

Ongoing sound changes in the Luxembourgish vowel system

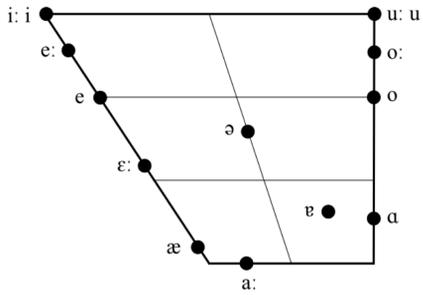
Peter Gilles, University of Luxembourg
Phonetik und Phonologie 17 - 2021, Frankfurt



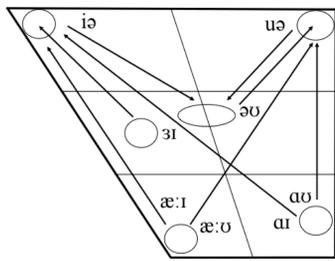
Background

- Low-research language Luxembourgish: mainly spoken, ~300k speakers
- Vowel system (Gilles 1999, Gilles/Trouvain 2013)
 - Lots of closed and open vowels; phonetically, mid vowels tend to raise or lower
 - 8 diphthongs /ai, au, æɪ, æɔ, ɔɪ, əʊ, iə, uə/

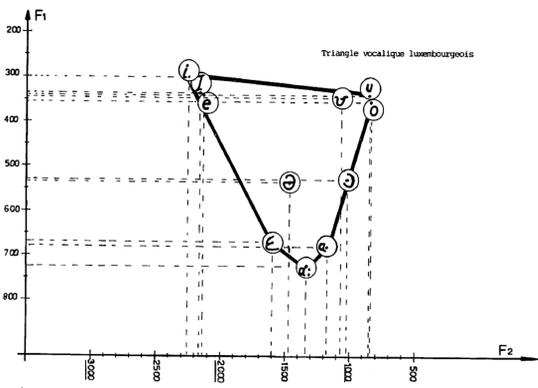
Monophthongs



Diphthongs



Keiser-Besch (1976)



Research questions

1. How to analyse and visualise *big data* for several hundreds of speakers reliably in a largely automated workflow?
2. Which are the trends in ongoing vocalic sound changes?

Data & methods

Data collection

- Crowd-sourcing with our smartphone application *Schnëssen - Är Sprooch fir d'Fuerschung* (since 2018) (Entringer et al. 2021)
- Intended to document and archive language variation (regional, social, language contact etc.) on a large scale
- Audio recordings of constructed sentence items, spontaneously translated from German or French into Luxembourgish
 - 'Die Flugzeuge von Luxair sind die neuesten in Europa.'
 - 'D'Fligere vun der Luxair sinn déi neisten an Europa.'
 - 'Je suis la seule à ne pas être en retard.'
 - 'Ech sinn dat eenzegt, dat net ze spëtt ass.'
- ~700 constructed items, 500 to 2500 speakers per item, ~300,000 recordings, 3 - 20 minutes recording/speaker
- Lots of speakers, sparse data <-> few speakers, lots of data

