Monolingual and trilingual production of Northern Standard German vowels

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Introduction – Background

  → cross-linguistic interactions suggest a common phonological space (cf. Bond, Stockmal & Markus 2006; Guion 2003; Flege 1995; Grosjean 1989)

• despite language-specific categories and near-monolingual-like performance effects of cross-linguistic interference in vowel productions (Guion 2003; MacLeod, Stoel-Gammon & Wassink 2009)
  → large-scale phonetic convergence in the context of regional bilingualism (Mayr, Morris, Mennen & Williams 2015; cf. Bullock and Gerfen 2004)
  → monolingual-like productions were observed in the languages that have the wider communicative range and larger speech community
Introduction – Trilingualism in Saterland

Heeringa et al. (2015): cross-linguistic comparison of vowel productions of Saterland trilinguals

→ Saterland Frisian (SF), Low German (LG), and Northern Standard German (NSG)

Main finding:

• no systematic differences between the two local languages (SF, LG), but between the two local languages and NSG, spoken by several millions of speakers in Northern Germany
Introduction – Motivation & Study Aim

Do the deviant realizations of NSG vowels point at an orientation towards the broader speech community of NSG?

Expansion of Heeringa et al. (2015):
→ studying the substrate effect of SF and LG on the standard language
→ comparison of the NSG vowel productions of the trilingual Saterland speakers reported in Heeringa et al. (2015) with monolingual speakers of NSG from Hanover – representing the wider speech community of Northern Germany
Scharrel: trilingual speakers (SF, LG, NSG)

Hanover: monolingual speakers (NSG)
Method

Speakers:
23 male speakers aged between 50-75 years
• 11 trilingual speakers (TRI)
• 12 monolingual speakers (MON)

Material:
• all 15 NSG monophthongs
Method – Recording Procedure

- monosyllabic /hVt/ context
- elicitation via rhymes in sequences of High German triggers followed by the /hVt/ target word
- sequences were presented in a controlled randomized order
- each sequence was presented three times per speaker
- falling intonation contour on /hVt/ target words
Method – Data Processing

Acoustic variables:
- vowel duration (ms)
  → absolute duration & duration ratio of long/tense vs. short/lax vowels
- vowel quality: F1, F2 at vowel midpoint (50%)

1) conversion of Hertz data to Bark scale (Traumüller 1990)
   \[ z = \left[ \frac{26.81}{1 + 1960/F_i} \right] - 0.53 \]
2) multiplication of Bark values with a speaker-specific k factor, derived by dividing one fixed subject’s average F3 \( (F_3 S_{median}) \) of the open vowel (/a/) by speaker j’s mean F3 \( (F_3 S_j) \).
   \[ k_j = \frac{\text{mean } F_3 S_{median}}{\text{mean } F_3 S_j} \]
Method – Statistical Processing

Linear mixed effects models in R with function lmer from lme4 package

<table>
<thead>
<tr>
<th>Full model (speaker group comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>dependent variables</td>
</tr>
<tr>
<td>fixed effects</td>
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<tr>
<td>random effects</td>
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<td></td>
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</tbody>
</table>

- backward elimination of non-significant effects of each full model using the step function of the lmerTest package
- all $p$-values were calculated using the Satterthwaite approximation in the lmerTest package
Results – Vowel Duration

- Clear separation between long and short vowels in both groups
- No general effects of speaker group
- Only individual long vowel categories are longer for MON than for TRI: /aː/ and /eː/
### Results – Duration Ratio

<table>
<thead>
<tr>
<th></th>
<th>ratio monoling.</th>
<th>ratio triling.</th>
<th>$\beta$</th>
<th>SE</th>
<th>$t$(df)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>aː - a</td>
<td>3.0</td>
<td>2.3</td>
<td>0.75</td>
<td>0.20</td>
<td>3.84(23)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>εː - ε</td>
<td>2.3</td>
<td>1.7</td>
<td>0.71</td>
<td>0.16</td>
<td>4.43(21)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>eː - ɛ</td>
<td>2.5</td>
<td>1.8</td>
<td>0.75</td>
<td>0.20</td>
<td>3.73(23)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>øː - œ</td>
<td>2.2</td>
<td>1.7</td>
<td>0.47</td>
<td>0.16</td>
<td>2.88(23)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>oː - Œ</td>
<td>2.3</td>
<td>1.7</td>
<td>0.57</td>
<td>0.17</td>
<td>3.32(23)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>iː - ï</td>
<td>2.5</td>
<td>1.9</td>
<td>0.56</td>
<td>0.21</td>
<td>2.70(23)</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>yː - ÿ</td>
<td>2.1</td>
<td>1.6</td>
<td>0.31</td>
<td>0.10</td>
<td>2.99(23)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>uː - ŋ</td>
<td>2.0</td>
<td>1.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>n.s.</td>
</tr>
<tr>
<td>mean</td>
<td>2.4</td>
<td>1.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

→ duration differences in phonological short/lax and long/tense oppositions are smaller for TRI than for MON
Results – Formant Frequencies
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[Graph showing formant frequencies with symbols for TRI_NS_G and MON_NS_G]
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Comparison with Heeringa et al. 2015

Heeringa et al. (2015)
- no differences between SF and LG; longest mean durations in NSG
  → effect most pronounced in long vowels

Present study
- mean long vowel duration of the MON exceeds all of the TRI values
- differences in the duration ratios are similar to the differences in absolute durations

MON_NSNG ≥ TRI_NSNG > TRI_LG/SF
Comparison with Heeringa et al. 2015
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Conclusion

NSG productions of trilinguals approach or are similar to productions of NSG monolinguals

- in F1/F2 for 10 of 14 categories
- in vowel duration, especially long vowels
- in vowel duration ratios

Comparison with results from prior studies:

- Monolingual-like vowel production is language with wider speech community? ✓
- Language-specific intermediate categories (Guion (2003) & hypothesis #6 of the SLM (Flege 1995))? ✓
- Contact-induced phonetic convergence (cf. Mayr et al. 2015)? ✓
THANK YOU


