

*When is vowel reduction (not) about
predictability?*

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The problem

- A few ways to look at vowel reduction (whatever that is).
 - Vowel reduction **is driven by** prosodic strength: the further away from a prominent position, the more likely reduction is.
 - Vowel reduction **is a consequence of** predictability; the more predictable a segment is, the less information is lost if that segment is reduced.
 - Vowel reduction is just duration-driven undershoot in the vein of **Lindblom (1963)**, none of which precludes:
 - Vowel reduction **is a driver of / precursor to** sound change: all things being equal, the loss of information in the signal should promote reanalysis. This results in, for example, the phonologisation of vowel harmony (**Ohala 1994; Flemming 1997**); or, instead, the loss of it.
- All of this should be interesting to those of us concerned with the mechanisms by which phonological change takes place.

The problem

- Several versions of a connection between **vowel reduction** and **vowel harmony** have been drawn in the literature.
 - **Pearce (2008, 2012)** claims that vowel harmony (VH) in Kera (Chadic) blocks vowel reduction, with harmonic vowels resisting VR where non-harmonic vowels do not.
 - The **inverse** claim is made by **McCollum (2020)** for the Turkic language Kyrgyz:
 - In Kyrgyz, non-initial vowels are consistently more centralised than their initial-syllable counterparts.
 - **McCollum's** argument is that this is driven by *predictability*: since backness and rounding harmony entirely determine the quality of a vowel in a non-initial syllable, centralisation is minimally information-destroying and therefore favourable.
 - Both framings essentially assume that we can read causality off synchronic facts (/synchronic correlations between properties) in some way.

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In fact, there are plenty of explicit claims about the (directionality of the) diachronic relationship between vowel reduction and vowel harmony.

- On the one hand, if VR = predictability, and VH \Rightarrow predictability, then VH \Rightarrow VR; and even VH \Rightarrow VR \Rightarrow **harmony decay**.
 - McCollum (2020) claims exactly this, after Binnick (1991); McCollum (2019) finds larger reduction in Uzbek, which has lost VH almost entirely, than in Kyrgyz which retains it.
 - This link between phonetic reduction and the loss of harmony has been drawn for several cases (Binnick 1991; Shiraishi & Botma 2017; Li 1996); in essentially all of these, non-initial vowels \rightarrow /ə/, and as such the value of the harmonising feature is obscured.

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- At the same time, (coarticulation +) reduction have been implicated in the phonologisation of VH (Ohala 1994; Hyman 2002).
 - Especially left-to-right VH, according to Hyman.
- And there is no reason not to think that even after the instantiation of the **categorical, phonological process**, the **gradient phonetic reduction** that triggered phonologisation in the first place should be able to stick around (and see the *rule scattering* of Bermúdez-Otero 2007: 506, e.g.).

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- **And how do we disambiguate between these?** Recapitulates classic problems e.g. inheritance vs. parallel innovation. Or even more cheekily, where does diachrony end and synchrony begin?

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 - Establishing the parameters of synchronic typological variation: what is possible?
 - Developing a typology of **diachronic trajectories**: do outcomes correlate with synchronic patterning?

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 - Inheritance vs. contact vs. independent parallel innovation ...
- Obvious (?) but not always explicitly spelled out implications for causal inference about the relationship between P and Q writ large.

The Turkic languages



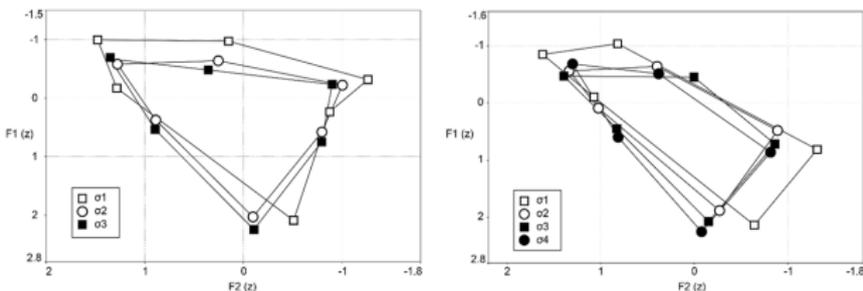
The languages under consideration.

