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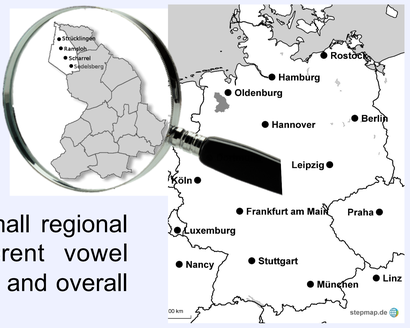
# REGIONAL VARIATION OF VOWELS IN SATERLAND FRISIAN (4pSC5)

## INTRODUCTION

### Saterland Frisian

- minority language
- ≈ 2250 speakers [1]
- variety of East Frisian




### Regional variation

- natives highly aware of small regional differences: use of different vowel qualities, vocalic durations, and overall speech rate [2, 3, 4]
- Scharrel regarded as most divergent variety [5]

### Exceptionally large vowel inventory

- 16 diphthongs, 21 monophthongs [1, 3, 5]
- vowel length and tenseness not linked

| | front | | central | back | | | | |
|---|---|---|---|---|---|---|---|---|
| **close** | i | y | | u | | | | |
| | iː | yː | | uː | yːi̯ | uːi̯ | iːu̯(w) | ɛːu̯(w) |
| **close-mid** | ɪ | ʏ | | ʊ | | | | |
| | eː | øː | | oː | œːi̯ | oːi̯ | iˑu̯(w) | ɛu̯(w) |
| **open-mid** | ɛ | œ | | ɔ | | | | |
| | ɛː | œː | (ə) | ɔː | ɛːi̯ | ɔːi̯ | ɪu̯(w) | oːu̯ |
| **open** | | | a aː | | aːi̯ | ɔy̯ | eːu̯(w) | aːu̯ |

- /i y u/ likely to merge with /iː yː uː/ [1, 6, 7]
- number of diphthongs disputed: 6-16 [1, 3, 5, 8]
- likely to employ supplementary acoustic dimensions to support vowel distinction within the crowded vowel space (cf. phonetic feature enhancement [9]), e.g. vowel dynamics (i.e. VISC [10]) and acoustic duration (cf. [11, 12, 13, 14]).

## RESEARCH QUESTIONS

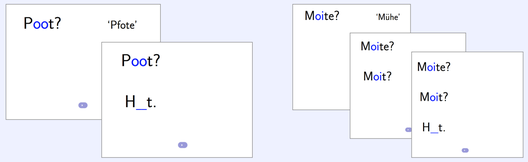
(1) Are all categories in the **depicted inventory** still distinguished or do we find **mergers?**
(2) Are there **supplementary acoustic dimensions** that support vowel distinction?
(3) Is there **regional variation** in the phonetic realization of corresponding categories?

## METHOD

- 34 male, trilingual speakers from the respective villages: 13 Ramsloh, 11 Scharrel, 11 Strücklingen
- born in Saterland, aged 50-75 years

### Recordings

- elicitation in /hVt/ context, cued by a rhyming monosyllabic Saterland Frisian word immediately preceding the production of the /hVt/ target word (e.g. *Poot* 'paw' – *Hoot*, cf. [11])
- where no rhyming monosyllabic trigger was available, an intermediate step was introduced




- sequences were presented in a controlled randomized order on a computer screen
- each sequence of a trigger and the rhyming target word was presented twice
- practice sequences preceded all blocks
- intonation was monitored, ensuring a falling contour

### Acoustic analysis

For each manually labeled /hVt/ word we measured
- vowel duration
- F1 and F2 at 20%, 50%, 80% of vowel duration
- Hertz data were normalized using a version (*2mW&F)* of the Watt and Fabricius method [15] modified by Flynn [16]

Dynamic spectral features (cf. [12]):
- trajectory length, i.e. sum of two vowel section lengths

$$VSL_{50-20} = \sqrt{(F1_{50} - F1_{20})^2 + (F2_{50} - F2_{20})^2}$$
$$VSL_{80-50} = \sqrt{(F1_{80} - F1_{50})^2 + (F2_{80} - F2_{50})^2}$$
$$TL = VSL_{50-20} + VSL_{80-50}$$

- spectral rate of change for each vowel section and the trajectory length

$$VSL\ roc_{50-20} = \frac{VSL_{50-20}}{0.30 \times V_{dur}} \qquad VSL\ roc_{80-50} = \frac{VSL_{80-50}}{0.30 \times V_{dur}} \qquad TL\ roc = \frac{TL}{0.60 \times V_{dur}}$$

