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## VOWEL HARMONY IN THE KIHNU VARIETY OF ESTONIAN: A CORPUS STUDY

**Abstract.** This paper investigates back/front vowel harmony in the Kihnu variety of Estonian. Data from the Estonian Dialect Corpus are analyzed to inform the description of harmony in this dialect, a phenomenon that has been understudied in the literature. Previously reported patterns of categorical harmony (/u/-/y/ and /ɑ/-/æ/ pairs) and transparency (/i/) are confirmed. However, the corpus provides insufficient direct evidence to either support or refute previous descriptions of the /o/-/ø/ pair as non-participatory. Subtleties of a relationship previously described as variable (/e/-/ɛ/ pair) are explored in more depth, with /e/ proposed as a second transparent vowel. Vowel harmony is also explored in Kihnu Estonian's rich inventory of diphthongs, with intra-syllabic harmony in diphthongs shown to occur at a similar rate to that of inter-syllabic harmony between monophthongs.

**Keywords:** Estonian dialects, Kihnu, corpus, vowel harmony.

### 1. Introduction

Vowel harmony (hereafter VH) in many of the world's languages has been quite well-studied (see general overviews in e.g. Archangeli, Pulleyblank 2007; Gafos, Dye 2011; van der Hulst, van de Weijer 1995; Krämer 2003; Rose, Walker 2011, and work specific to Finnic in e.g. Fejes 2021; Kiparsky, Pajusalu 2001; 2003; Ringen, Heinämäki 1999; Wiik 1988). Estonian is in the Finnic branch of the Uralic language family and comprises several dialects and distinct languages, each classified as either a Northern Estonian or a Southern Estonian variety.<sup>1</sup> The Southern varieties, and some Northern varieties such as Kihnu and Kodavere, have VH whereas the bulk of Northern varieties, including Standard Estonian,<sup>2</sup> do not (Kiparsky, Pajusalu 2001; 2003; Léonard 1993).<sup>3</sup>

<sup>1</sup> Southern Estonian (including Võro, Seto, Mulgi, and Tartu dialects) has recently come to be viewed as a separate language from Northern Estonian (Kallio 2014).

<sup>2</sup> Standard Estonian is a standardized institutional variety of Estonian, most similar to the Central dialect group (*keskmurre*) of Northern Estonian (<https://www.eki.ee/murded/kiiker>; <http://www.ethnologue.com>).

<sup>3</sup> The Votic language is considered to be even more closely related to Northern Estonian than Southern Estonian is (e.g. Kallio 2014), and it too has VH (Lauerma 1993).

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VH patterns in Estonian varieties have been described by Fejes (2021), Kiparsky and Pajusalu (2001; 2003), and Wiik (1988), among others. However, the Kihnu dialect, which also has VH, has been studied primarily through other sound-focused lenses; for example, by Asu, Lippus, Niit and Türk (2012), by Türk (2013), and by Türk, Asu, Lippus, and Niit (2016) on vowel acoustics, or by Asu and Salveste (2012) on intonation. Kihnu Estonian is a Northern Estonian dialect in the Insular dialect group (*saarte murre*). It is a minority dialect spoken by about 1300 people ([https://andmed.stat.ee/en/stat/rahvaloendus\\_\\_rel2011/](https://andmed.stat.ee/en/stat/rahvaloendus__rel2011/)), largely on the island of Kihnu. This paper aims to fill in some of the gaps in the literature on Kihnu Estonian VH (though cf. Help 1991; Wiik 1988), by analyzing data from the Estonian Dialect Corpus (<https://www.murre.ut.ee/mkweb/murdekorpus.html>; hereafter EDC), and to situate this dialect in the typology of Finnic languages in general.

### 1.1. Vowel inventories

Though the paper focuses primarily on Kihnu Estonian (KE), I will begin by also describing the vowel inventory and distribution of Standard Estonian (SE) for comparison, with reference to the existing literature. SE and KE are both Northern Estonian varieties and share the same vowel inventory /i, e, a, o, u, ɤ, æ, ø, y/.<sup>4</sup> Figure 1 illustrates the Estonian monophthongs, all of which also contrast for length.