The Turkic languages

- Well-known for generally robust backness harmony (save only Uzbek), and slightly-less-robust rounding harmony.
- Save the best-known members, not really that well-examined.
- **Centralisation** of the vowel space outside the initial syllable reported for several Turkic languages: Kyrgyz (McCollum 2020), Tatar (Conklin & Dmitrieva 2018), Uyghur (McCollum, Durvasula & Abudushalamu 2024), Sakha Chan & Kuang (2023); with or without attendant reports of harmony decay.

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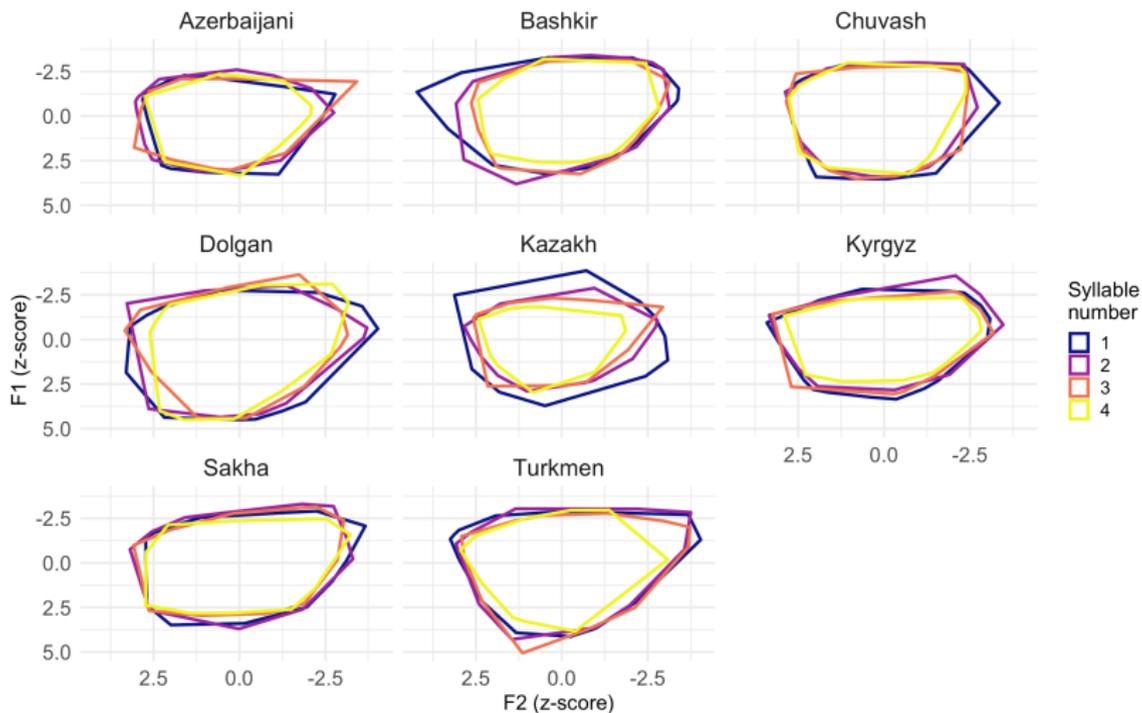
McCollum (2020): Vowel reduction in Kyrgyz.

