

Comparing Vowel Spaces across Three Circles: a quantitative corpus-based Approach

Sven Albrecht, Josef Schmied, Marina Ivanova
sven.albrecht@phil.tu-chemnitz.de

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Objectives

Mission

Quantify vowel space and duration to verify impressionistic descriptions from the literature.

- RQ1** Do speakers of inner/outer/expanding circle varieties of English exhibit a clear tense-lax difference in their vowel spaces?
- RQ2** Do speakers of inner/outer/expanding circle varieties of English exhibit a clear tense-lax difference in their vowel lengths?
- RQ3** How do vowel spaces and vowel lengths of expanding circle varieties differ in comparison with each other?

Data Sets

- ▶ AmE: LJSpeech (Ito & Johnson, 2017)
- ▶ BrE, ScE, IrE: Demirsahin et al. (2020)
- ▶ NigE: Albrecht et al. (fc-b) and Isiaka (2021)
- ▶ ItE: Albrecht et al. (fc-b)
- ▶ CzE: Albrecht et al. (fc-b)
- ▶ ChE: Albrecht et al. (fc-a)

Variety	AmE	BrE	ScE	IrE	NigE	ItE	CzE	ChE
Data points	229,100	26,873	11,537	8,120	3,313	6,621	12,228	85,135

Table 1: Number of vowels per data set

Measuring Vowel Spaces

Quantification workflow

- ▶ Forced alignment using the Montreal Forced Aligner (McAuliffe et al., 2017)
- ▶ Automated vowel formant measurements in Praat
- ▶ Vowel plots generated in R
- ▶ Hampel filtering of outliers (Hampel, 1974)
- ▶ speaker intrinsic, vowel extrinsic, formant intrinsic normalization (Lobanov, 1971)

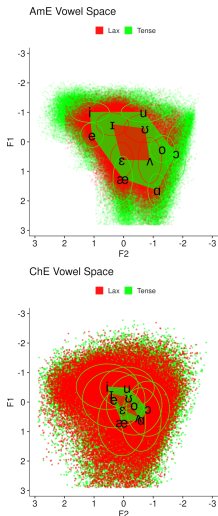


Figure 1: Vowel space plot of pilot test subjects

Measuring Vowel Length

Method:

- ▶ best done in Praat (same script as formant measurements)
- ▶ analysis and plotting in R
- ▶ speech rate normalization requires a separate Praat script

Methodological Considerations:

