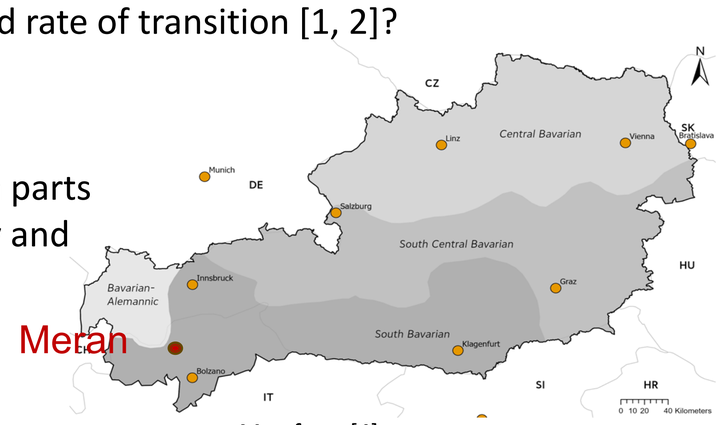
THE INNER COMPOSITION OF DIPHTHONGS: FIRST INSIGHTS FROM TYROLEAN

Marianne Pouplier[1], Aleese Block[1], Alessandro Vietti[2],
[1]Ludwig-Maximilians-Universität, Munich, Germany; [2]Free Univeristy Bozen-Bolzano, Italy

Background

Compositionality of diphthongs:
Combinations of independently available monophthongs or dynamic vowels, defined for onset and rate of transition [1, 2]?

Tyrolean is a South Bavarian dialect of German, spoken in parts of Austria and Northern Italy and is characterized by a rich diphthong inventory [3].



Map from [4]

14 contrastive monophthongs: /i-iː, e-eː, ɛ-ɛː, a-aː, u-uː, o-oː, ɒ-ɒː/
No quantity-quality difference for monophthongs.
9 diphthongs: /ai, au, ui, ia, ua, ɛa, ɒa, ei, ou/

Research approach:
- Relation diphthong **onset/offset frequencies** to monophthong inventory
- Comparing **variability** of diphthong onset, offset frequencies
- Analysis of **movement direction** in formant space

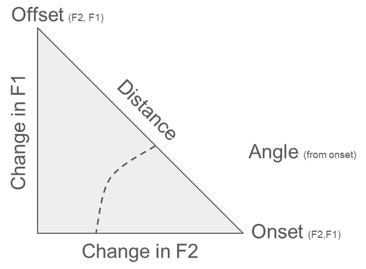
Recordings

Field recordings of **35 speakers** (22F, 13M, 20-86 years) in Meran.
Inventory recorded over 105 **real words in read speech**;
4-6 words per vowel.

Measurements:
- **F1, F2** [5] over 10% window centered at
  50% of vowel duration for monophthongs
  20, 80% of vowel duration for diphthongs
  Normalization by scaling to [0, 1] per speaker
- **Pillai** score
  to assess vowel category overlap in formants
  threshold for distinctness: > 0.3 [6]
- **Trajectory length:** Euclidean distance of normalized F1, F2

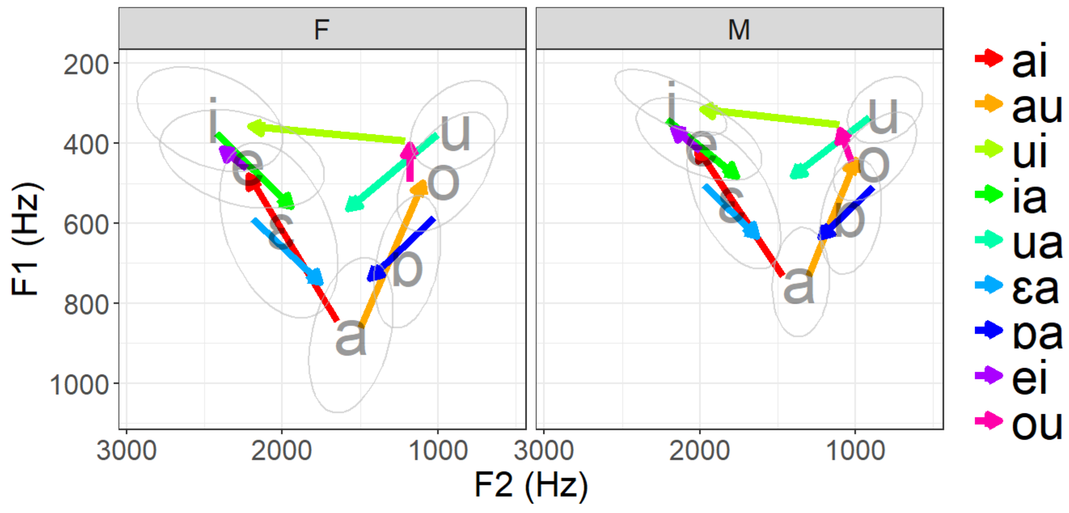
$$ED = \sqrt{\Delta F1_{norm}{}^2 + \Delta F2_{norm}{}^2}$$

- **Direction of movement**
  angle of change in the F1/F2 space toward the offset relative to the onset

