Experimental Phonetics

Phonetic corpus analysis
2019-07-18, 10:10-12:10

Dafydd Gibbon

Bielefeld University
Jinan University, Guangzhou

Empirical ~~Experimental~~ Phonetics

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Empirical Phonetics

- Pre-recording phase
  - Scenario development
  - Equipment selection
  - Subject selection

- Recording phase
  - Selection of recording environment
  - Correct position of microphone
  - Drinking water to keep vocal folds moist

- Post-recording phase
  - Systematic archiving
  - Analysis

Empirical Phonetics

- Pre-recording phase
  - Scenario development

 Speech styles to be recorded:

 Prompted 'laboratory' speech for phonetic experiments.

 Task-oriented speech.

 Dialogue (interview, conversation): dialogues require one microphone per person for high quality analysis.
  - Equipment selection
    - Highest quality possible
    - WAV format audio
  - Subject selection

Empirical Phonetics

- ## Pre-recording phase
    - ### Background information
        - Gibbon, Dafydd, Roger Moore and Richard Winski, eds. 1997. *Handbook of Standards and Resources for Spoken Language Systems*. Berlin: Mouton de Gruyter (2 editions: single volume and four volumes).

        - Hardcastle, William J., John Laver and Fiona E. Gibbon, eds. 2010. *Handbook of Phonetic Sciences*, 2nd Edition. London: Wiley-Blackwells,

        - International Phonetic Assoc., 1999. *Handbook of the International Phonetic Association*. Cambridge: University Press.

        - Check also the SAMPA alphabet for convenient keyboard-friendly input

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- ## Recording phase
  - Selection of recording environment
  - Correct position of microphone
  - Drinking water to keep vocal folds moist
  - Volume control:
    - As high as possible, but without signal clipping
  - Sampling frequency:
    - 44.1 kHz (CD, 2^2 x 3^2 x 5^2 x 7^2 = 44100 Hz)
    - 22.05 kHz (half CD)
    - 16 kHz (many phonetics laboratories)
    - Must be >2f, where f is the highest frequency needed

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- Recording phase
  - Scenario environment for recording:

Avoid echo as far as possible:

echo is caused by hard walls and floors,

so an environment with soft furnishings (curtains, carpets, cushions) is preferable, if recording is done outside a studio,

and a studio should have sound-proofed floor, walls and ceiling.

Avoid noise (tapping on table, wind, touching microphone, …)

Place the microphone at least 25cm thumb ⟷ little finger an) the speaker in order to avoid breath noi) the left or the right of the speaker,
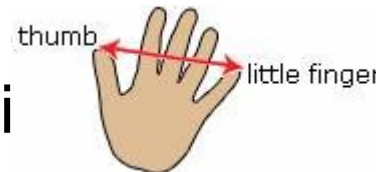
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- Recording phase
  - Speaker:

  The speaker should receive appropriate instructions.

  The speaker should be asked to give permission for the recording to be used for scientific purposes. The permission can be in writing, but in any case should be included in the recording as recorded metadata.

  The recording should include other metadata, including the date, the place, the speaker(s), other participants such as audience and those making the recording.

  Speakers should take a sip of water every 5-10 minutes to avoid drying out the vocal folds and thereby changing the voice quality.

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- Recording phase
  - Protocol:

A protocol of the recording session should be kept, containing:

the same metadata information as on the recording (time, place, participants),

instructions given to speaker(s),

permissions of speaker(s)

file names and any other aspects of the recordings,

a list of any problems which occurred.

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- Post-recording phase
  - Protocol:

A protocol of the recording session should be kept, containing:

the same metadata information as on the recording (time, place, participants),

instructions given to speaker(s),

permissions of speaker(s)

file names and any other aspects of the recordings,

a list of any problems which occurred.

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- Post-recording phase
    - There are many other kinds of post-recording activity:

Systematic filing of metadata in a database (or temporarily in a word processor table),

Systematic labelling of recorded audio files with a project (or language, etc.) name, serial number, and date, e.g.: 'englinterview_05_2016-05-09.wav'.

Cutting recordings: usually necessary in order to systematise items for analysis – but always keep the original recordings (cutting can be done using the general audio tool Audacity or the phonetic workbench Praat):

http://www.audacityteam.org/

http://www.fon.hum.uva.nl/praat/

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- Post-recording phase
  - Transcription:

Transcription types vary according to needs (e.g. IPA or SAMPA phonetic vs. orthographic vs. discourse analytic transcription), labelled to match the recording, e.g.:

    engexp05_2016-05-09.txt, engexp05_2016-05-09.doc, engexp05_2016-05-09.odt

Text format: keep a plain text (ASCII) version of the transcription (not possible for some orthographies), and print it on paper.

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- ## Post-recording phase
    - Annotation:

    For phonetic and discourse analysis it is necessary to annotate the recording with software such as Praat (the most popular), Annotation Pro, Transcriber or WaveSurfer, or ELAN (more for video than for phonetics).

A selection of useful annotation software:

Praat: a very versatile 'phonetic workbench' with high quality measurements of acoustic parameters, graphics for publications, speech synthesis, scripting (for automatising analysis), for Windows, Mac, Linux:

http://www.fon.hum.uva.nl/praat/

Annotation Pro: with many of the features of Praat, compatible format, with facilities for perception experiments, Windows only:

http://annotationpro.org/

SPPAS: for large quantities of speech to be annotated it is worth considering automatic annotation (with manual post-editing), Windows, Mac, Linux:

http://www.sppas.org/

Now you do it with your own laptop ...

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- ## Pre-recording phase
    - Scenario development
        - Reading from one to ten in any language you choose
    - Equipment selection
        - Your laptop or phone
    - Subject selection:
        - yourself
        - your best friend
        - your neighbour
        - your colleague

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- ## Recording phase
  - – Selection of recording environment
  - – Correct position of microphone
  - – Drinking water to keep vocal folds moist

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- ## Post-recording phase
  - Systematic archiving
    - Unique filename with date and number
  - Analysis
    - Praat
    - Calc, Excel, …
    - TGA

Analysis

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- Part I: Annotation
  - Basic knowledge of signal analysis
  - Basic knowledge of syllable annotation
  - Recording of data by course participants
- Part II: Syllable timing analysis
  - Examination of Praat annotation file.

- Analysis of Praat annotation with Time Group Analyser (TGA)

  http://wwwhomes.uni-bielefeld.de/gibbon/TGA/

- Analysis of Praat annotation with Calc / Excel

Signal analysis

- Waveform
  - Annotation
  - Analysis of annotation

- Amplitude envelope (or: amplitude^2: intensity)

- Fundamental frequency (F0)

- Short term spectrum, spectrogram

- Long term amplitude spectrum

- Long term F0 spectrum

- Rhythm zones

> Illustrations with *ProsodySuite*

> If anyone is interested in the code, just ask!

Signal analysis

- Waveform
  - Annotation
  - <u>Analysis of annotation</u>

- Amplitude envelope (or: amplitude^2: intensity)

- Fundamental frequency (F0)

- Short term spectrum, spectrogram

- Long term amplitude spectrum

- Long term F0 spectrum

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Illustrations with *TGA*

Annotation Mining (Time Group Analysis)

Illustrations with *TGA*

- Waveform
  - Annotation
  - <u>Analysis of annotation</u>
    - Save annotation file
    - Open annotation file in editor
    - Open TGA
    - Copy annotation text from editor to TGA input field
    - Calculate TGA
      - Descriptive statistics:
        - N, mean, rate, nPVI, slopt
      - Wagner quadrant in z-score normalised scatter plot