Cross-linguistic vowel variation in Saterland: Saterland Frisian, Low German and High German

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Introduction

Germany

District of Cloppenburg

Introduction

- Saterland Frisian is spoken in the municipality of Saterland (Strücklingen, Ramsloh and Scharrel) by 1500 to 2000 people.
- Speakers are trilingual: they speak Saterland Frisian, Low German and High German.
- Saterland Frisian is the last East Frisian language still spoken today.
- It is one of the smallest minority languages in Europe.
- We focus on Scharrel.

Monophthongs in Scharrel

Notation according to Fort (1980):

Sater Frisian			Low German			High German		
iː	yː	uː	iː	yː	uː	iː	yː	uː
i	y	u						
eː	øː	oː	eː	øː	oː	eː	øː	oː
ɪ	ʏ	ʊ	ɪ	ʏ	ʊ	ɪ	ʏ	ʊ
ɛː	œː	ɔː	ɛː	œː	ɔː	ɛː		
ɛ	œ	ɔ	ɛ	œ	ɔ	ɛ	œ	ɔ
			aː			aː		
a			a			a		

19	17	15

monophthongs found in closed stressed syllables

Adaptive dispersion (1)

- Adaptive dispersion: the distinctive sounds of a language tend to be positioned in phonetic space so as to maximize perceptual contrast (Liljencrantz & Lindblom 1972; Lindblom & Engstrand 1989; Lindblom 1990).

- Maximizing contrast achieved by 1) increasing vowel space and 2) spreading the vowels over the whole area, i.e. vowels are moved away from the center.

Adaptive dispersion (1)

- Research question 1:
  Do the three language's vowel systems differ in vowel space and dispersion?

Adaptive dispersion (2)

- Adaptive dispersion: variability of individual vowels should be inversely related to the number of phonemes in the vowel inventory.

- I.e. vowel formant values should vary to a larger extent in smaller than in larger systems (Lindblom 1986, Flege 1995).

Adaptive dispersion (2)

- Research question 2:
  Does the inter-speaker variability of individual vowels correlate with the number of vowels in the vowel systems of the three languages?

Base-of-articulation

- Language-specific base-of-articulation: similar sounds across two languages can differ due to a consistent, language-specific adjustment of the articulators (Disner 1983, Bradlow 1995).

- Example: vowel categories that have the same phonological feature specification and that occupy similar positions in the acoustic space across two different languages may have different precise phonetic realizations due to different bases-of-articulation of each language (Bradlow 1995).

Base-of-articulation

- Research question 3:
  Are there systematic differences between the three languages
  in duration and language-specific base-of-articulation?

Subjects

- 9 male speakers between 51 and 75 years old.
- All born and raised in Scharrel; have lived there the greater part of their lives.

Method

- Goal: to obtain all vowels in /hVt/ context for each language.
- /hVt/ syllables were cued by reading aloud real rhyming monosyllabic Saterland Frisian/Low German/High German words immediately preceding the production of the /hVt/ syllable (cf. Bohn 2004).
- Each such sequence was presented twice, thus two /hVt/ samples were obtained per speaker and per vowel.
- Sequences were presented in random order.

Sw**ee**t? 'Schweiß'

Sweet?

H_t.

Strait?   '(er) streut'

Strait?

H_t.

Data analysis

- For each /hVt/ we measured:
  - Vowel duration (milliseconds)
 - F1 and F2 at 50% (Hertz)

Research question 1

Do the three language's vowel systems differ in vowel space and dispersion?

- On the basis of the 14 common vowels of the three languages we measured for each language and for each speaker:
    - the subset of vowels which lie on the hull of the vowel points (function `chull` in R package `grDevices`);
    - the area within the convex hull (function `polyarea` in R package `pracma`);
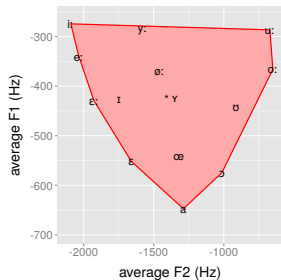   - the center of mass by calculating the average F1 and F2.
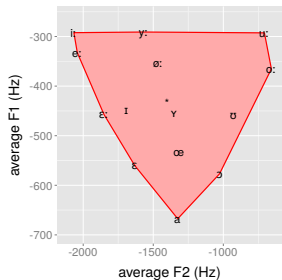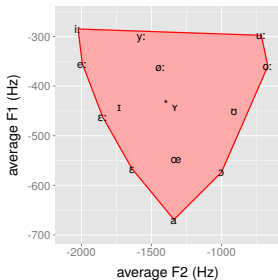
Vowel spaces and centers of mass (indicated by a *) per language averaged over the speakers.

Dispersion measures

- Dispersion F1
  - Average distance to center of mass in F1 dimension
  - Measured for: all vowels, close vowels, open vowels
  - Close: above center, open: below center
- Dispersion F2
  - Average distance to center of mass in F2 dimension
  - Measured for: all vowels, front vowels, back vowels
  - Front: left from center, back: right from center
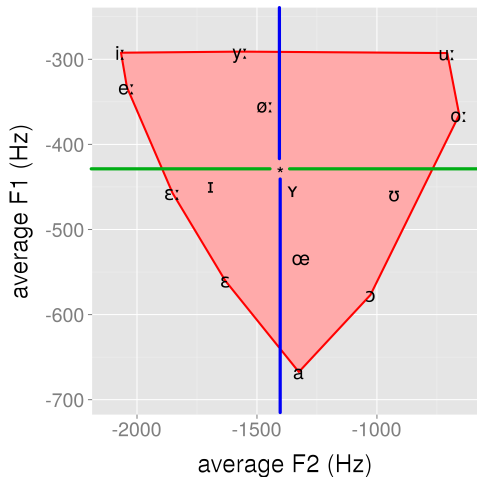
Green line: division close/open; blue line: division front/back

Results

- No significant differences are found between vowel spaces.
- There are dispersion differences in F2:
    - High German > Low German;
    - High German > Saterland Frisian.

