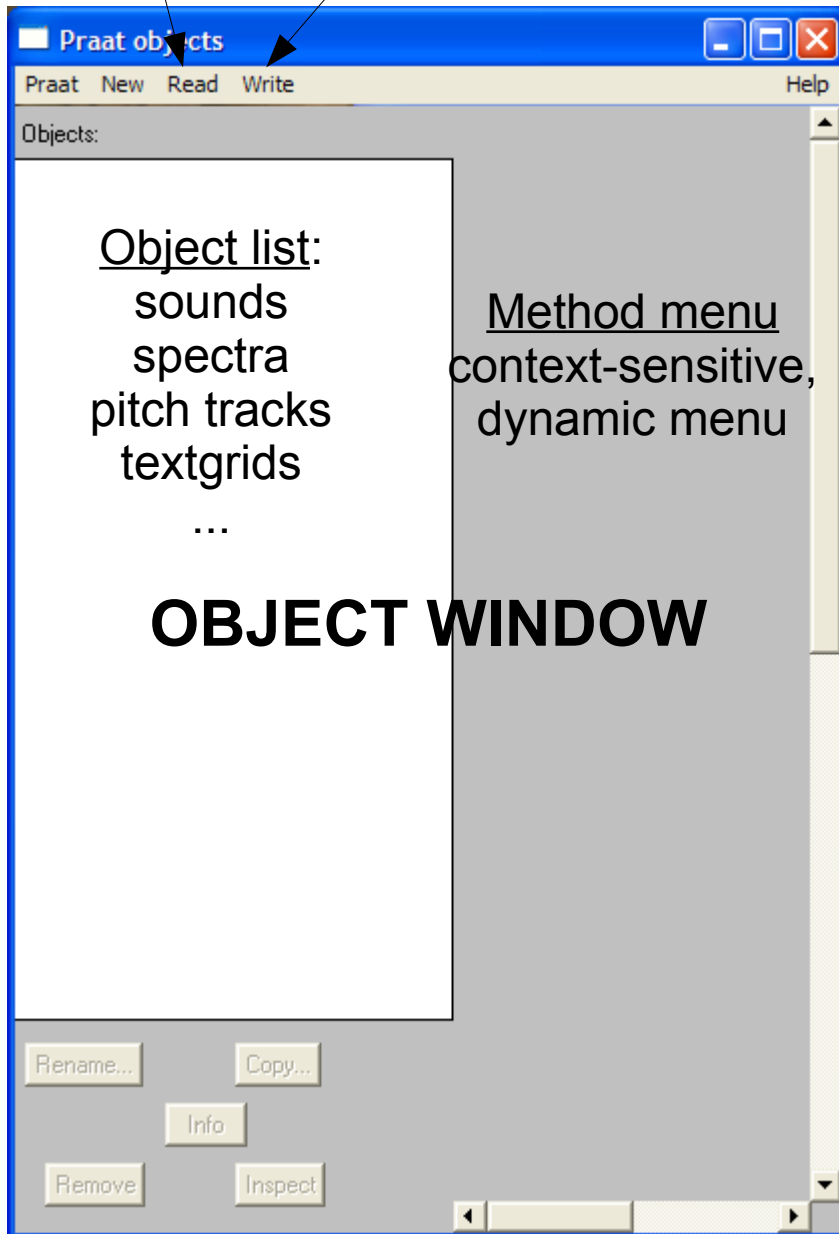
- provide recordings with metadata immediately
- label the data media immediately
- make safety copies immediately