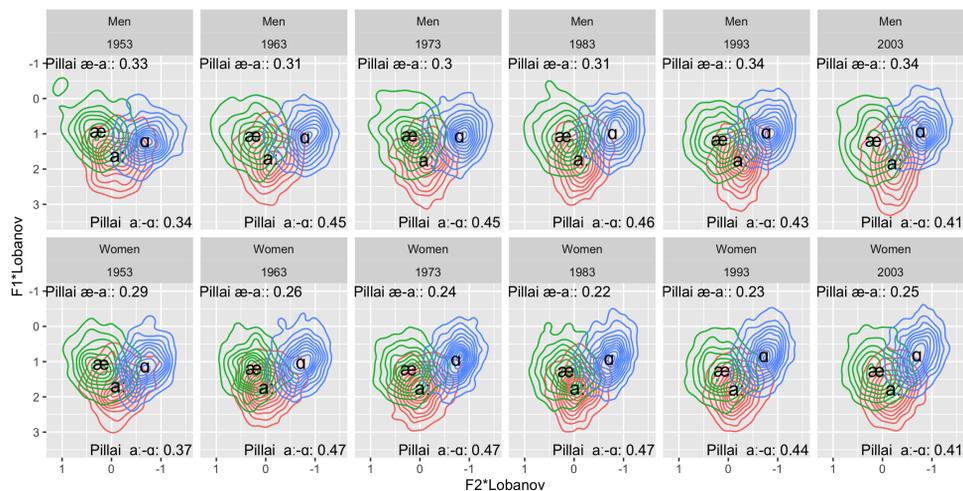
Data preparation

- Orthographical transcription
- G2P conversion
- Forced alignment with MAUS
- Creation of an EMU-SDMS database, managed with emuR (Winkelmann et al. 2017)
- Formant extraction with Praat (ceiling 5500 Hz for women, 5000 Hz for men)
- Stopword removal
- Filtering for implausible formant values
- No manual correction of segment boundaries or formant values!
- Formant normalisation with modified Lobanov formula (Brand et al. 2021)
- Corpus size: 115 sentences, 979 content words, 3194 speakers, 361,740 full vowels
- Statistical modelling with Generalised Additive Mixed Models (GAMMs) (Sóskuthy 2017, Wieling et al., 2018, Warren 2019, Brand et al. 2021)

Results

1. Distances and potential mergers for open vowels /æ, a, ɑ/

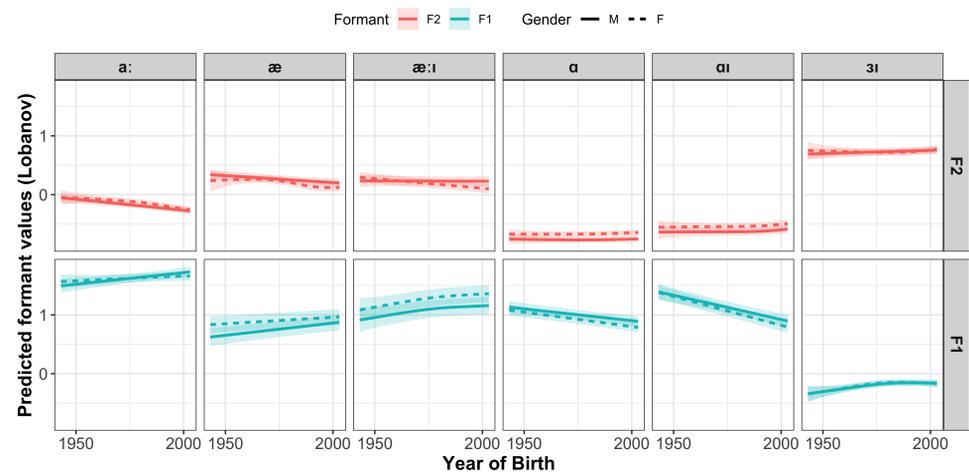
- Data: 1806 speakers, æ 17,263, a: 23,124, ɑ 26,831
- Density plot shows centers and overlapping peripheries
- Slight lowering of /æ/; raising of /ɑ/; /a:/ seems stable
- Using Pillai score to measure the degree of a vowel merger
 - 0 = complete merger, 1 = completely separated
 - Distance of /æ/ and /ɑ/ remains stable over time: partial merger
 - Decreasing Pillai score for /a:/ and /ɑ/ indicating further separation