Research question 2

Does the inter-speaker variability of individual vowels correlate with the number of vowels in the vowel systems of the three languages?

- We considered: duration, F1 (50%), F2 (50%).

- We consider only the common vowels of the three languages.

- Per vowel and per language we measured the standard deviation over the 9 speakers.

- Two languages are compared by comparing their corresponding vowel standard deviations.

Results

	mono	front	back	close	open	diph
duration	HG > LG HG > SF	HG > LG	HG > SF	HG > LG HG > SF		HG > LG
F1				HG > SF		
F2		HG > SF			HG > LG	

In some cases High German vowels have a higher standard deviation than Saterland Frisian and Low German vowels, but no differences are found between Saterland Frisian vowels and Low German vowels.
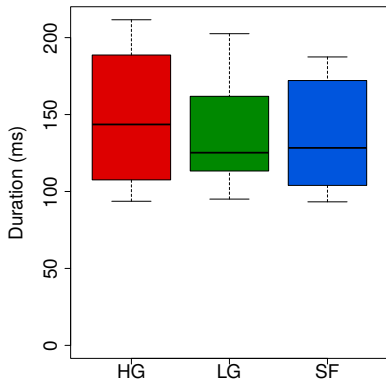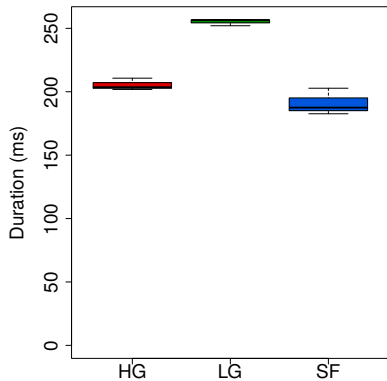
Research question 3

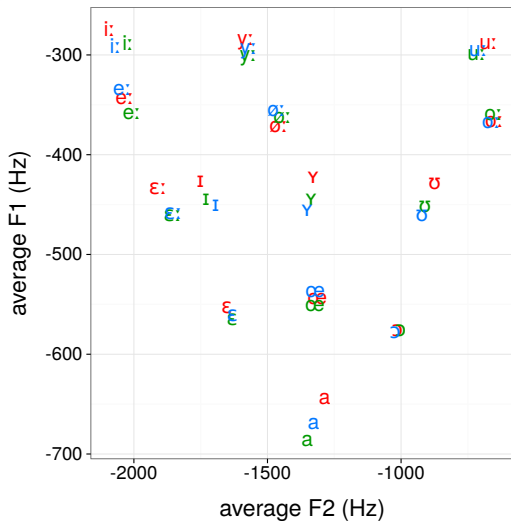Are there systematic differences between the three languages in duration and language-specific base-of-articulation?

- We consider the common vowels of the three languages.

red: High German, green: Low German, blue: Saterland Frisian

Analysis per category

- We distinguish the following categories:
    - monophthongs: front/back, close/open
    - diphthongs
- We used a linear mixed model for each acoustic variable and per category (*R* packages `lme4`, `lmertest` and `multcomp`).
- *Language* is a fixed factor, random intercepts are included for *speaker* and *vowel*.
- *Language* is a random slope of *vowel* only when this improves the model (i.e. decreases the Akaike information criterion)

Results

	mono	front	back	close	open	diph
duration	HG > LG	HG > LG		HG > LG	HG < LG	HG < LG
	HG > SF	HG > SF		HG > SF		SF < LG
F1	HG < LG	HG < LG		HG < LG	HG < LG	
					HG < SF	
F2		HG > LG				
		HG > SF				

Comparison of languages by comparing means of common vowels
measured over 9 speakers.

Results

- Duration:
  HG has larger duration than LG/SF for monophthongs.
  LG has larger duration than HG/SF for diphthongs.

- F1:
  HG has smaller F1 than LG for monophthongs
  HG has smaller F1 than SF for open vowels.

- F2:
  HG has larger F2 than LG/SF for front vowels.

Conclusions

1. Do the three language's vowel systems differ in vowel space and dispersion?

- No differences between vowel spaces.
- There are dispersion differences in F2: High German vowels are most dispersed.

Conclusions

2. Does the inter-speaker variability of individual vowels correlate with the number of vowels in the vowel systems of the three languages?

- Yes, especially for duration. High German vowels vary stronger than Low German and Saterland Frisian vowels.

Conclusion

3. Are there systematic differences between the three languages in duration and language-specific base-of-articulation?

- An overall effect is found for:
    - duration:
      High German monophthongs are longer than Low German and Saterland Frisian monophthongs. Low German diphthongs are longer than Saterland Frisian and High German diphthongs.
    - F1:
      High German monophthongs are more closed than Low German monophthongs.

- No differences found between Low German and Saterland Frisian monophthongs.

Thanks!