# Basic Praat Methods and Operation

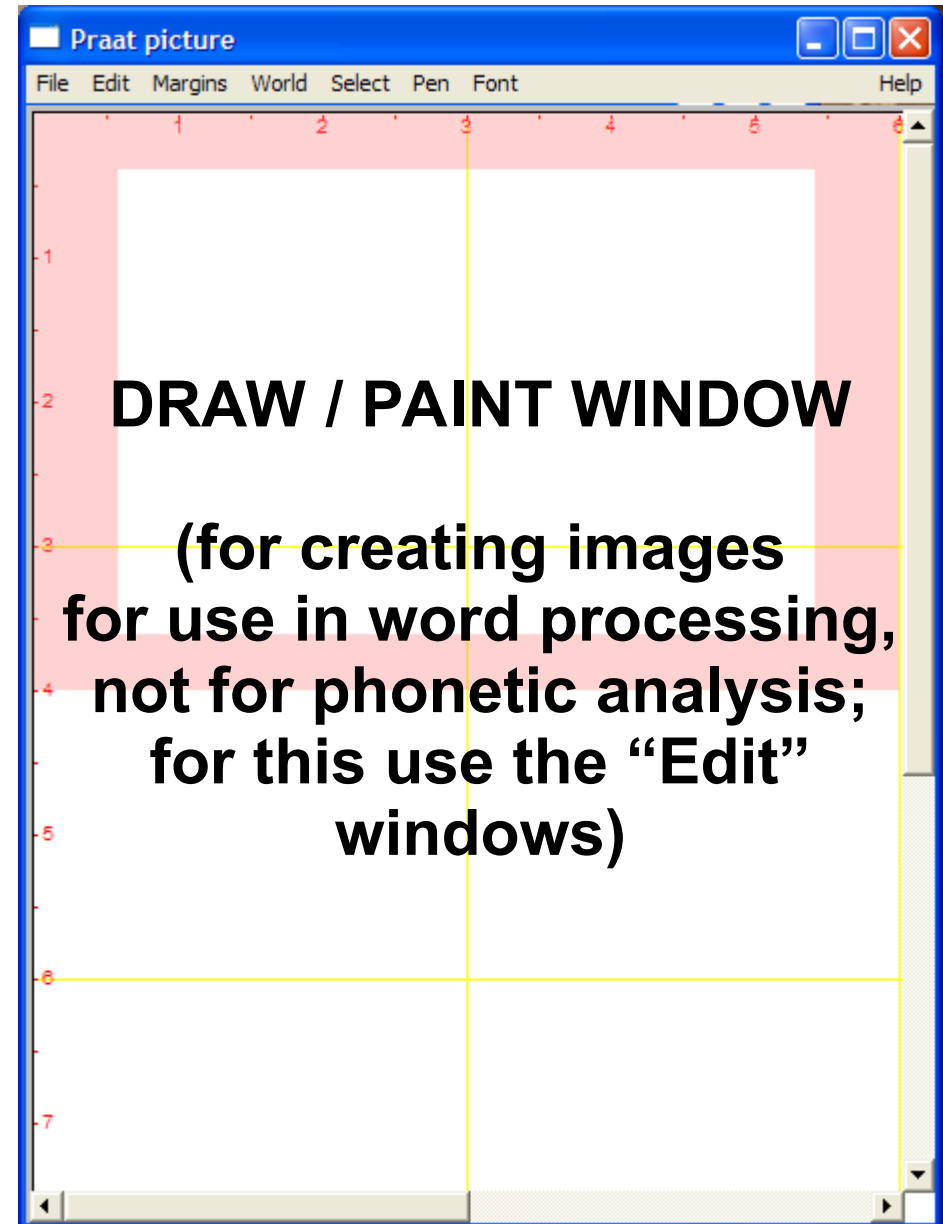
# Praat Windows

Load file