## RESULTS

### Statistical processing

- intra- and inter-dialectal comparison of the 36 vowels with linear mixed effect models
- fixed factor: *vowel*; random intercepts for *speaker*
- dependent variables: duration, F1 or F2 at 20%, 50%, 80%, TL

### Mergers

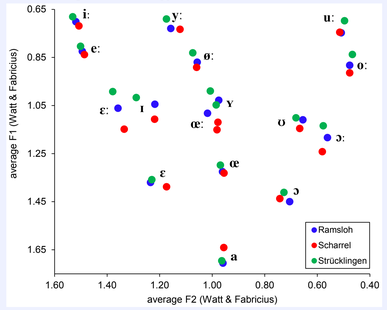
| | monophth. merged | diphthongs merged | vowels not elicited |
|---|---|---|---|
| **S** | /i̯-/iː/ /y̯-/yː/ /u̯-/uː/ | /ɪu̯w/-/iˑu̯w/ | /aː/ /yːi̯/, /uːi̯/ |
| **St** | /i̯-/iː/ /y̯-/yː/ /u̯-/uː/ | /ɪu̯w/-/iˑu̯w/ /ɪu̯w/-/iːu̯w/ | /yːi̯/, /uːi̯/ |
| **R** | /i̯-/iː/ /y̯-/yː/ /u̯-/uː/ | /ɪu̯w/-/iˑu̯w/ /iːu̯w/-/iˑu̯w/ /ɛu̯w/-/ɛːu̯w/ /oːi̯/-/ɔːi̯/ | /yːi̯/, /uːi̯/ |

### Comparison of means

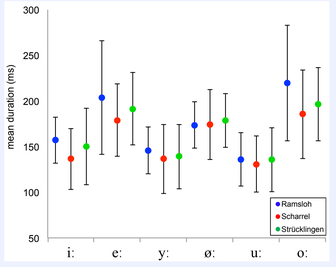
| | F1 50% |
|---|---|
| **all vowels** | St < S* |
| **monophth.** | St < S** |
| **front vowels** | St < S** |
| **back vowels** | St < S* |
| **close-mid** /ɛː œː ɔː ɪ ʏ ʊ/ | St < S*** R < S* |

S = Scharrel
St= Strücklingen
R = Ramsloh

### Monophthongs (F1 & F2 at 50%)




### Mean duration of closed vowels




### LDA analysis - vowel discrimination

| Monophthongs | Ramsloh | Scharrel | Strückl. |
|---|---|---|---|
| $F1_{50} + F2_{50}$ | 75,0 % | 82,8 % | 81,8 % |
| $F1_{20} + F2_{20} + F1_{80} + F2_{80}$ | 76,7 % | 81,4 % | 82,0 % |
| **$F1_{50} + F2_{50}$ + Vdur** | **86,1 %** | **92,1 %** | **91,4 %** |
| $F1_{20} + F2_{20} + F1_{80} + F2_{80}$ + Vdur | 85,7 % | 91,6 % | 91,6 % |
| $F1_{20} + F2_{20} + F1_{50} + F2_{50} + F1_{80} + F2_{80}$ | 82,0 % | 85,2 % | 85,5 % |
| $F1_{20} + F2_{20} + F1_{50} + F2_{50} + F1_{80} + F2_{80}$ + Vdur | 88,3 % | 93,3 % | 92,5 % |
| $F1_{20} + F2_{20} + F1_{50} + F2_{50} + F1_{80} + F2_{80}$ + Vdur + TL + TL roc | 88,2 % | 93,3 % | 93,0 % |
| **Diphthongs** | **Ramsloh** | **Scharrel** | **Strückl.** |
| $F1_{50} + F2_{50}$ | 66,8 % | 64,0 % | 66,5 % |
| $F1_{20} + F2_{20} + F1_{80} + F2_{80}$ | 82,9 % | 74,9 % | 80,1 % |
| $F1_{50} + F2_{50}$ + Vdur | 70,0 % | 66,4 % | 70,9 % |
| $F1_{20} + F2_{20} + F1_{80} + F2_{80}$ + Vdur | 86,1 % | 74,6 % | 81,6 % |
| **$F1_{20} + F2_{20} + F1_{50} + F2_{50} + F1_{80} + F2_{80}$** | **84,2 %** | **78,8 %** | **82,0 %** |
| $F1_{20} + F2_{20} + F1_{50} + F2_{50} + F1_{80} + F2_{80}$ + Vdur | 86,5 % | 78,1 % | 83,9 % |
| $F1_{20} + F2_{20} + F1_{50} + F2_{50} + F1_{80} + F2_{80}$ + Vdur + TL + TL roc | 85,8 % | 79,2 % | 83,5 % |

