



Vowel Plots with Praat and R

CASE 21/4

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About me



- ▶ BA & MA in English and American Studies from TU Chemnitz
- ▶ worked as vocational school teacher in Germany
- ▶ worked as high school teacher in China
- ▶ currently working at TUC as part of the DFG funded CRC **Hybrid Societies** and the Erasmus+ project **TEFL-ePAL**

Step 0: Data Collection

Sociolinguistic Interviews

in a Labovian tradition (Labov, 1994, 2001, 2010), based on Tagliamonte (2006, 2011)

1. linguistic reading passages (Arthur the Rat, The North Wind and the Sun, The Boy who cried Wolf; cf. Deterding (2006))
2. computational linguistic reading passages, optimized for phoneme coverage (Taubert, Sternkopf, Kahl, & Eibl, fc.)
3. semi-structured interview based on questions from Tagliamonte (2006)

Participant selection:

- ▶ Chinese university students
 - ▶ from either Guangxi, Yunnan or Guangdong
 - ▶ majors other than English
 - ▶ preferably undergraduates
- ▶ Nigerian researcher/expats

Step 1: Data Preparation

Problem 1: Vowel measurements require annotated data. Annotation is very time consuming.

Solution: Forced alignment using the Montreal Forced Aligner (MFA, McAuliffe, Socolof, Mihuc, Wagner, & Sonderegger, 2017)

Problem 2: Manual vowel measurements are very time consuming, especially for larger data sets.

Solution: Automated formant measurements using a Praat (Boersma, 2001) script. (available on my website)

Forced Alignment

Two step process:

1. create pronunciation dictionary (grapheme to phoneme, ARPABET¹ (Rice, 1976))
2. force align the text using a pretrained model and the created dictionary

```
1 | #!/usr/bin/bash
2 | # create dictionary of text
3 | mfa g2p english_g2p ~/data/input/transcript.txt ~/data
   | /transcript.dict
4 | # force align
5 | mfa align ~/data/input/ ~/data/transcript.dict english
   | ~/data/output --clean --verbose
```

Listing 1: Running the MFA

¹for a convenient overview, see <https://en.wikipedia.org/wiki/ARPABET>

Forced Alignment - Output

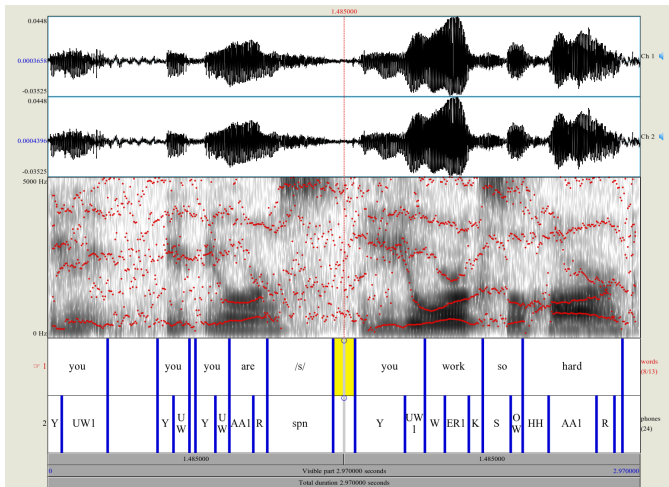


Figure 1: TextGrid File created by MFA in Praat

Automated Vowel Formant Measurements

Status quo: Praat scripts circulated at linguistics departments.

Issue: scripts require specific annotations, not compatible with MFA output.

Solution: new , KISS Praat script

- ▶ processes all files in a given directory, expects *.wav and *.TextGrid files with identical names
- ▶ measures formants of all vowels at 20%, 50% and 80% duration
- ▶ write all measurements to CSV file

Workflow Note

By default, all vowels (monophthongs and diphthongs) are measured, selection should happen in R during analysis.

Step 2: Analysis

R (R Core Team, 2021) script using `dyplr` (Wickham, François, Henry, & Müller, 2020), `tidyverse` (Wickham et al., 2019), `ggplot2` (Wickham, 2016) and `phonR` (McCloy, 2016).

Overview

The script generates a grid of vowel plots and vowel movement plots comparing different data sets.

1. load data from CSV file
2. prepare data for analysis
3. select subset of vowels to analyze
4. filter outliers using Hampel filtering (Hampel, 1974)
5. normalize² data using Lobanov normalization (Lobanov, 1971)
6. find absolute minima and maxima in data sets
7. create plots for each data set and arrange them

²for a comparison of normalization algorithms, see Fabricius, Watt, and Johnson (2009)

Results: Comparison of Native and NN Varieties

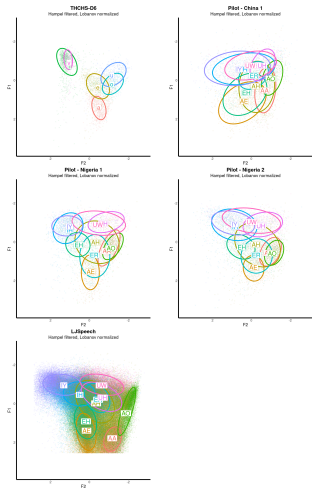


Figure 2: Monphthongs

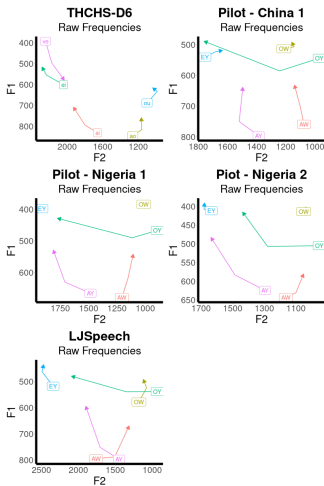


Figure 3: Diphthongs

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