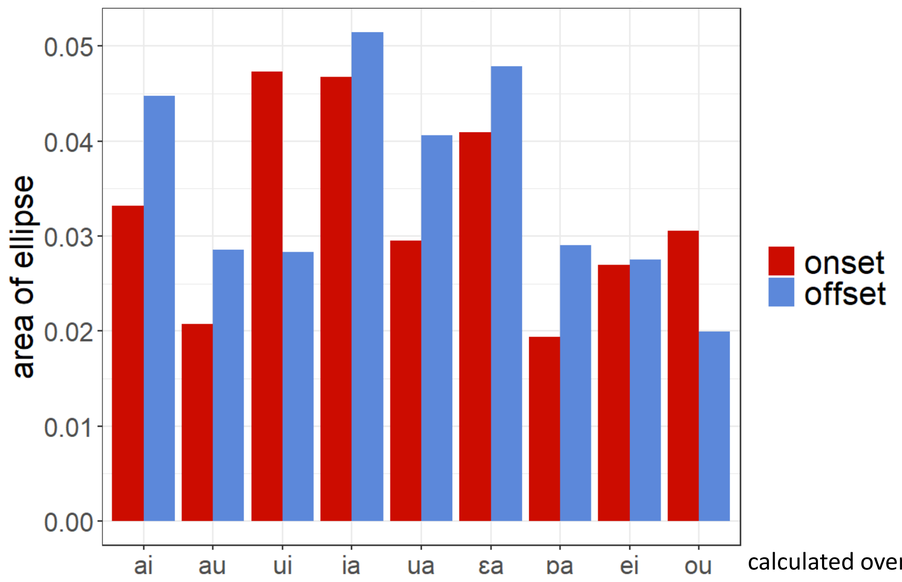


Results

Monophthong and diphthong inventory

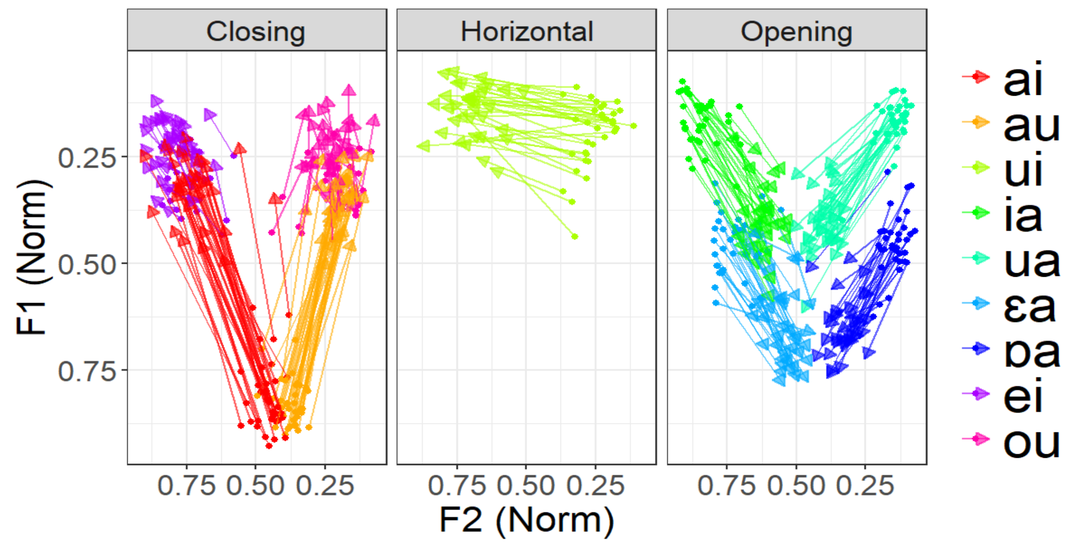


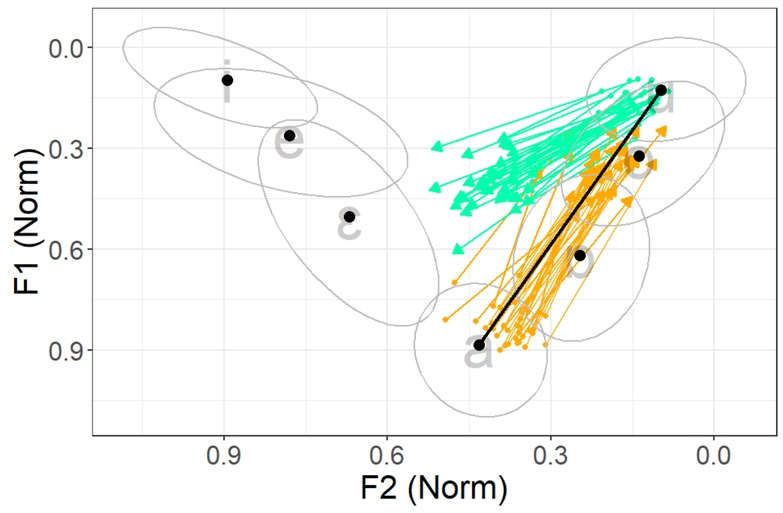
Onset – offset variability across speakers and items



calculated over normalized formants

Diphthongs by speaker





Direction of movement

For all diphthongs but /ei ou ua/, the movement angle does not differ significantly from the angle of a straight line connecting corresponding monophthongs.

Discussion

Relationship to monophthong inventory: Most diphthong onsets are close to what the transcriptions from the literature [3] suggest, but particularly offsets can undershoot their assumed target
- /ai, au/ are closer to /ae, ao/ based on the Pillai score
- /ia, ua/ are mid-centralizing (/iɛ, uə/ rather than wide-opening, and by no means symmetric with /ai, au/.

Onset/offset variability: There is little evidence for the onset being less variable than the offset across diphthong qualities.
Direction of movement: The direction of movement is in most cases statistically identical to the axis connecting the monophthong centroids, with the exception of the narrow diphthong /ei, ou/ and the mid-centralizing diphthong /ua/.

This means that the diphthong inventory of Tyrolean is closely related to the monophthong inventory, with the exception of /ua/.
Onset frequencies are well described by the monophthong inventory, offset differences mostly seem to arise from undershoot.
The direction of movement in formant space is generally similar to the axis of independently available monophthong. Exceptions are /ua, ei, ou/.

Acknowledgments & References

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