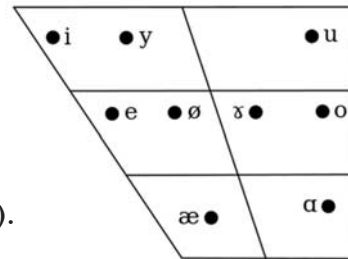


Figure 1. Estonian vowels (Asu, Teras 2009).

Due to VH having been preserved in KE but lost in SE, the two dialects differ in their distribution of these vowels (Asu, Lippus, Niit, Türk 2012; Asu, Teras 2009; Léonard 1993). SE restricts vowels in non-initial syllables of non-compound native words to the primary vowels /i, e, a, o, u/, with /o/ available only in proper names (Asu, Teras 2009), while the distribution of KE vowels is tied to VH and will be discussed in greater depth in Section 1.2.

Estonian has a rich inventory of diphthongs, and though the monophthong inventories are the same for KE and SE, their diphthong inventories are not. Diphthongs in SE restrict their second vowel to the same set as non-initial monophthongs, but otherwise most vowel combinations are attested as diphthongs in the standard dialect (see Table 1).

Diphthongs in KE, however, demonstrate more flexibility. Table 2 summarizes the diphthongs attested in the KE subset of the EDC; composition, frequency, and interaction with VH are discussed in more detail in Section 3.

<sup>4</sup> I use International Phonetic Alphabet (IPA) symbols to refer to vowels throughout, except when presenting an entire word from the EDC (or another source) in which it is recorded using the orthography, in which case I use the same orthography. Conversion from orthography to IPA is defined in Section 2.

Table 1

Diphthongs occurring in SE (Asu, Teras 2009)  
 (The second member must be a primary vowel;  
 entries in parentheses occur only in loanwords)

		V <sub>2</sub>								
		i	e	ɑ	o	u	ɤ	æ	ø	y
V <sub>1</sub>	i		(ie)	(ia)	(io)	iu	–	–	–	–
	e	ei		ea	eo	(eu)	–	–	–	–
	ɑ	ai	ae		ao	au	–	–	–	–
	o	oi	oe	oa		ou	–	–	–	–
	u	ui	(ue)	(ua)	uo		–	–	–	–
	ɤ	ɤi	ɤe	ɤɑ	ɤo	ɤu		–	–	–
	æ	æi	æe	–	æo	æu	–		–	–
	ø	øi	øe	øɑ	–	–	–	–		–
	y	yi	(ye)	(ya)	(yo)	–	–	–	–	

Table 2

KE diphthongs occurring in the EDC  
 The four rightmost columns contain secondary vowels,  
 which never appear as the second member of a SE diphthong (Asu, Teras 2009)

		V <sub>2</sub>								
		i	e	ɑ	o	u	ɤ	æ	ø	y
V <sub>1</sub>	i		ie	ia	io	iu	iɤ	iæ	–	–
	e	ei		ea	eo	eu	–	eæ	–	ey
	ɑ	ai	ae		ao	au	ɑɤ	–	–	–
	o	oi	oe	oa		ou	oɤ	–	–	–
	u	ui	ue	ua	uo		uɤ	uæ	–	–
	ɤ	ɤi	ɤe	ɤɑ	ɤo	ɤu		–	–	ɤy
	æ	æi	æe	æɑ	æo	æu	–		æø	æy
	ø	øi	–	–	–	øu	–	–		øy
	y	yi	ye	–	–	–	–	–	yø	

1.2. Vowel harmony in Kihnu Estonian

KE is not subject to the positional restrictions of SE. Rather, it is described as having progressive back/front (that is, [±back]) VH, with the vowel inventory partitioned into [+back] segments /ɑ, o, u, ɤ/ and [–back] segments /i, e, æ, ø, y/. The small body of existing work on VH in KE (e.g. Help 1991; Wiik 1988) describes the dialect as having /u/-/y/ and /ɑ/-/æ/ (but not /o/-/ø/) harmony, with /i/ being neutral and transparent, and the /e/-/ɤ/ pair participating somewhat variably. (1) illustrates five examples of [±back] harmony in KE drawn from Sang (2009 : 810), along with their SE cognates. In (1a–1b) the KE forms are different from their SE counterparts, since in these SE forms the restrictions on non-initial vowels result in disharmony. In (1c–1e), however, the KE forms and the SE forms are identical; note that in (1e) transparent /i/ co-occurs with /u/ even though they have different values of [back].