The data

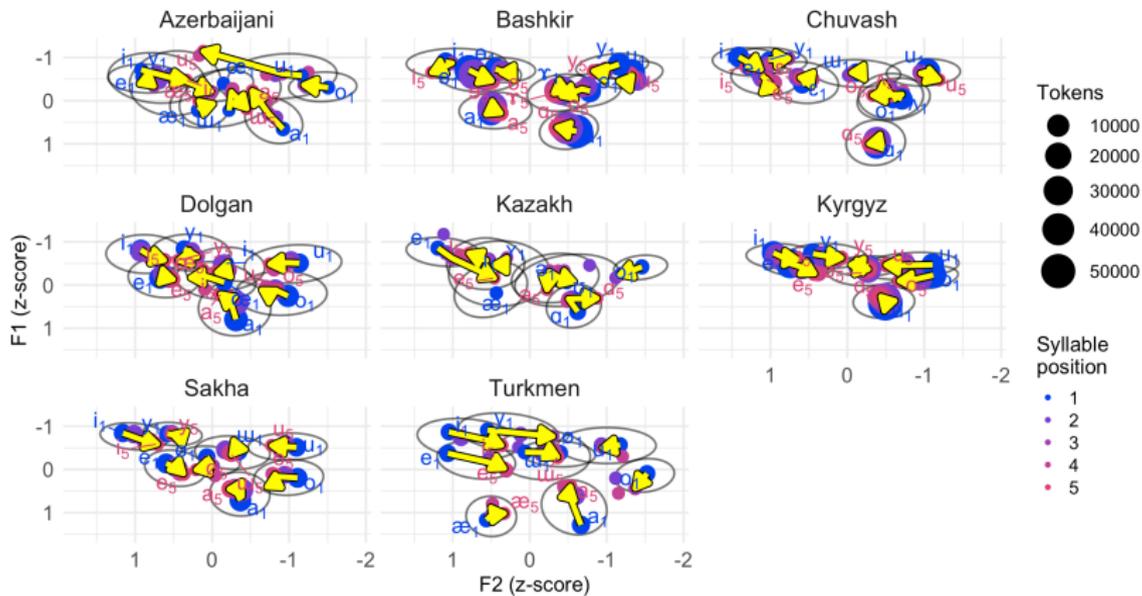
- We use two datasets:
 - 1,340,918 vowel tokens extracted from the ‘validated’ subsets of the Mozilla Common Voice corpora (Ardila, et al. 2020) of Azerbaijani (27 speakers, 2 hours), Bashkir (177 speakers, 230 hours), Chuvash (108 speakers, 120 hours), Kazakh (140 speakers, 2.2 hours), Kyrgyz (251 speakers, 35 hours), and Turkmen (70 speakers, 2.8 hours), and from the INEL corpus of Dolgan (48 speakers, 12 hours) (Däbritz, Kudryakova & Stapert 2022; Däbritz 2020), all segmented using the Montreal Forced Aligner.
 - 32,641 vowel tokens extracted from a ‘mini-corpus’ of read texts (2.5 hours total) collected by Károly (2022), covering 24 of the Turkic languages with one speaker each; for these data points, segmentation was manually-corrected.