Save file



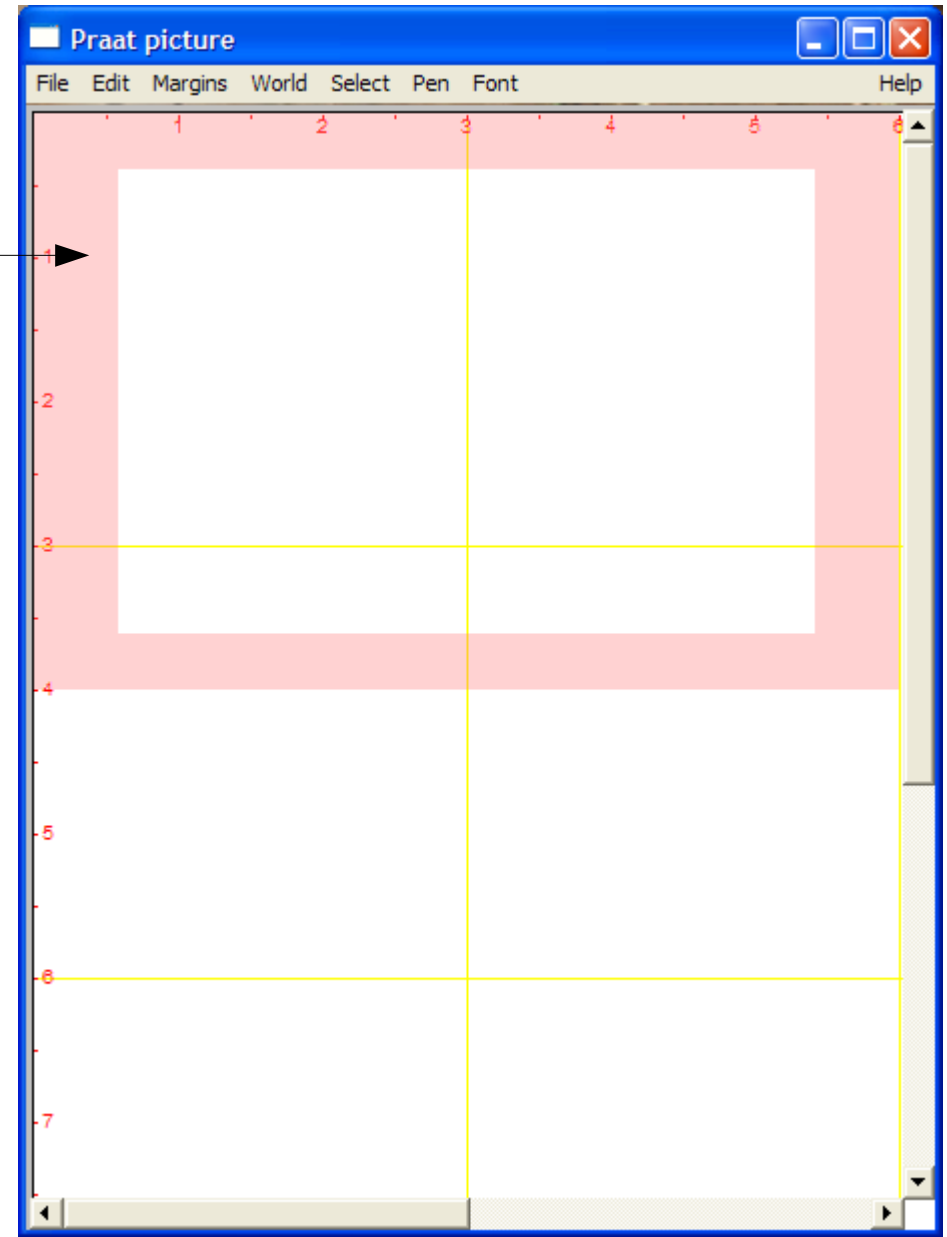
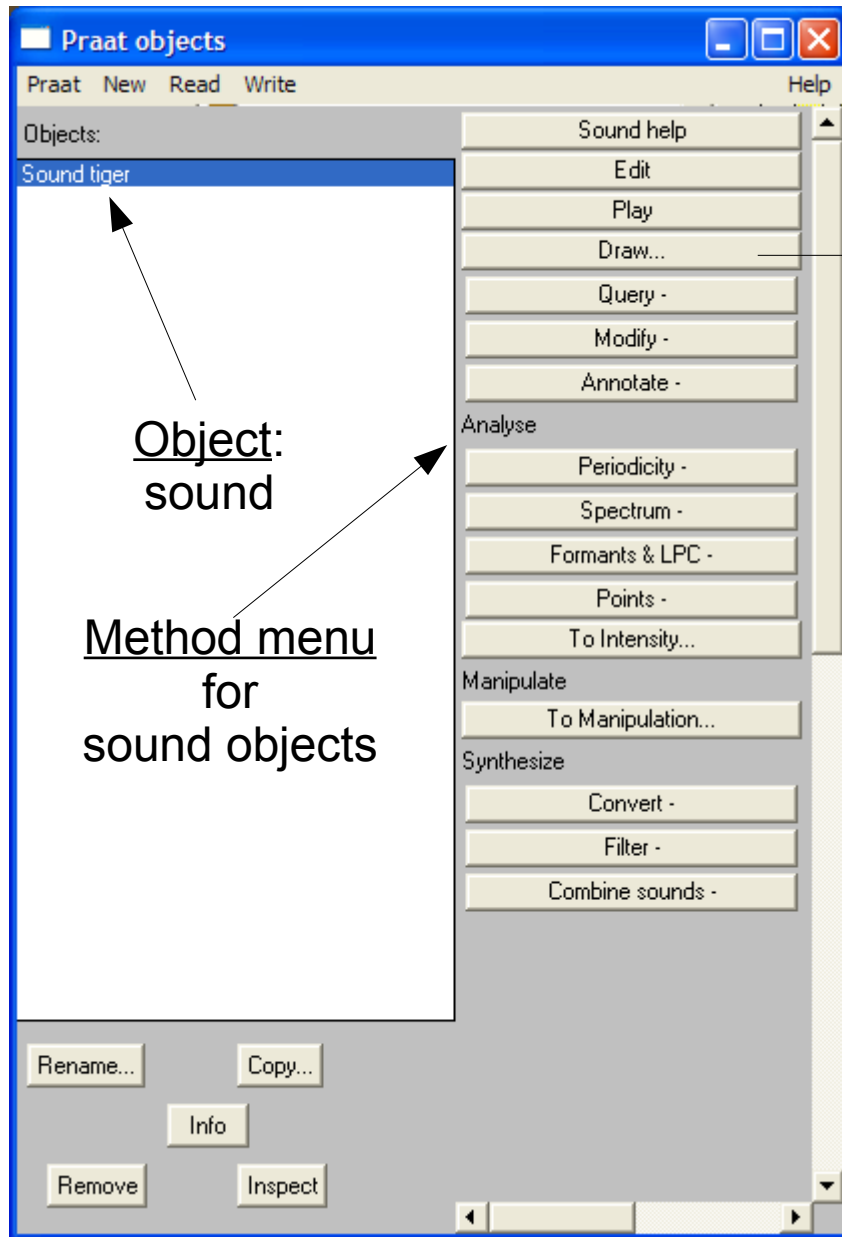
**OBJECT WINDOW**



