Tools for Speech Analysis

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Thanks to Jean-Philippe Goldman, Fadi Biadsy

Goals

- Create stimuli for an experiment (i.e. hybridization)
- Create databases for TTS or research
- Analyze a speech corpus from an experiment or natural speech
- Verify/correct an automatic segmentation or pitch track
- Fix your TTS recordings to sound better, different

Data

- Speech content (noise, multivoice,…)
- Data Files
  - Sound/Transcription/PitchContour
  - Sampling/Quantization

    16k 🔊 12k 🔊 8k 🔊 4k 🔊 8bit 🔊
  - Size: how much data?
  - Format
    - Sound: wav, wma, mp3, ogg, aiff, aifc, au, vox, raw, sd, CSL, Ogg/Vorbis, NIST/Sphere,…
    - Translation: sox or Praat
    - Transcription schemes: ToBI

What tasks do we want to perform ?

- **Visualization and Editing**:
    - Record, play, edit, mix, add effects
- **Analysis**:
    - Spectral information, pitch, intensity
- **Speech manipulation**:
    - Filtering, mixing, adding effects, prosodic manipulation
- **Annotation**:
    - Segmentation, labeling
- **Scripting**:
    - Batch, communication with outside programs

Software Options

- Goldwave   (audio editor)
- Esps Xwaves   (routines + visual.)
- Praat   (speech analysis)
- Wavesurfer   (speech editor)
- Transcriber   (annotation tool)
- Matlab   (general purpose soft)
- OGI speech tools   (routines + app. dev.)
- …winpitch, pitchworks, phonedit, cooledit…..

Links

- www.goldwave.com
- www.speech.kth.se/software/#esps
- www.praat.org
- www.speech.kth.se/software/#wavesurfer
- http://cslu.cse.ogi.edu/toolkit/
- www.mathworks.com (Matlab)

- www.lpl.univ-aix.fr/~sqlab/ (phonedit)
- http://www.kvraudio.com/get/696.html (PitchWorks)
- www.winpitch.com (WinPitch)
- http://www.adobe.com/special/products/audition/syntrillium.html (CoolEdit > Audition)

How to Evaluate

- Visualization/Edition
- Analysis
- Speech manipulation
- Annotation support
- Scripting
- Plotting

- Supported formats
- Platform/installation
- Evolution/community
- Accessibility
- Price

Our Choice: Praat

- Developed by Paul Boersma and David Weenink at the Institute of Phonetic Sciences, University of Amsterdam

- General purpose speech tool : editing, segmentation and labeling, prosodic manipulation
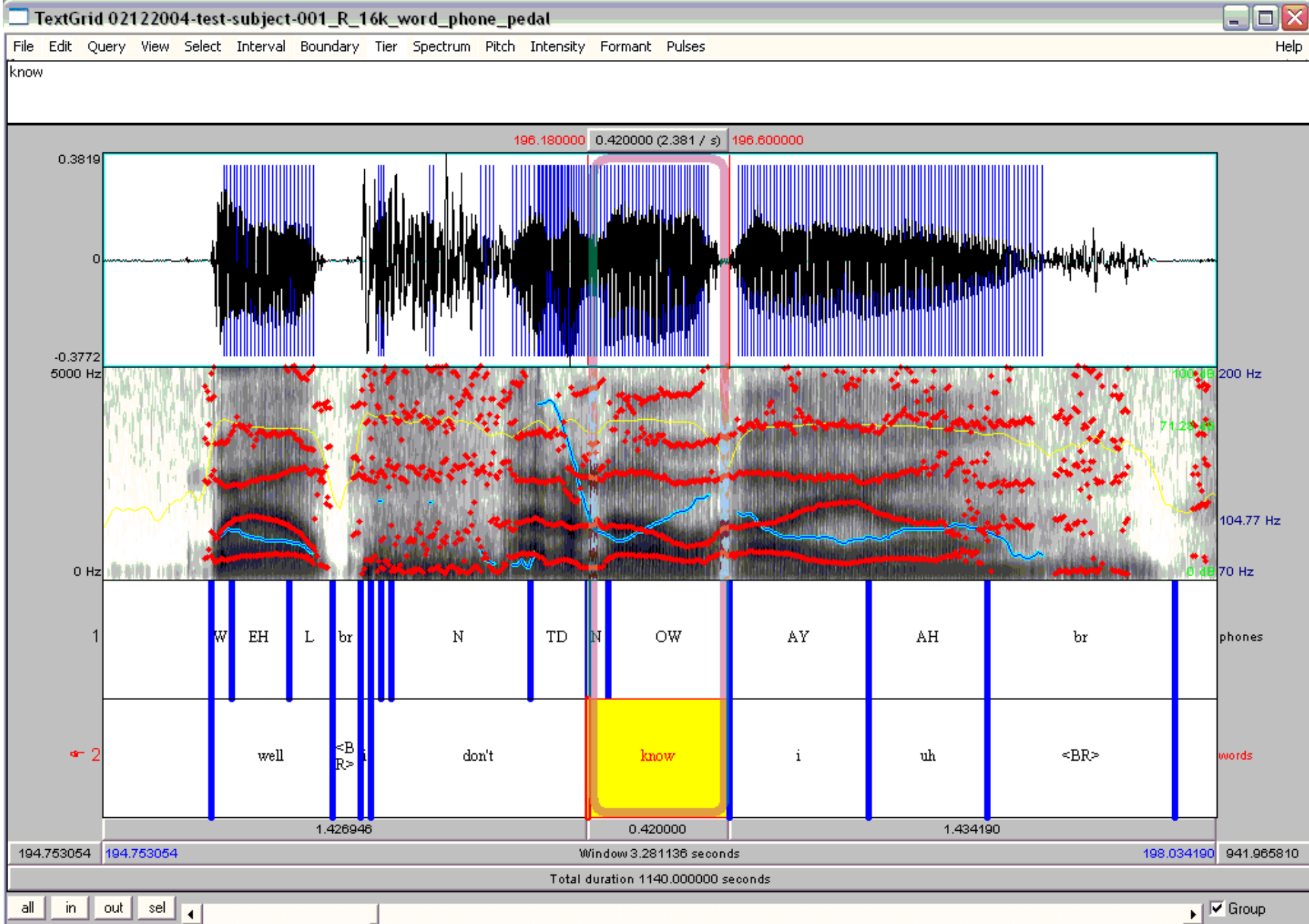
Praat