The data

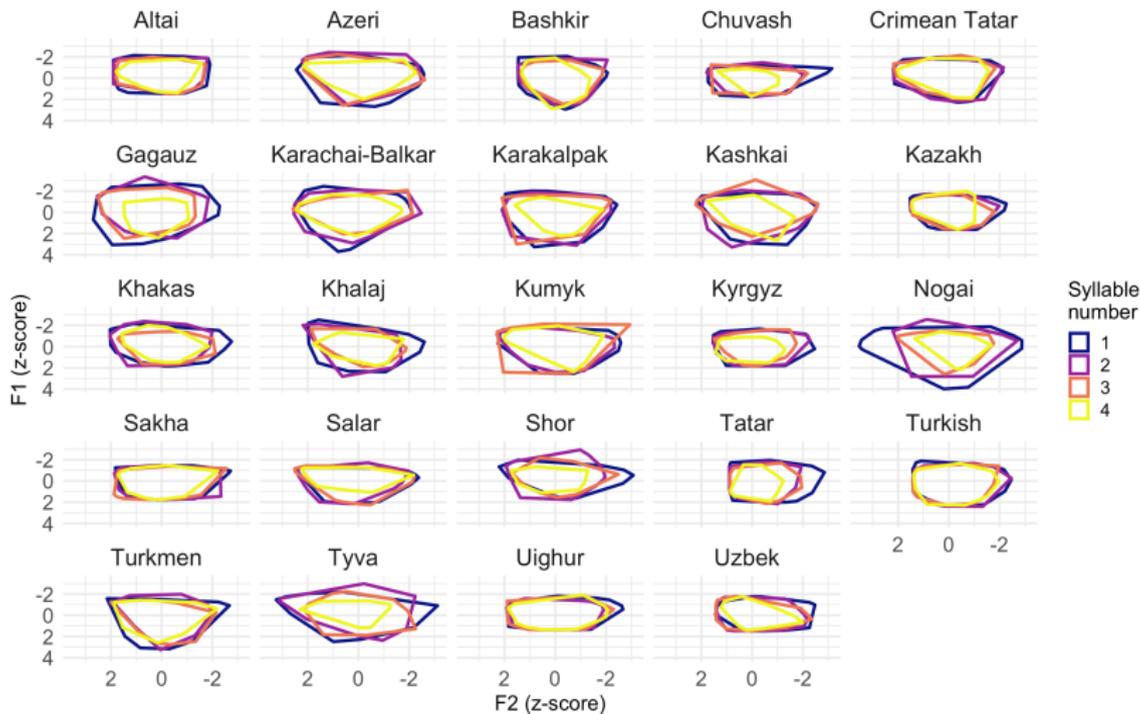
- For all data, F0, F1, F2, and F3 taken at three points (25%, 50%, 75%), and tokens coded for vowel type (phonemic length, rounding, fronting, and height), position within the word, and root vs. affix status where inferrable.



F1 \times F2 space for short monophthongs in 8 Turkic languages (Common Voice), showing polygons corresponding to the total spread of the data in each syllable.



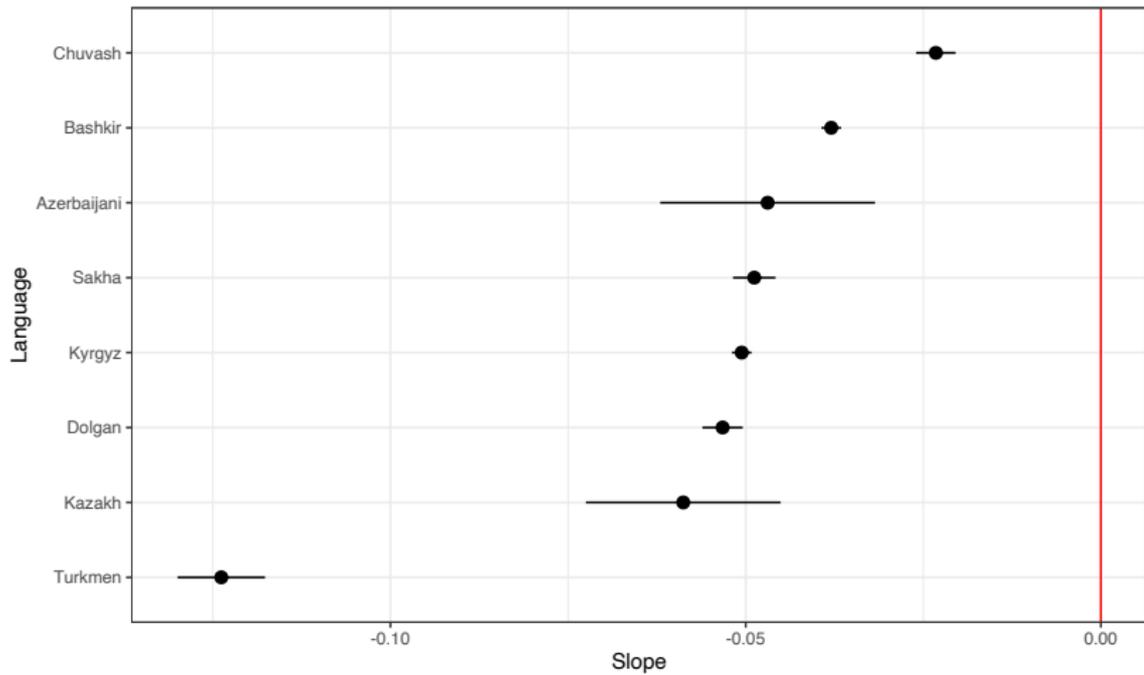
F1 × F2 space for short monophthongs in 8 Turkic languages (Common Voice), showing ellipses corresponding to 50% of the total spread of the data, and points corresponding to the median F1-F2 values by category and syllable number; arrows indicate the magnitude and direction of change in F1 × F2 space between syllables 1 and 5.