(1) Examples of VH in KE (from Sang 2009 and EDC), compared with SE cognates:

	KE word	KE vowels	Gloss	SE word	SE vowels
(a)	<i>panõ</i>	ɑ..ɤ	put.SG.IMP	<i>pane</i>	ɑ..e
(b)	<i>segä</i>	e..æ	mix.SG.IMP	<i>sega</i>	e..ɑ
(c)	<i>sõtku</i>	ɤ..u	knead.SG.IMP	<i>sõtku</i>	ɤ..u
(d)	<i>talü</i>	ɑ..u	farm.SG.NOM	<i>talü</i>	ɑ..u
(e)	<i>ilus</i>	i..u	beautiful.SG.NOM	<i>ilus</i>	i..u

Not only is there very little existing work on VH in KE, it is also the case that the behaviour of diphthongs in VH systems in general has been a rather neglected topic in the theoretical literature. In particular, no analysis has been offered (other than Sang's work (2009) on the interaction of VH, palatalization, and metathesis in KE) regarding how diphthongs may or may not be involved in KE VH. Examining the intersection of VH, diphthongs, and KE therefore has potentially significant implications for all three of these topics, and this paper has precisely this investigation at its heart.

In order to probe in more detail the subtleties of KE VH in monophthongs, as well as how diphthongs are involved, I leverage data from the Estonian Dialect Corpus (EDC. <https://www.murre.ut.ee/mkweb/murdekorpus.html>) to answer the following questions:

- Q1. How categorical is [ $\pm$ back] harmony in KE?
- Q2. To what extent are /i/ and /e/ transparent to VH?
- Q3. How do diphthongs participate in VH, both intra- and inter-syllabically?

Following these investigations, I will also take a step back to explore how KE's VH patterns compare to those in other Finnic varieties.

## 2. Corpus characteristics of KE vowel harmony

The characterization of KE VH that I provide is based on data from the EDC. The EDC comprises a total of over 1.2 million words transcribed from spontaneous speech of native Estonian speakers recorded between 1938 and 1996. Speaker dialects are identified via dialect group, dialect, and parish. The transcriptions in the original version of the corpus were made phonetically, using traditional Finno-Ugric phonetic transcription. These were converted to simplified text (orthographic) transcriptions for the publicly available version of the corpus, which is the one I refer to herein. Though each entry in the EDC is recorded orthographically, I have presented vowels in International Phonetic Alphabet (IPA) symbols in various examples throughout the paper. I used the following conversions, which preserve the salient features of each vowel (most crucially backness, but also height and rounding):

<i>i</i> → /i/	<i>ü</i> → /i/	<i>u</i> → /u/
	<i>ö</i> → /ø/	<i>o</i> → /o/
	<i>e</i> → /e/	<i>õ</i> → /ɤ/
	<i>ä</i> → /æ/	<i>a</i> → /ɑ/

As with any text-based representation of speech data, the accuracy of each entry may be affected by anything from the degree of narrowness attempted, to the quality of the recordings (made over a long period of time, some likely

outside of a laboratory), to auditory-perceptual errors on the part of the researchers transcribing the data. As well, any individual utterance may be affected by coarticulation or connected-speech processes. Low-level variation and noise will, to some degree, be an inherent part of the data that any such corpus contains.

The KE subset of the corpus was extracted by restricting entries to those from the Insular dialect group, Kihnu dialect. This subset includes 21,599 word tokens which have been reduced to 4,780 types;<sup>5</sup> this is the set of forms that my investigations explore and that I will refer to as EDC-KE. Words identified as compound (segmented by a '+' symbol in the corpus) had their single-root components considered separately, as individual words. The corpus data have been processed to identify the vowels in each word (both monophthongs and diphthongs) which inform the descriptions herein, though note that diphthong components of three-vowel sequences such as *aea* in *maead* 'houses' (corresponds to SE *majad*) have been excluded.