**DRAW / PAINT WINDOW**

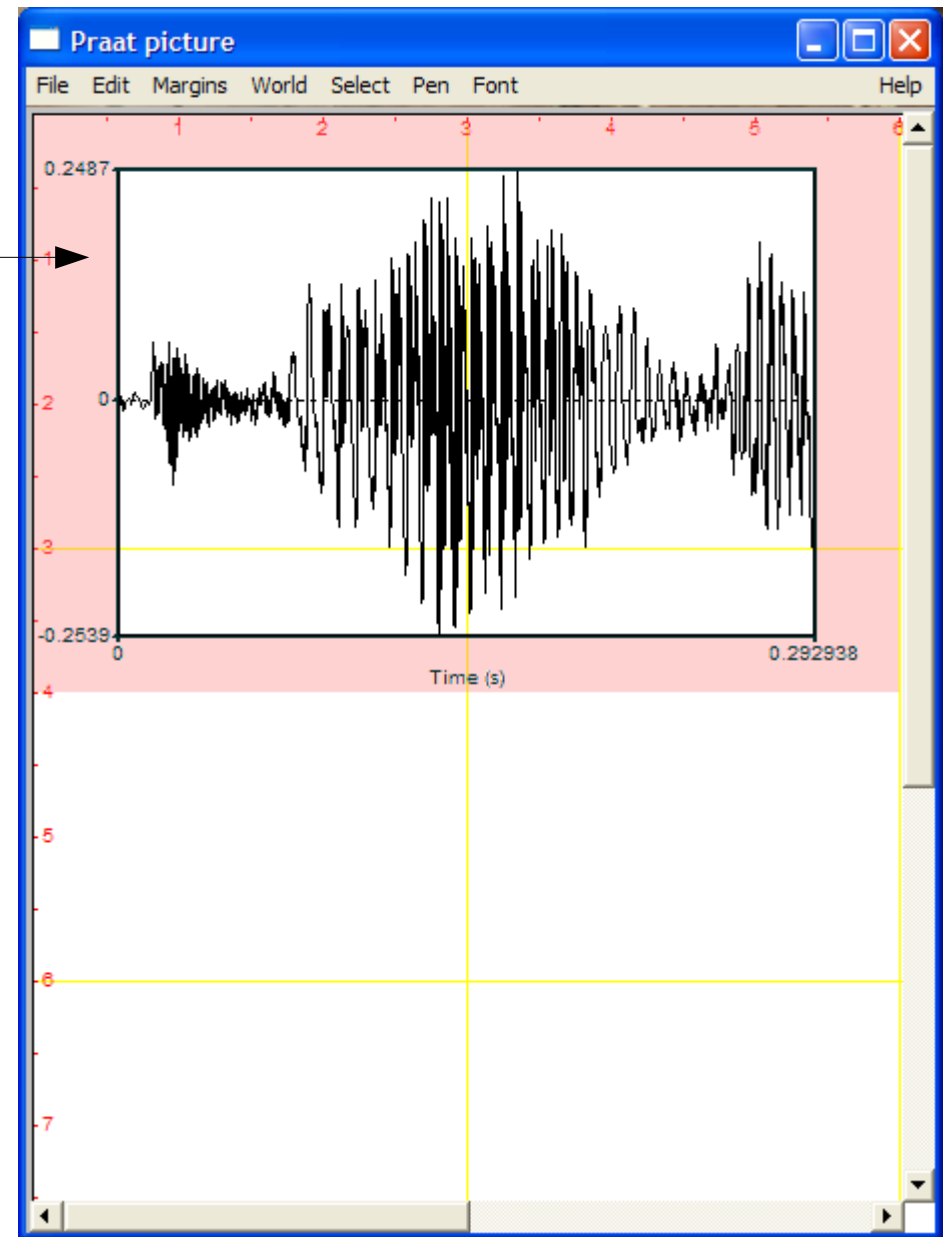
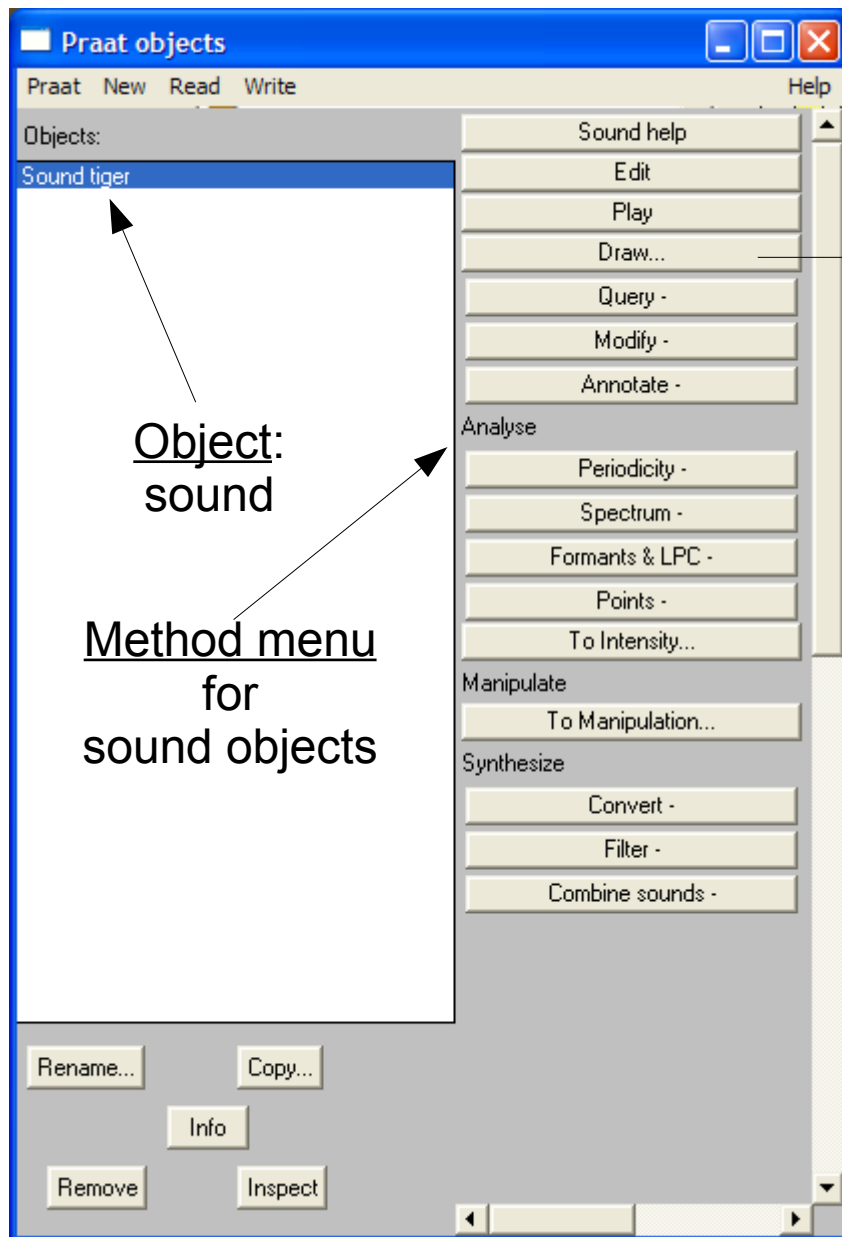
**(for creating images for use in word processing, not for phonetic analysis; for this use the "Edit" windows)**