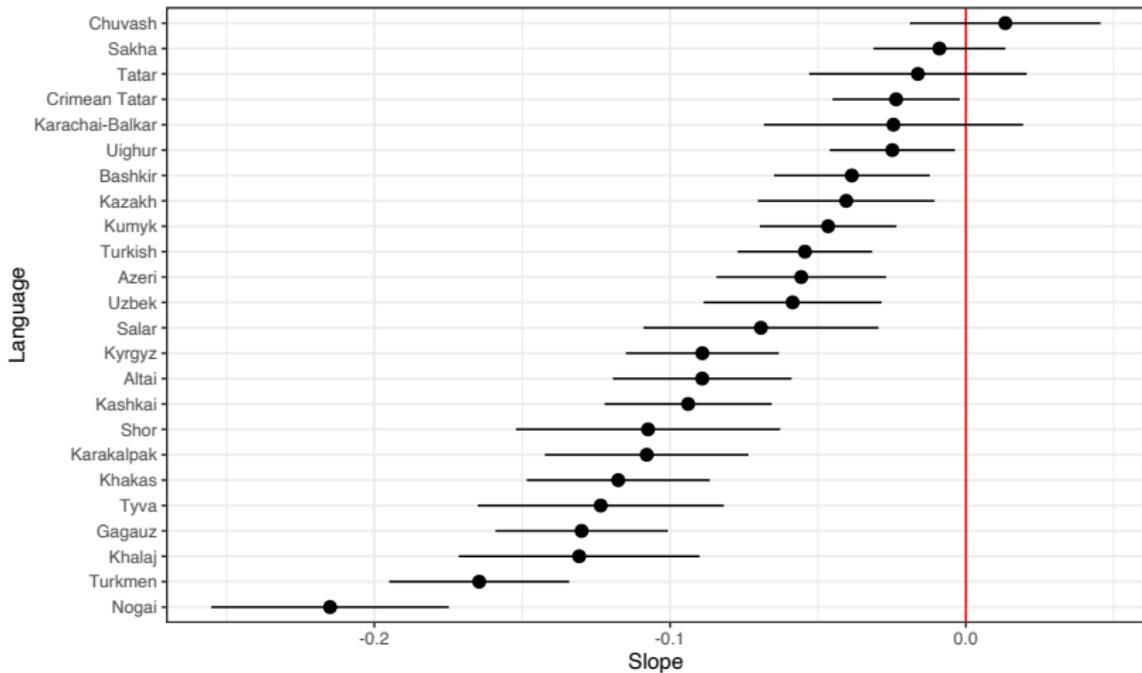


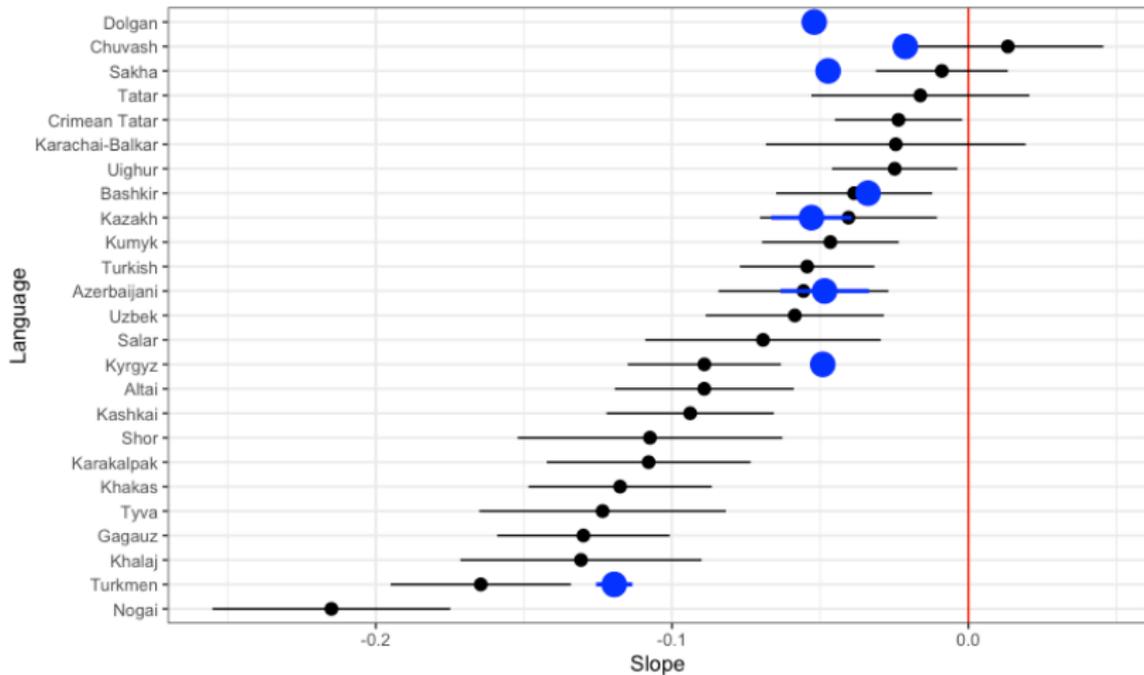
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- A quick and slightly dirty way to try to quantify ‘centralisation’:
 - For each language, a centroid was calculated as the speaker-weighted mean of (normalised) F1 and F2 across all vowel tokens in word-initial syllables; this represents the centre of the vowel space, under the presumption that syllable 1 contains the least reduced vowels. Euclidean distance then taken between the centroid and each token.
 - Two linear mixed-effects regressions were fit (one per corpus) predicting distance from the centroid as a function of syllable number, with vowel identity as a covariate. The models included random intercepts and slopes for language, and random intercepts for speaker for the Common Voice corpus (but not for the ‘mini-corpus’).
 - Slope sign corresponds to centralisation (negative slope \rightarrow distance from centre decreases rightward in the word), we hope.









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- If we want to claim that every one of these languages shows centralisation across the word, what does this mean for the **diagnostic value** of VR in these languages?
- VH is **mostly** stable across Turkic **despite** at least some VR
- A straightforward interpretation is that VR does not necessarily imply **harmony loss**
- Less clear what (if anything) this means for the **phonologisation** of harmony
- Tentatively, if reduction **postdates** Common Turkic, then harmony is not diachronically *contingent* on it

Быйан! Тәҗәккүр edirik! рәхмәт! Пысәк тав сана! сагъ олунъыз!
пасиба! Saa olunuz! Сау бол! Рахмет! اتشكور! Рақмет!
спасиба! Көп баракалла! Чоң рахмат! Бек савболынъыз!
Махтал! рәхмәт! Teşekkürler! Sagboluñ! Четтирдибис! رهمته!
Rahmat!

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