As mentioned in Section 1.2, KE is described as having back/front VH triggered by the vowel in the first (stressed) syllable, with alternating pairs /*ɑ*/-/*æ*/ and /*u*/-/*y*/ (but not /*o*/-/*ø*/), variable alternation of the pair /*e*/-/*ɤ*/, and one neutral (transparent) vowel, /*i*/. In this section, I present evidence from EDC-KE to address questions Q1 and Q2 above. The tables in sections 2.1 through 2.4 summarize various slices of monophthong-based corpus data which is presented in its entirety in Table 23 (see Appendix A). Monophthong length is contrastive, but ignored for the purposes of these summaries; that is, *padi* (pillow.SG.NOM) and *paadi* (boat.SG.GEN) are considered to contain the same vowel sequence (bigram).

## 2.1. Categorical harmony behaviour of /*u*/-/*y*/ and /*ɑ*/-/*æ*/

The high (/*u*/-/*y*/) and low (/*ɑ*/-/*æ*/) back/front pairs demonstrate very consistent harmony behaviour. First, I consider monophthong bigrams not including /*i*/, from anywhere in the word, containing at least one of /*y*, *u*, *æ*, *ɑ*/; see (2) and (3).

(2) Back harmonic words containing /*u*, *ɑ*/ (KE from EDC-KE; SE from the author):

	KE word	KE vowels	Gloss	SE word	SE vowels
(a)	<i>murõ</i>	u..ɤ	worry.SG.NOM	<i>mure</i>	u..e
(b)	<i>vanõm</i>	ɑ..ɤ	old.SG.CMPR	<i>vanem</i>	ɑ..e
(c)	<i>puhast</i>	u..ɑ	clean.SG.PART	<i>puhast</i>	u..ɑ
(d)	<i>magas</i>	ɑ..ɑ	sleep.3SG.PST	<i>magas</i>	ɑ..ɑ
(e)	<i>tantsud</i>	ɑ..u	dance.PL.NOM	<i>tantsud</i>	ɑ..u

(3) Front harmonic words containing /*y*, *æ*/ (KE from EDC-KE; SE from the author):

	KE word	KE vowels	Gloss	SE word	SE vowels
(a)	<i>emä</i>	e..æ	mother.SG.NOM	<i>ema</i>	e..ɑ
(b)	<i>Pärnü</i>	æ..y	Pärnu.SG.NOM	<i>Pärnu</i>	æ..u
(c)	<i>südä</i>	y..æ	heart.SG.NOM	<i>süda</i>	y..ɑ
(d)	<i>üle</i>	y..e	over	<i>üle</i>	y..e
(e)	<i>ühes</i>	y..e	one.SG.INE	<i>ühes</i>	y..e

<sup>5</sup> Tokens are reduced to types by eliminating repetitions of the exact same word form.

Table 3 summarizes the number of bigrams *s t a r t i n g* with each of these vowels, ending with either a vowel in the back harmonic set or a vowel in the front harmonic set. Table 4, on the other hand, summarizes the number of bigrams *e n d i n g* with each of these vowels. In both tables, cells whose values are displayed in boldface fit the expected harmony pattern whereas those in plain text do not. Values marked with an asterisk are counted as even lower (and therefore the rate of harmony even higher) if it is supposed that /e/ can be transparent; this will be discussed in Section 2.4.

Table 3

**High rounded and low unrounded vowels as V<sub>1</sub> in a monophthong bigram**

V <sub>1</sub>	V <sub>2</sub> ∈ back /u, o, α, ʏ/	V <sub>2</sub> ∈ front /y, ø, æ, e/	Rate of harmony (%)
y	8	<b>146</b>	94.8
u	<b>412</b>	28*	93.6
æ	25	<b>248</b>	90.8
α	<b>950</b>	65*	93.6

With rates of harmony consistently over 90% when a high rounded or low unrounded vowel appears in a monophthong bigram, EDC-KE demonstrates clear support of the claim that harmony involving these vowels is categorical. As for the disharmony rate (between 1.1% and 9.2%, depending on the particular form of bigram), this can be partly attributed to the noise described in Section 2; however, Section 2.4 addresses the issue of /e/-/ʏ/ variability, which also contributes to the disharmony rate as measured here.