# Processing Praat Objects

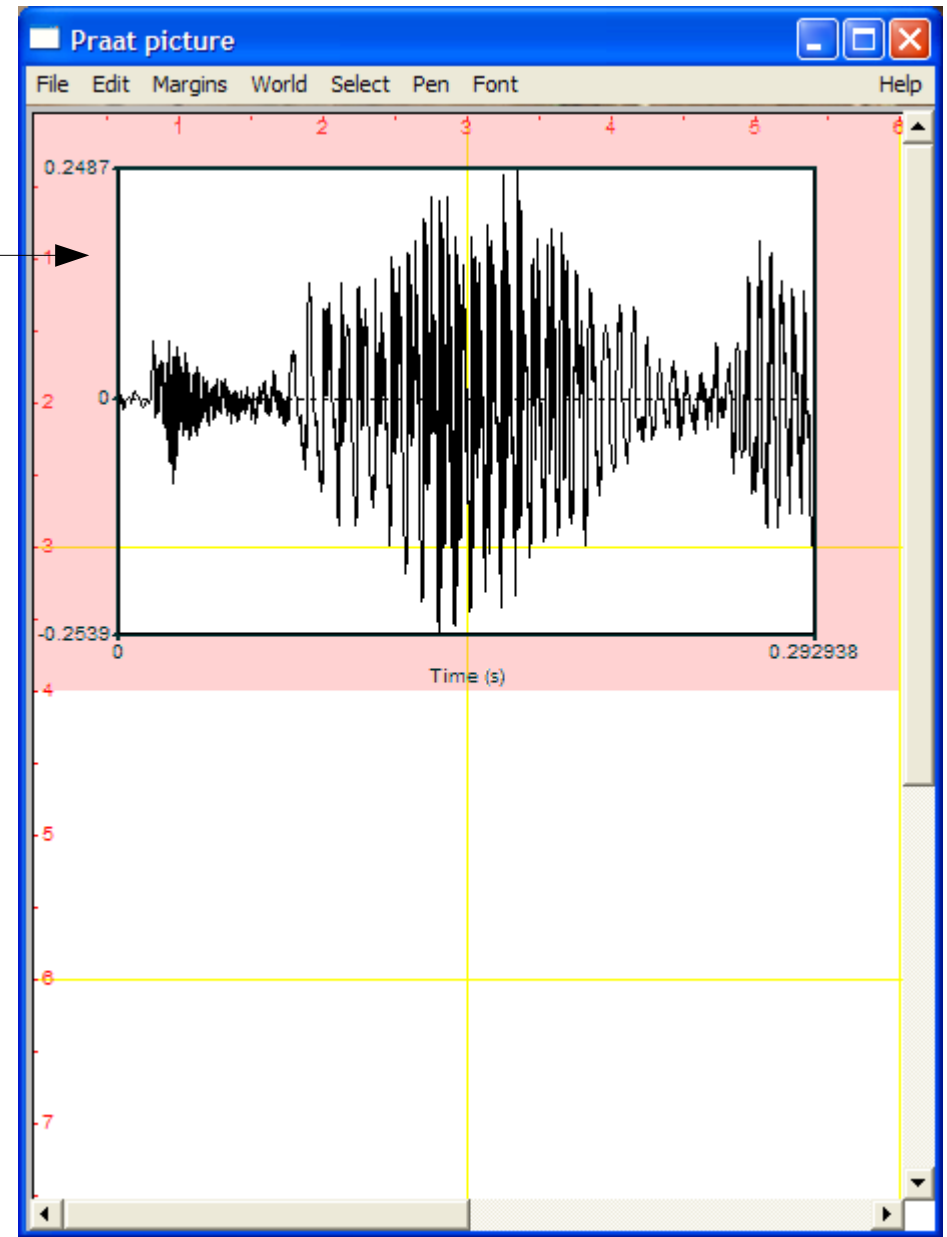
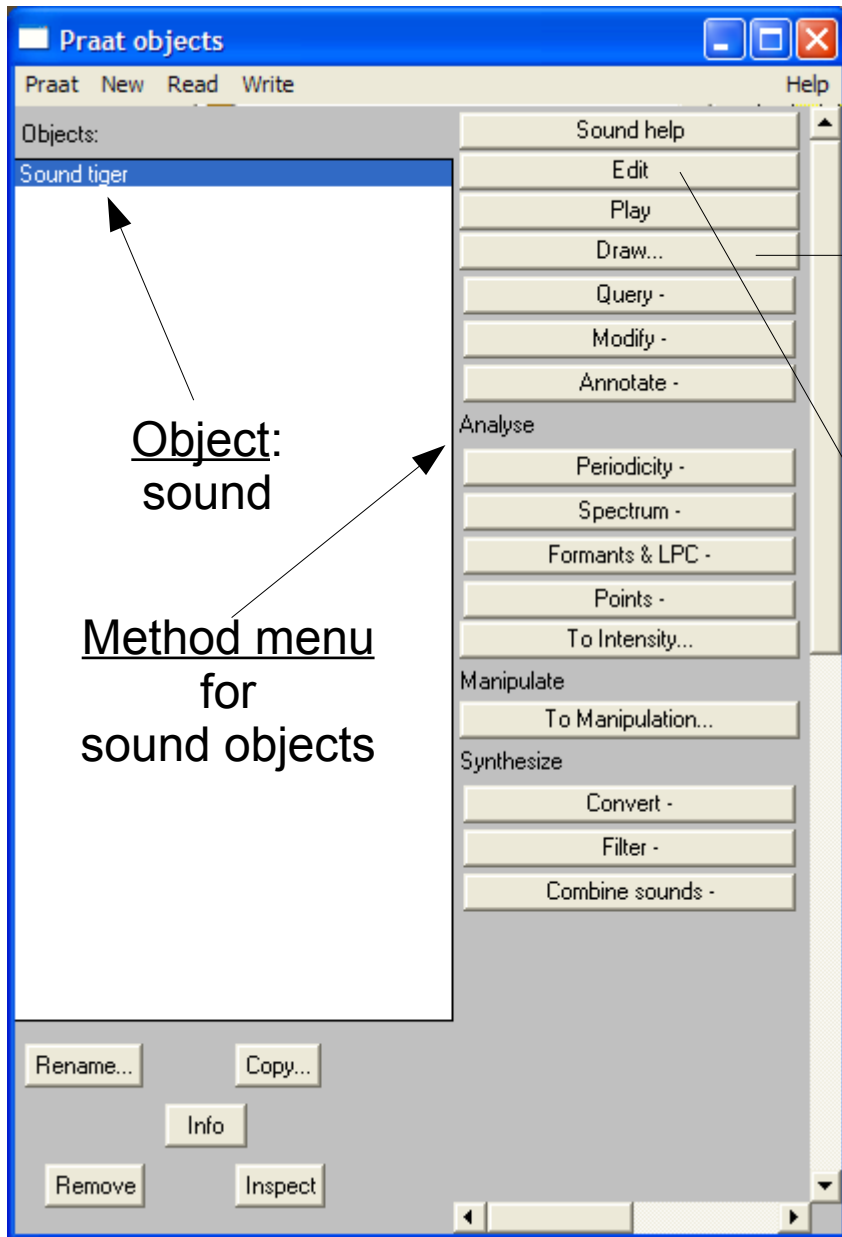




# Processing Praat Objects



# Processing Praat Objects



# Processing Praat Objects

**Praat objects**

Praat New Read Write Help

Objects:

Sound tiger

Sound help  
Edit  
Play  
Draw...

