

## Are neutral roots in Uyghur really neutral? Experimental and structural evidence

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This study presents acoustic and structural evidence against a purported covert phonemic contrast in Uyghur, corroborating and expanding on results from McCollum (2021).

**Background.** Uyghur has a system of *backness harmony* that requires certain vowels and consonants in suffixes agree for the feature [back] with the final vowel of the root.

(1) /pul-GA/	→	[pul-ʌɑ]	'money-DAT'
(2) /øj-GA/	→	[øj-gæ]	'house-DAT'

Uyghur also has a pair of transparent vowels /i e/. These vowels have no phonemic back counterparts. They allow the [back] value of preceding vowels to 'pass through' them.

(3) /mæstjit-DA/	→	[mæstjit-tæ]	'mosque-LOC'
(4) /uniwersitet-DA/	→	[uniwersitet-tɑ]	'university-LOC'

A large class of roots in Uyghur contains no harmonizing segments. These roots tend to take back suffixes (5), but a minority of them take front suffixes (6).

(5) /sir-lAr/	→	[sir-lɑr]	'secret-PL'
/din-GA/	→	[din-ʌɑ]	'religion-DAT'
(6) /siz-GA/	→	[siz-gæ]	'you (formal)-DAT'
/bir-DA/	→	[bir-dæ]	'one-DAT'

There are two phonological analyses for these neutral roots. Previous work (Lindblad 1990, Hahn 1991) claims that the behavior of these roots is governed by a covert phonological contrast between /i-/ʌ/ and /e-/ɤ/ that is neutralized on the surface by a post-lexical fronting rule. A second possibility is that these roots are specified for backness at the lexical level: rather than attributing the idiosyncratic behavior of these roots to an underlying phonemic contrast, speakers simply memorize the idiosyncratic harmonizing behavior of certain roots.

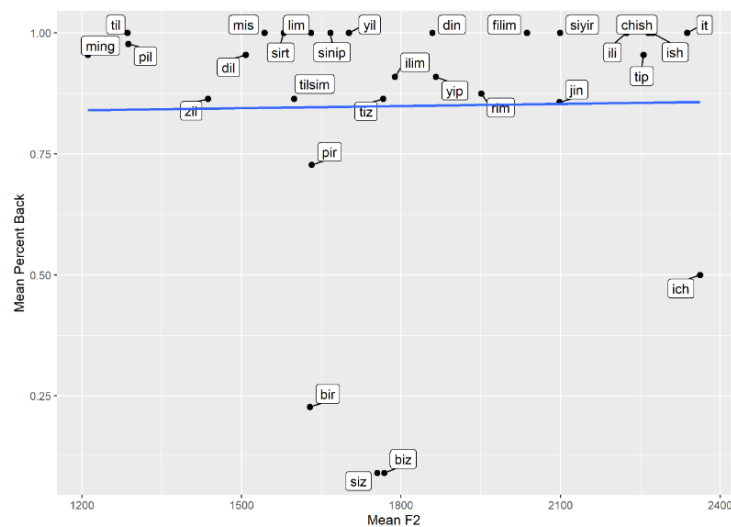
Although both analyses describe the pattern adequately, they locate the mechanism driving the behavior of such roots in different components of the grammar. The goal of the current study is to present experimental and structural evidence to differentiate between these hypotheses.

**Experimental study.** Hungarian vowel harmony also has transparent vowels and neutral roots. Benus & Gafos (2007) presented empirical evidence consistent with a covert contrast, noting that the vowels in front neutral roots are produced with a fronter tongue position than in back neutral roots, even though this difference is not acoustically measurable.

We look for similar phonetic evidence of a covert contrast in a study of 23 native Uyghur speakers living in Almaty, Kazakhstan. Speakers were recorded producing a set of 28 neutral

roots in both unsuffixed and dative-suffixed forms. In addition to audio recording, we also coded whether speakers chose the front or back form of the dative suffix.

We fit a linear mixed-effects model to the data, with vowel F2 as the dependent variable, and suffix choice (front vs. back), speaker gender, and place of articulation of the consonant following the vowel as independent variables. Random intercepts were used for each root and speaker. To avoid acoustic variation due to coarticulation with material in the suffix, only acoustic measurements from unsuffixed forms were used. Results show



that both speaker gender and the place of articulation of the following consonant were significant predictors of F2. Suffix choice, however, was not. The relationship between vowel F2 and suffix backness is shown in the figure on this page. These results indicate that there are no systematic acoustic contrasts in unsuffixed tokens between neutral roots that take front suffixes and those that take back suffixes. That this lack of acoustic contrast is due to quantal properties of the transparent vowels, as B&G suggest for Hungarian, is unlikely due to the degree of coarticulation they exhibit in other contexts (McCollum 2021).

**Structural evidence.** A second source of evidence against a covert phonemic contrast is the nonexistence of minimal pairs between underlying /i/-/u/ or /e/-/ɤ/: that is, pairs of roots that are surface homophones but differ in whether they take front or back suffixes. In fact, under a covert contrast analysis, the pairs /i/-/u/ and /e/-/ɤ/ both have a functional load of 0 (eliminating this contrast does not introduce any additional ambiguity into the language). Although phonemic contrasts with functional loads of 0 exist, such as /h/-/ŋ/ in English, the claim that such pairs are phonemes, rather than allophones, is based on their phonetic dissimilarity (e.g., Peperkamp et al. 2007). This consideration does not apply here.

**Conclusion.** These results support the claim that the harmonizing behavior of neutral roots in Uyghur is governed by lexical factors, rather than a covert phonological contrast. This evidence does not definitively rule out speakers intuiting a covert contrast, but it casts doubt on the parsimony and learnability of such an analysis. A lexical analysis also unifies the treatment of neutral roots in Uyghur with other cases of exceptionality in the harmony system (Mayer 2021).

**Benus S, Gafos A** (2006). Articulatory characteristics of Hungarian ‘transparent’ vowels. *J Phonetics*, 35, 271-300. **Hahn RF** (1991). *Spoken Uyghur*. Seattle, WA: University of Washington Press. **Lindblad VM** (1990). *Neutralization in Uyghur*. University of Washington. **Mayer C** (2021). *Issues in Uyghur backness harmony*. UCLA. **McCollum A** (2021). Transparency, locality, and contrast in Uyghur backness harmony. *J Assoc Lab Phon* 12(1), 10. **Peperkamp S et al.** (2006). The acquisition of allophonic rules. *Cognition*, 101, B31-41.