Table 4

**High rounded and low unrounded vowels as V<sub>2</sub> in a monophthong bigram**

V <sub>1</sub> ∈ back /u, o, α, ʏ/	V <sub>1</sub> ∈ front /y, ø, æ, e/	V <sub>2</sub>	Rate of harmony (%)
1	<b>50</b>	y	98.0
<b>363</b>	22*	u	94.3
4	<b>350</b>	æ	98.9
<b>1026</b>	82*	α	92.6

## 2.2. Non-participation of /o/-/ø/ in harmony

As mentioned above, members of the /o/-/ø/ pair are typically not viewed as active targets in KE VH, though they do act as initial-syllable triggers of harmony just as /α/-/æ/ and /u/-/y/ do. If this were the case, then we should expect to see harmonic bigrams with initial /o/ or /ø/ (such as o..{o, α, u, ʏ} and ø..{ø, æ, y, e}). There is some evidence for these types of patterns in EDC-KE; see (4) and (5). However, if /o/ and /ø/ resist being targets in KE vowel harmony, then we should also expect to see disharmonic bigrams with subsequent /o/ or /ø/ (such as {o, α, u, ʏ}..ø and {ø, æ, y, e}..o); there is less evidence for these kinds of patterns in EDC-KE. There are six word types that contain [-back]..o bigrams (e.g. *peregond* 'family.SG.NOM') but these do not provide strong support for the idea that /o/ and /ø/ are not good targets. There are two reasons for this: first, all six of the examples happen to be either loanwords or compounds, and second, even if this were not the case, I present in Section 2.4 an argument for variable transparency of /e/, which could render e..[+back] bigrams moot.

(4) Back harmonic words with initial-syllable /o/ (KE from EDC-KE; SE from the author):

	KE word	KE vowels	Gloss	SE word	SE vowels
(a)	<i>olõmõ</i>	o..ɣ..ɣ	be.1PL.PRES	<i>oleme</i>	o..e..e
(b)	<i>kodo</i>	o..o	home.SG.NOM	<i>kodu</i>	o..u
(c)	<i>rohod</i>	o..o	medicine.PL.NOM	<i>rohud</i>	o..u
(d)	<i>kopsu</i>	o..u	lung.SG.GEN	<i>kopsu</i>	o..u
(e)	<i>omaga</i>	o..a..a	own.SG.COM	<i>omaga</i>	o..a..a

(5) Front harmonic words with initial-syllable /ø/ (KE from EDC-KE; SE from the author):

	KE word	KE vowels	Gloss	SE word	SE vowels
(a)	<i>tööle</i>	ø::..e	work.SG.ALL	<i>tööle</i>	ø::..e

Certainly, Tables 5 and 6 show clearly that the data contained in EDC-KE provide very few opportunities for /ø/ to be involved in harmony in any way. But it is also worth highlighting the fact that /o/, whether as the first or the second element of a monophthong bigram, is not often found co-occurring with front vowels.<sup>6</sup>

Table 5

Mid rounded vowels as V<sub>1</sub> in a monophthong bigram

V <sub>1</sub>	V <sub>2</sub> ∈ back /u, o, a, ɣ/	V <sub>2</sub> ∈ front /y, ø, æ, e/	Rate of harmony (%)
ø	2	3	n/a (N = 5)
o	200	27*	88.1

Table 6

Mid rounded vowels as V<sub>2</sub> in a monophthong bigram

V <sub>1</sub> ∈ back /u, o, a, ɣ/	V <sub>1</sub> ∈ front /y, ø, æ, e/	V <sub>2</sub>	Rate of harmony (%)
0	0	ø	n/a
34	6*	o	85.0