**Praat picture**

File Edit Margins World Select Pen Font Help

1 2 3 4 5 6

0.2487

**Sound tiger**

File Edit Query View Select Spectrum Pitch Intensity Formant Pulses Help

0.2487

0.146469

0.01224

-0.2539

0.146469 0.146469

0.000000 Visible part 0.292938 seconds 0.292938

Total duration 0.292938 seconds

all in out sel Group

**Object: sound**

**Method menu for sound objects**

# Processing a Sound Object

The image shows two overlapping windows from the Praat software. The top window, titled 'Praat objects', has a menu bar with 'Praat', 'New', 'Read', 'Write', and 'Help'. Below the menu is a list of objects with 'Sound tiger' selected. To the right of this list is a method menu with buttons for 'Sound help', 'Edit', 'Play', and 'Draw...'. The bottom window, titled 'Sound tiger', has a menu bar with 'File', 'Edit', 'Query', 'View', 'Select', 'Spectrum', 'Pitch', 'Intensity', 'Formant', 'Pulses', and 'Help'. The main area of this window displays a waveform plot. The y-axis ranges from -0.2539 to 0.2487, and the x-axis shows time in seconds. A red vertical dashed line is positioned at 0.146469 seconds. A blue horizontal dashed line is at 0.01224. The status bar at the bottom of the 'Sound tiger' window shows 'Visible part 0.292938 seconds' and 'Total duration 0.292938 seconds'. At the bottom left of the 'Praat objects' window, there are buttons for 'Rename...', 'Copy...', 'Info', 'Remove', and 'Inspect'. Arrows point from the text 'Object: sound' to the 'Sound tiger' entry in the 'Praat objects' window, and from 'Method menu for sound objects' to the method menu in the 'Sound tiger' window.

Object: sound

Method menu for sound objects

# Selecting Part of a Sound Object

The image shows two windows from the Praat software. The top window, titled "Praat objects", has a menu bar with "Praat", "New", "Read", "Write", and "Help". Below the menu is a list of objects with "Sound tiger" selected. To the right of the list is a "Method menu" with buttons for "Sound help", "Edit", "Play", and "Draw...". The bottom window, titled "Sound tiger", has a menu bar with "File", "Edit", "Query", "View", "Select", "Spectrum", "Pitch", "Intensity", "Formant", "Pulses", and "Help". The main area of this window displays a waveform of a tiger sound. A red shaded region highlights a segment of the sound, bounded by vertical dashed red lines. The time values for these boundaries are 0.071819 and 0.233795. The waveform itself is black, and the zero line is a dashed cyan line. The y-axis ranges from -0.2539 to 0.2487. At the bottom of the window, there is a status bar showing "Visible part 0.292938 seconds" and "Total duration 0.292938 seconds". Below the status bar are buttons for "all", "in", "out", "sel", and a "Group" checkbox.

Object: sound

Method menu for sound objects

0.071819 0.161977 (6.174 / s) 0.233795

0.2487

0

-0.2539

0.071819 0.161977 0.059142

0.000000 Visible part 0.292938 seconds 0.292938

Total duration 0.292938 seconds

all in out sel Group

# Displaying More Properties of a Sound Object

The image shows two windows from the Praat software. The top window is titled 'Praat objects' and contains a list of objects with 'Sound tiger' selected. A menu is open for 'Sound tiger' with options: 'Sound help', 'Edit', 'Play', and 'Draw...'. The bottom window is titled 'Sound tiger' and displays a waveform and a spectrogram. The waveform is a black line on a white background, and the spectrogram is a grayscale image below it. The waveform has a red shaded region between 0.071819 and 0.233795 seconds. The spectrogram shows frequency components up to 5000 Hz. The bottom of the 'Sound tiger' window shows time markers: 0.000000, 0.071819, 0.161977, 0.059142, 0.292938, and 0.292938. The total duration is 0.292938 seconds. The visible part is 0.292938 seconds. The bottom of the 'Praat objects' window has buttons: 'Rename...', 'Copy...', 'Info', 'Remove', and 'Inspect'.

Object: sound

Method menu for sound objects

0.071819 0.161977 (6.174 / s) 0.233795

0.2487

0

-0.2539

5000 Hz

0 Hz

0.071819 0.161977 0.059142

0.000000 Visible part 0.292938 seconds 0.292938

Total duration 0.292938 seconds

all in out sel Group

# Displaying More Properties of a Sound Object

The image shows two windows from the Praat software. The top window is titled 'Praat objects' and contains a list of objects with 'Sound tiger' selected. A menu is open for 'Sound tiger' with options: 'Sound help', 'Edit', 'Play', and 'Draw...'. The bottom window is titled 'Sound tiger' and displays a waveform and a spectrogram. The waveform is a black line on a white background, and the spectrogram is a grayscale image with red diamonds. The time axis is marked with 0.071819, 0.161977 (6.174 / s), and 0.233795. The frequency axis is marked with 0 Hz and 5000 Hz. The visible part of the spectrogram is 0.292938 seconds, and the total duration is 0.292938 seconds. The bottom of the window has buttons for 'all', 'in', 'out', 'sel', and a 'Group' checkbox.

**Object:**  
sound

**Method menu**  
for  
sound objects

Rename... Copy...  
Info  
Remove Inspect

all in out sel Group

# Displaying More Properties of a Sound Object

The image shows two overlapping windows from the Praat software. The top window is titled 'Praat objects' and contains a list of objects with 'Sound tiger' selected. A menu is open for 'Sound tiger', showing options: 'Sound help', 'Edit', 'Play', and 'Draw...'. The bottom window is titled 'Sound tiger' and displays a waveform and a spectrogram. The waveform is a black line on a white background, with a red shaded region highlighting a segment. The spectrogram is a grayscale plot with red diamonds and a blue line. The x-axis represents time in seconds, with markers at 0.071819, 0.161977 (6.174 / s), and 0.233795. The y-axis represents frequency in Hz, with markers at 0 Hz, 76 Hz, 155.34 Hz, and 500 Hz. The bottom status bar shows 'Visible part 0.292938 seconds' and 'Total duration 0.292938 seconds'. There are also buttons for 'Rename...', 'Copy...', 'Info', 'Remove', and 'Inspect' at the bottom left of the 'Sound tiger' window.