- ▶ raw values
- ▶ speech rate normalization
- ▶ Lobanov normalization

Vowel Spaces

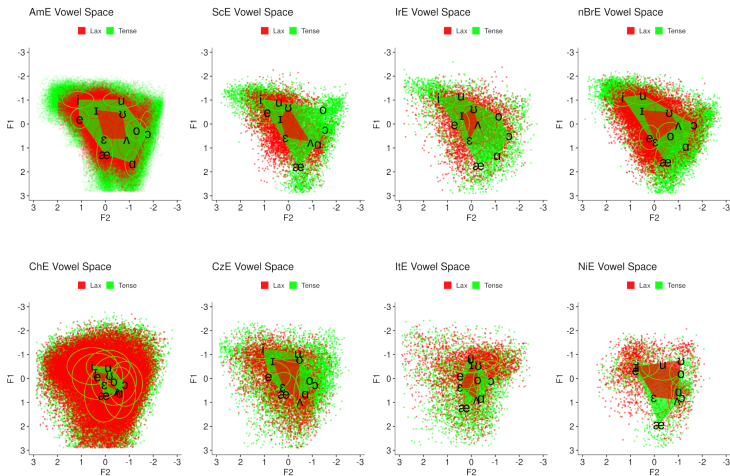


Figure 2: Vowel spaces of all varieties under investigation

Vowel Spaces - ChE

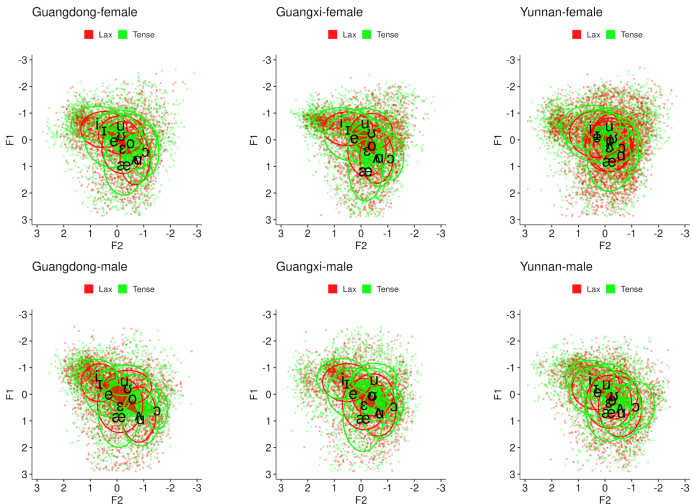


Figure 3: Vowel spaces of Chinese English subnational varieties

Vowel Length

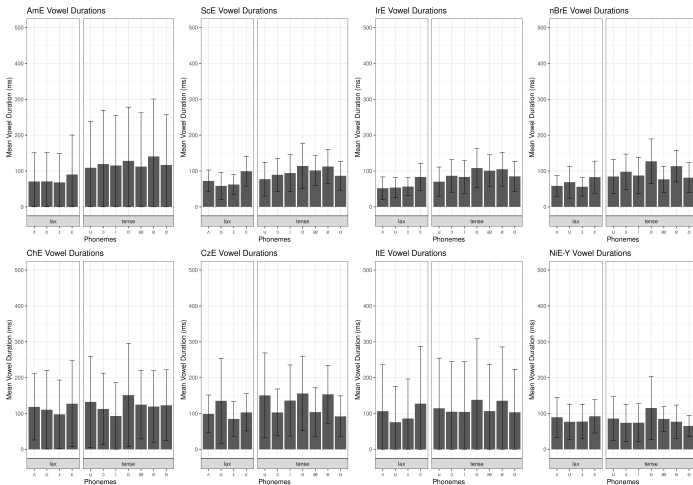


Figure 4: Raw vowel duration of all varieties under investigation

Vowel Length

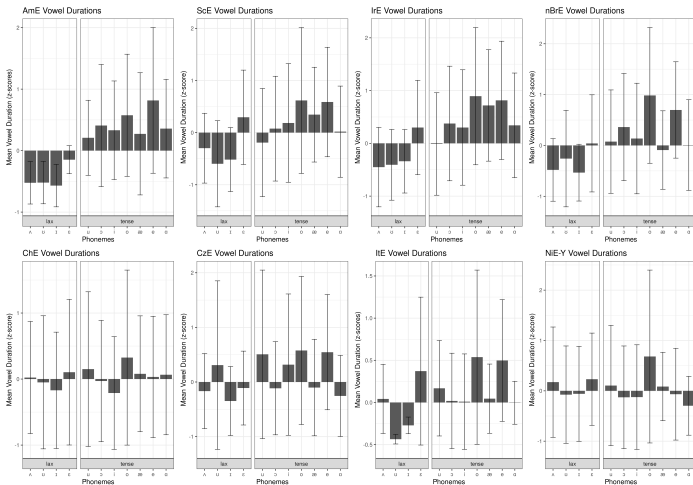


Figure 5: Lobanov normalized vowel duration of all varieties under investigation

Discussion

- ▶ large variance in expanding circle vowel space, especiall ChE
- ▶ curious shape of ItE vowel space
- ▶ ChE subnational variation exists, but not very prominent
- ▶ large variance in expanding circle vowel lengthk

Conclusion

- ▶ inner circle varieties have clear tense-lax contrast, but European varieties also have variation
- ▶ expanding circle varieties mostly have no clear tense-lax contrast
- ▶ tense-lax contrast not clearly visible in vowel length data across all three circles
- ▶ Chinese English data shows subnational variation
- ▶ automatic vowel formant and duration measurement and analysis methods are valid and reliable

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