Given the dearth of evidence in the EDC-KE that could further illuminate this investigation, I am grateful to an anonymous reviewer who suggests that there is in fact evidence in KE for ö-harmony, and recommends "Kihnu sõnaraamat" (2016; <http://www.eki.ee/dict/kihnu/>) as an additional source for ö-harmonic KE words; for example, *köhömä* (cough.INF), *lõrsõne* (sloppy.SG.NOM), and *pögö* (fool.SG.NOM). These examples demonstrate that a more systematic, dictionary-based approach could inform conclusions about the mid-rounded vowels that the EDC-KE is simply not able to support. Further investigations using this resource would require searches for harmonic bigrams not only of types ø..ø and o..o, but also those of type {a, u, ɣ}..o or {æ, y}..ø, the results for all four of which would be compared to search results for disharmonic bigrams of types {a, u, ɣ}..ø and {æ, y}..o.

<sup>6</sup> Mid rounded vowels (particularly /o/) occur in non-initial syllables of KE words even though they are uncommon in those positions in SE (e.g. KE *kodo* vs SE *kodu* 'home.SG.NOM'). This is potentially due to a \*u, \*o > \*u merger in non-initial syllables of Proto-Finnic. Both are back vowels and therefore it is not important for our purposes which one surfaces. However, interested readers may refer to Kettunen 1962 and Mattsson 2021 for further historical discussion.

### 2.3. Transparency of /i/

The high front vowel /i/ has no corresponding back vowel in the Estonian inventory. Such vowels are often neutral in VH languages; here /i/ is neutral and transparent to KE VH. To begin with, Tables 7 and 8 show that /i/ does not demonstrate the same tendency to co-occur with a particular set (whether front or back) of vowels as the vowels in Sections 2.1 and 2.2 do.

Table 7

#### /i/ as V<sub>1</sub> in a monophthong bigram

V <sub>1</sub>	V <sub>2</sub> ∈ back /u, o, a, ʏ/	V <sub>2</sub> ∈ front /y, ø, æ, e/	Rate of harmony (%)
i	358	277	43.6

Table 8

#### /i/ as V<sub>2</sub> in a monophthong bigram

V <sub>1</sub> ∈ back /u, o, a, ʏ/	V <sub>1</sub> ∈ front /y, ø, æ, e/	V <sub>2</sub>	Rate of harmony (%)
627	250	i	28.5

(6) and (7) contain words with /i/-medial trigrams flanked by either two back or two front vowels. These support the idea that the KE forms harmonize across the /i/, with the potential to produce forms whose SE cognates are not harmonic. Note also that some of these example forms involve suffixes that can be seen to alternate according to VH, such as first person plural *-me* ~ *-mõ* (6c, 7c, 7e), adjective-forming *-ine* ~ *-inõ*, (6a, 6b, 7b) and comitative *-gä* ~ *-ga* (6e, 7d).

(6) Back harmonic words containing a trigram with medial /i/ (KE from EDC-KE; SE from the author):

KE word	KE vowels	Gloss	SE word	SE vowels
(a) <i>rohõlinõ</i>	o..ʏ..i..ɤ	green.SG.NOM(grass-like)	<i>roheline</i>	o..e..i..e
(b) <i>tulinõ</i>	u..i..ɤ	hot.SG.NOM(fire-like)	<i>tuline</i>	u..i..e
(c) <i>olimõ</i>	o..i..ɤ	be.1PL.PST	<i>olime</i>	o..i..e
(d) <i>kuninga</i>	u..i..a	king.SG.GEN	<i>kuninga</i>	u..i..a
(e) <i>mõrsiga</i>	ɤ..i..a	string-bag.SG.COM	<i>mõrsiga</i>	ɤ..i..a
(f) <i>korista</i>	o..i..a	clean.SG.IMP	<i>korista</i>	o..i..a

(7) Front harmonic words containing a trigram with medial /i/ (KE from EDC-KE; SE from the author):