**Object:**  
sound

**Method menu**  
for  
sound objects



# Creating a New Object

The image displays two windows from the Praat software interface. The top window, titled "Praat objects", shows a list of objects with "Sound tiger" selected. A menu is open over this selection, containing options: "Sound help", "Edit", "Play", and "Draw...". An arrow points from the text "Object: sound" to the "Sound tiger" entry. Another arrow points from "Method menu for sound objects" to the menu. The bottom window, titled "Sound tiger", shows a waveform and spectrogram. A red shaded region highlights a portion of the waveform, with time markers at 0.071819, 0.161977 (6.174 / s), and 0.233795. An arrow points from the text "Extract sound selection" to this red region. The spectrogram below shows frequency components up to 500 Hz, with a blue line indicating the pitch contour. The bottom status bar shows "Visible part 0.292938 seconds" and "Total duration 0.292938 seconds".

# Creating a New Object

The image shows two windows from the Praat software. The top window, titled "Praat objects", has a menu bar with "Praat", "New", "Read", "Write", and "Help". Below the menu is a list of objects, with "Sound tiger" selected. A context menu is open over "Sound tiger", showing options: "Sound help", "Edit", "Play", and "Draw...". An arrow points from the text "Extract sound selection" to the "Draw..." option. The bottom window, titled "Sound tiger", has a menu bar with "File", "Edit", "Query", "View", "Select", "Spectrum", "Pitch", "Intensity", "Formant", "Pulses", and "Help". The main area shows a waveform and a spectrogram. The waveform has a red shaded selection box between time markers 0.071819 and 0.233795. The spectrogram shows a blue line for the pitch contour and red diamonds for formants. The time markers at the bottom of the spectrogram are 0.071819, 0.161977, and 0.059142. The visible part is 0.292938 seconds, and the total duration is 0.292938 seconds. At the bottom left, there are buttons for "Rename...", "Copy...", "Info", "Remove", and "Inspect".

Object: sound

Method menu for sound objects

Extract sound selection

# Creating a New Object

The image displays two windows from the Praat software interface. The top window, titled "Praat objects", has a menu bar with "Praat", "New", "Read", "Write", and "Help". Below the menu is a list of objects: "Sound tiger" and "Sound untitled". A context menu is open over "Sound untitled", showing options: "Sound help", "Edit", "Play", and "Draw...". An arrow points from the text "Extract sound selection" to the "Play" option. The bottom window, titled "Sound tiger", has a menu bar with "File", "Edit", "Query", "View", "Select", "Spectrum", "Pitch", "Intensity", "Formant", "Pulses", and "Help". The main area shows a waveform and a spectrogram. The waveform has a red selection box from 0.071819 to 0.233795 seconds. The spectrogram shows a blue line for the pitch contour. The time axis is labeled with 0.071819, 0.161977 (6.174 / s), and 0.233795. The frequency axis is labeled with 0 Hz, 500 Hz, 155.34 Hz, and 76 Hz. The bottom status bar shows "Visible part 0.292938 seconds" and "Total duration 0.292938 seconds".

Object: sound

Method menu for sound objects

Extract sound selection

# Saving a Praat Object

Save file

Praat objects

Praat New Read Write Help

Objects:

Sound tiger  
Sound untitled

Sound help  
Edit  
Play  
Draw...  
Query -  
Modify -  
Annotate -

Analyse

Periodicity -  
Spectrum -  
Formants & LPC -  
Points -  
To Intensity...

Manipulate

To Manipulation...