## CONCLUSION

**(1) Inventory & merger**
Complex inventory, however
- not the complete inventory was obtained
- short tense vowels have undergone a merger and become phonetic variants
- Ramsloh shows the overall highest number of merged categories

**(2) Acoustic dimensions for vowel distinction**
- Vowel duration and mid-vowel F1 and F2 rather than dynamic spectral features are used to disambiguate neighboring monophthongs.
- Saterland Frisian shows a tendency to exploit the phenomenon of intrinsic vowel duration as an enhancing factor for the distinction of neighboring categories within the upper part of the vowel space.

**(3) Regional variation**
- Perceived differences in speech rate are not mirrored by larger vowel durations in our data.
- In Scharrel monophthongs are more centralized in F1.

**REFERENCES: [1]** Fort, M. C. 2015. *Saterfriesisches Wörterbuch mit einer phonologischen und grammatischen Übersicht*. Hamburg: Buske. **[2]** Fort, M. C. 2004. Sprachkontakt im dreisprachigen Saterland. In: Munske, H. H. (ed), *Deutsch im Kontakt mit germanischen Sprachen*. Tübingen: Niemeyer, 77–98. **[3]** Kramer, P. 1982. *Kute Seelter Sproakleere.* Rhauderfehn: Ostendorp. **[4]** Siebs, Th. 1889. *Zur Geschichte der englisch-friesischen Sprache*. Reprint Wiesbaden: Sändig, 1966. **[5]** Sjölin, B. 1969. *Einführung in das Friesische*. Stuttgart: Metzler. **[6]** Tröster-Mutz, S. 2002. Untersuchungen zu Silbenschnitt und Vokallänge im Saterfriesischen. *Theorie des Lexikons*. Working Papers of the SFB 282, No. 120, 1–27. **[7]** Willkommen, D. 1991. *Sölring. Phonologie des Nordfriesischen Dialekts der Insel Sylt.* (= CO-Frisica XII). **[8]** Bussmann, K. S. 2004. *Diphthongs in Frisian. A comparative analysis of phonemic inventories past and present*. Heidelberg: Winter. **[9]** Clements, G. N., Ridouane, R. (2006). Distinctive feature enhancement: a review. In: Botinis, A.(ed), *Proc. of the ISCA Tutorial and Research Workshop on Experimental Linguistics* Athens, 97–100. **[10]** Nearey, T. M., Assmann, P. F. 1986. Modeling the role of vowel inherent spectral change in vowel identification. *J. Acoust. Soc. Am.* 80, 1297–1308. **[11]** Bohn, O.-S. 2004. How to organize a fairly large vowel inventory: The vowels of Fering (North Frisian). *Journal of the International Phonetic Association* 34, 161–173. **[12]** Fox, R. A., Jacewicz, E. 2009. Cross-dialectal variation in formant dynamics of American English vowels. *J. Acoust. Soc. Am.* 126, 2603–2618. **[13]** Jacewicz, E., Fox, R. A. 2013. Cross-dialectal differences in dynamic formant patterns in American English vowels. In: Morrisson, G. S., Assmann, P. F. (eds), *Vowel Inherent Spectral Change*. Berlin: Springer, 177–198. **[14]** Strange, W., Jenkins, J. J. 2013. Dynamic specification of coarticulated vowels: research chronology, theory, and hypotheses. In: Morrisson, G. S., Assmann, P. F. (eds), *Vowel Inherent Spectral Change*. Berlin: Springer, 87–115. **[15]** Fabricius, A. H., Watt, D., Johnson, D.E. 2009. A comparison of three speaker-intrinsic vowel formant frequency normalization algorithms for sociophonetics. *Language Variation and Change* 21, 413–35. **[16]** Flynn, N. 2011. Comparing vowel formant normalisation procedures. *York Working Papers in Linguistics (Series 2)* 11, 1–28. **ACKNOWLEDGEMENTS:** We would like to thank Darja Appelganz, Romina Bergmann, Dorothee Lenartz, and Nicole Mayer for labeling the recordings in Praat. The research reported in this paper has been funded by the *Deutsche Forschungsgemeinschaft* **(DFG)**, **grant number PE 793/2-1.**