- Pros: designed for speech analysis (not just sound editing or spectrogram visualization), nice GUI, scripting, active development and community, prosodic manipulation, many scripts available on line
- Cons: limited scripting language, native format of transcription and pitch files

File Management

- Recording files and saving them
  - New menu
- Opening files
  - Read menu
    - Long and short sound files
    - Other file types
  - Write menu
  - Exercise: Record a file with your own name, play it to check, call it '<your name>', save it to list, write it to a .wav file on disk, remove it from the objects list, read it back in

Editing Options from Objects Window

- Select and edit your name file
- Spectrum:
  - Show a spectral slice
  - Show a spectrogram
- Pitch:
  - Show pitch
  - Check the settings, change the range
  - Get pitch information: get pitch, get min/max pitch
- Intensity:
  - Get intensity information: similar to pitch functions
  - Check the settings
- Formant: Display

Modifying the Data

- Changing the pitch contour of your name file:
  - Go to To manipulation
  - Edit the new object
  - Pitch → Stylize pitch (2st)
  - Modify pitch by dragging points up and down
  - Modify duration:
    - Add points in duration tier
    - Drag points up and down
  - To save: File -> Publish resynthesis

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Annotation: Textgrids

- From objects window, w/ sound file selected
  - Annotate → To textgrid
  - Point vs. interval tiers
- Add a point tier and an interval tier and insert some labels
- *NB: remember to select the interval or point **first** in the waveform or spectrogram before trying to insert a label*

Scripting

- From history:
  - Praat → new Praatscript → Edit → Paste history
  - NB: you can run all or part of the script
- Writing scripts
- Modifying existing scripts:
 - [Tutorials, scripts, resources, user groups](), search

Sample Praat Script

```
# This script will create a new text-grid for a wav file
form Make a text-grid for a .wav file
  comment Source Directory?
          sentence Directory C:\Documents and Settings\julila\My
Documents\
  comment File name?
          sentence Filename
  comment Tier Name?
          sentence Tier
endform
Read from file... 'directory$' 'filename$'
stem$ = left$(filename$,length(filename$)-4)
select Sound 'stem$'
To TextGrid... 'tier$' 'tier$' # tier names, which tiers are point tiers
Write to text file... 'directory$'\'stem$'.TextGrid
Remove
```

Task1

- Record a file with the following vowels:
  - /iy/ (heat), /ae/ (hat), /uw/ (you), /aa/ (not)
- Segment them in an annotation tier
- Find the height of the first 3 formants for each vowel
- How do the high vowels (/iy/, /uw) differ from the low vowels? The front (/iy/, /ae/) from the back?