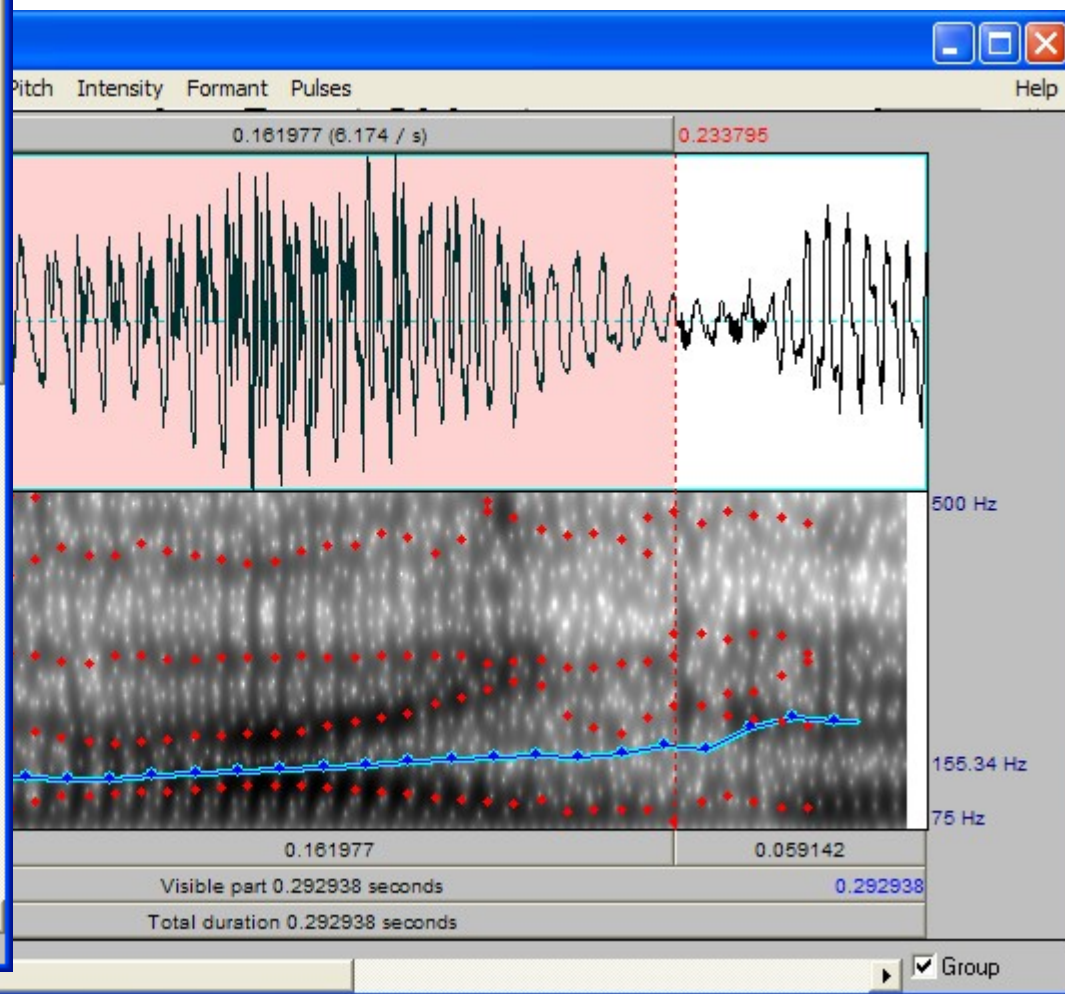
Synthesize

Convert -  
Filter -  
Combine sounds -

Rename... Copy...  
Info  
Remove Inspect

Object:  
sound

Method menu  
for  
sound objects



# Saving a Praat Object

Save file

The image shows two windows from the Praat software. The left window, titled 'Praat objects', has a menu bar with 'Praat', 'New', 'Read', 'Write', and 'Help'. Below the menu is a list of objects: 'Sound tiger' and 'Sound untitled'. A menu of actions is displayed to the right of the object list, including 'Sound help', 'Edit', 'Play', 'Draw...', 'Query -', 'Modify -', 'Annotate -', 'Analyse' (with sub-items: 'Periodicity -', 'Spectrum -', 'Formants & LPC -', 'Points -', 'To Intensity...'), 'Manipulate' (with 'To Manipulation...'), and 'Synthesize' (with 'Convert -', 'Filter -', 'Combine sounds -'). At the bottom of this window are buttons for 'Rename...', 'Copy...', 'Info', 'Remove', and 'Inspect'. The right window shows a spectrogram with a waveform above it. The waveform has a red shaded region from 0.161977 to 0.233795 seconds. The spectrogram has a blue line representing a formant track. The y-axis is labeled with frequencies: 500 Hz, 155.34 Hz, and 75 Hz. The x-axis has markers at 0.161977 and 0.059142. At the bottom, it shows 'Visible part 0.292938 seconds' and 'Total duration 0.292938 seconds'. A 'Group' checkbox is checked at the bottom right.

Object: sound

Method menu for sound objects

# Extracting information about the speech signal

## Operations:

- Read a speech file into Praat
- Open an “Edit” window
- Select sections of the signal and listen carefully for tones
- Experiment with the menu options to show
  - pitch
  - spectrum
  - ...
- Experiment with pitch:
  - modify the analysis range for pitch

# Annotating a speech signal

1. TextGrid TEM-all-amp-mono-normal-cropped

File Edit Query View Select Interval Boundary Tier Spectrum Pitch Intensity Formant Pulses Help

53.690072  
0.8152  
0.0006745  
-0.9441  
5000 Hz  
3889 Hz  
0 Hz  
200 Hz  
75 Hz

1	-	117	132	155	127	142	144	116	124	137	109	125	-	F0 (209 / 233)											
2	-	l	!h	h	l	!h	h	l	!h	h	l	!h	-	Pitch (233)											
3	-	L	H	L	L	H	L	L	H	L	L	H	-	Tone (233)											
4		k	O	d	O	N	a	r	i	k	e	J	a	z	I	w	u	r	o	t	a	s	i	-	Phoneme (427)
5	-	kO	dO	Na	ri	ke	Ja	zI	wu	ro	ta	si	-	Syllable (233)											
6	-	kOdONarike				JazI			wuro			ta	si	-	Word (139)										
7	-	18c. kOdONarike JazI wuro ta si?											-	Utterance (77)											
8	-	rire comme si le roi n'était pas mort!											-	Gloss Fr (77)											
9													-	Comments (77)											

2.000030  
53.688130 53.688130 Visible part 2.001972 seconds 55.690102 2.610601  
Total duration 58.300703 seconds

all in out sel bak Group

# Praat Output



# Praat Output

- Praat produces information which can be stored in a file.
- The file contents are not normally seen by the user.
- However, they can be seen and used for further analysis:
  - Excel, OpenOffice Calc
  - Praat scripting
  - Shell, Perl, Python scripting
  - Time Group Analyser online tool

```
intervals [1]:  
  xmin = 0  
  xmax = 0.3559744193778952  
  text = " "  
intervals [2]:  
  xmin = 0.3559744193778952  
  xmax = 0.500147057910385  
  text = "ta"  
intervals [3]:  
  xmin = 0.500147057910385  
  xmax = 0.614452757446077  
  text = "la"  
intervals [4]:  
  xmin = 0.614452757446077  
  xmax = 0.8853950267508599  
  text = "sin"  
intervals [5]:  
  xmin = 0.8853950267508599  
  xmax = 1.096059981756913  
  text = "Ge"  
intervals [6]:  
  xmin = 1.096059981756913  
  xmax = 1.5079951315848832  
  text = " _"
```

# Exercises

- Load a short speech signal (less than 5 seconds) into Praat.
- Listen to individual words and syllables.
- Experiment with switching the different displays (spectrogram, pitch track).
- Examine the highest, lowest and average frequencies in the signal.
- Annotate the syllables in the signal with a 'TextGrid' annotation. annotation (a 'TextGrid') of syllables, and save the file.
- Using a text editor, examine the file which has been saved.