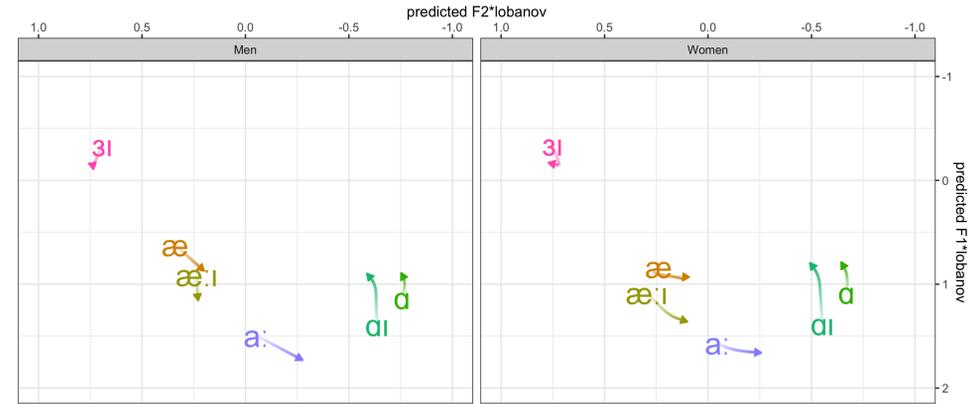
2. GAMM modelling of the co-variation

- Affected vowels: /æ, a, ɑ/, onsets of /æɪ, ai, ɔɪ/ (omitted: /au, əʊ/)

- Formants extracted at midpoints or diphthong onsets, respectively
- GAMM model (cf. Stanley 2020, Brand et al. 2021)
- Model based on 821 speakers, 14,417 a:, 15,659 ɑ, 11,918 æ, 4850 æɪ, 6299 ai, 8350 ɔɪ, 8 age groups with participants born between 1943 to 2013
 - mgcv::bam(F1_lobanov_2.0 ~ s(Decade, k=6, bs="cr", by=Gender) + s(Decade, k=6, bs="cr") + Gender + s(Speaker, bs="re") + s(Word, bs="re") # random effects
- Visualisation of predicted F1 and F2 values from GAMM



Trajectories of sound changes 1953-2013



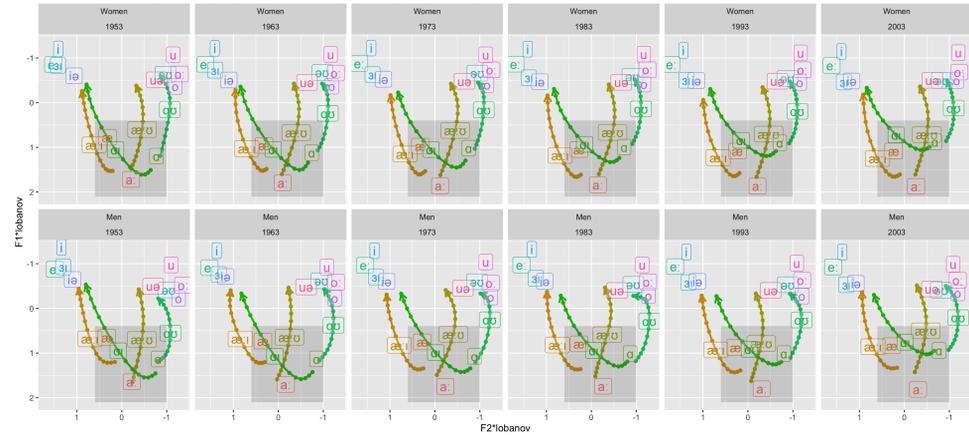
Indicator for a chain-shift of the low vowels

- Backing and lowering of /ɑ:/
 - Lowering and backing of /æ/ and /æɪ/
 - Switching height position with /ɑ/
 - No merger with /ɑ:/!
 - Raising of /a/ and /ai/
 - Chain-shift to close the large gap of the back vowels: /ɑ/ 'pulled' by /o, o:/
 - Slight lowering of onset of /ɔɪ/
- Women more advanced than men

3. Interaction with low starting diphthongs

- Onsets of /ai/ an /au/ identical with /a/
- Onset of /æɪ/ close to /æ/, however, onset of /æɔ/ closer to /ɑ/

Vowel charts for monophthongs (mid points) & low starting diphthongs (15-point trajectories)



Conclusion & future directions

- Fine-grained perspective for a substantial part of the population on how a sound change is travelling through time
- Chain-shift for low vowels clearly taking place
- Women leading the sound change
- TODOs
 - Improve segmentation & formant extraction
 - Take further factors into account: dialect region, educational level and duration
 - Reliability of Lobanov normalisation?

References

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