American English vowel space
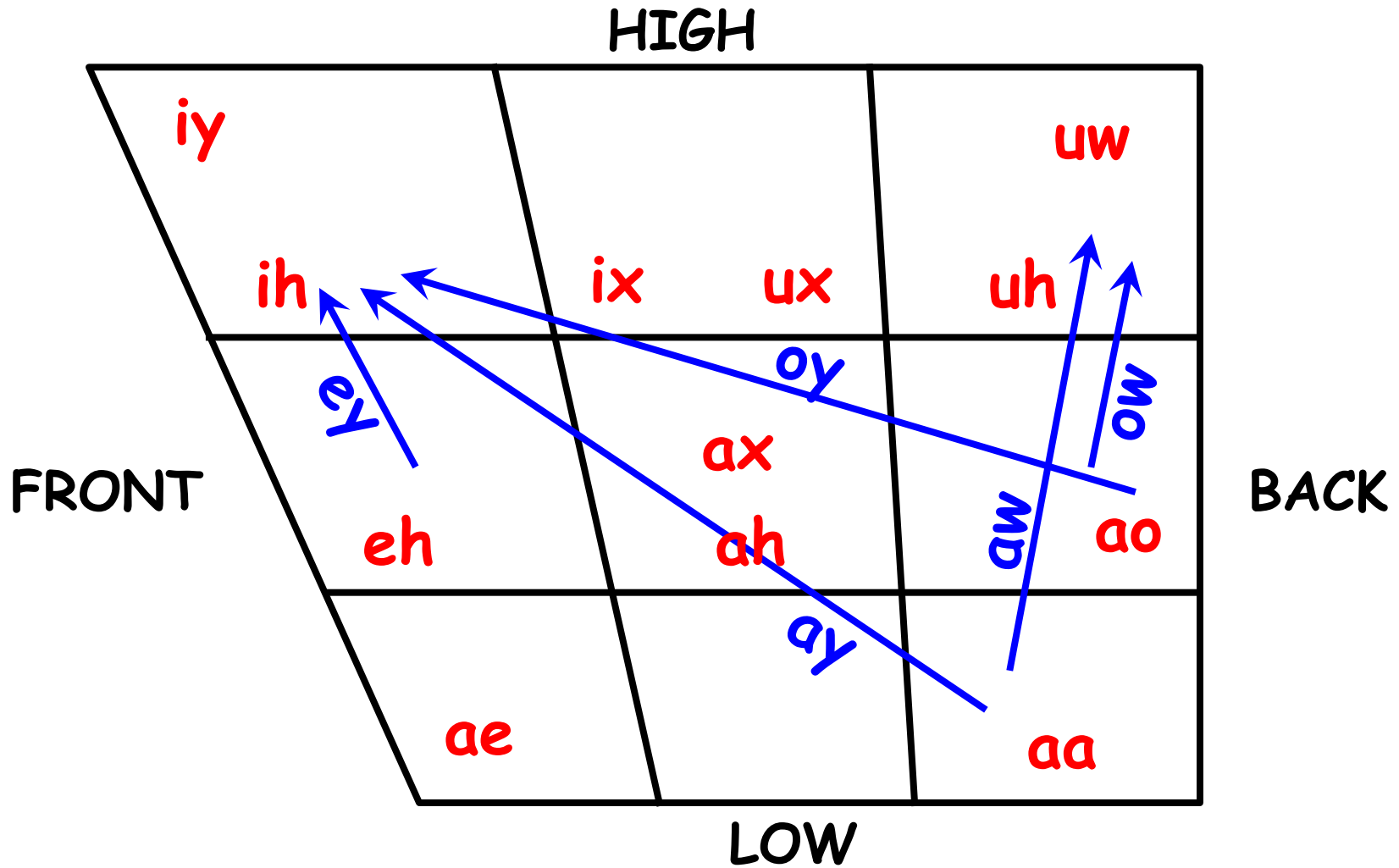
Vowels and Formants

- Higher F1, lower vowel (/ae/, /aa/) – high vowels have low F1 (/iy/, /uw/)

- Higher F2, fronter vowel (/iy/, /ae/) – back vowels have low F2 (/uw/, /aa/)

Task2

- Record files with different consonant classes as defined by manner of articular/voiced and unvoiced, all in the context of the same vowel /iy/ (e.g. /piyp/, /biyb/, /giyg/, /kiyk/, /miym/, /liyl/
- Measure the formants of /iy/ in each context
- Are they all the same? Are they different from /iy/ said alone?

Task3

- Record something in a very loud voice, to produce clipping, and see what the waveform looks like

Task4

- Record a file using falling intonation; modify it to produce a rising intonational contour

Task5

- Add a textgrid with one interval tier to Task4's file; label the words in the file, aligning each interval with the word in the waveform

Task6

- Record a sample of the same short sentence as angry speech, sad speech, happy speech, and see what things (pitch contour, pitch mean and max, intensity mean and max, spectral information) differ. choose something fully voiced if possible.

Help

- Online help, FAQ, manual
- Links from http://www.praat.org
- [Additional tutorials, scripts, resources, user groups](#)

Next Class

- Feb 3: More on speech tools and Lab visit