KE word	KE vowels	Gloss	SE word	SE vowels
(a) <i>tegiä</i>	e..i..æ	doer.SG.NOM	<i>tegiä</i>	e..i..a
(b) <i>nädäline</i>	æ..æ..i..e	weekly.SG.NOM(week-like)	<i>nädäline</i>	æ..a..i..e
(c) <i>eläsime</i>	e..æ..i..e	live.1PL.PST	<i>elasime</i>	e..a..i..e
(d) <i>värvigä</i>	æ..i..æ	colour.SG.COM	<i>värvigä</i>	æ..i..a
(e) <i>nägime</i>	æ..i..e	see.1PL.PST	<i>nägime</i>	æ..i..e

There are 248 trigrams occurring in EDC-KE that have /i/ as their medial vowel (and only their medial vowel). The rate of harmony across such medial /i/s (see Table 9) is not quite as high as for the vowel pairs in Section 2.1; however, it is still consistent enough to be worth noting.



Table 9

<b>/i/-medial monophthong trigrams</b>			
$V_1$	$V_3 \in$ back /u, o, a, $\gamma$ /	$V_3 \in$ front /y, ø, æ, e/	Rate of harmony (%)
back /u, o, a, $\gamma$ /	<b>146</b>	35	80.7
front /y, ø, æ, e/	17	<b>50</b>	74.6

Furthermore, if we consider all 4,663 monophthong pairs in EDC-KE under the assumption that /i/ is (a) a harmonic vowel that must pattern with other front vowels in order to satisfy harmony vs (b) a transparent vowel that satisfies harmony no matter the backness of its neighbouring vowel, then it is clear from Table 10 that assumption (b) addresses many of the apparent disharmonies and brings the rate of harmony up to a similar level as shown for the high and low vowels in Section 2.1.

Table 10

**Proportion of harmony between monophthong bigrams under two different assumptions about the role of /i/**

Assumption	# Harmonic	Examples	# Disharmonic	Examples
(a) /i/ harmonic	3422 (73.4%)	y..e i..æ o..a	1241 (26.6%)	e..a i..u u..æ
(b) /i/ transparent	4407 (94.5%)	i..u y..e o..a	256 (5.5%)	e..a u..æ o..e

#### 2.4. Variable harmony behaviour of /e/-/ $\gamma$ /

The /e/-/ $\gamma$ / pair is described as participating variably in harmony. Due to the particular asymmetries in the behaviour of /e/ vs / $\gamma$ /, I propose framing this instead as variable transparency of /e/. It is not the case that / $\gamma$ / fails to consistently trigger back harmony, but rather that (a) /e/ can either trigger front harmony or not, and also (b) /e/ appearing in non-initial syllables of SE words can surface as either /e/ or / $\gamma$ / in the corresponding KE cognates.<sup>7</sup> Note, however, that there are only two instances of /e/ in a back-harmonic word initiating a front harmonic span to its right; therefore /e/ is a transparent neutral vowel rather than an opaque one. The idea of /e/ having some transparent tendencies also aligns with the fact that there are a limited number of other Finnic languages (e.g. Finnish; Välimaa-Blum, 1999) in which /e/ is fully transparent.

I first consider the case of / $\gamma$ / vs /e/ as potential triggers of harmony. In Table 11, the rate of harmony in bigrams with / $\gamma$ / as their first element is easily in the range of the values shown for /u/-/y/ and /a/-/æ/ in Section 2.1. Compare this to the bigrams with /e/ as their first element: here there is a rather lower rate of harmony at 81.7%.

<sup>7</sup> An anonymous reviewer points out that the orthographic transcription of *e* [e] vs *õ* [ $\gamma$ ] could be random in non-initial syllables of KE words in EDC, since both are acoustically reduced to [ə] in unstressed syllables. Even with this possibility in mind, however, it is still possible for /e/ to be analyzed as transparent.

Table 11

Mid unrounded vowels as  $V_1$  in a monophthong bigram

$V_1$	$V_2 \in$ back /u, o, a, $\gamma$ /	$V_2 \in$ front /y, ø, æ, e/	Rate of harmony (%)
$\gamma$	435	21*	95.4
e	80	358	81.7

Next, I investigate the cases where / $\gamma$ / or /e/ has appeared in a non-initial syllable. Again, with very few exceptions the bigrams ending with / $\gamma$ / are harmonic, whereas only 72.3% of the bigrams ending in /e/ are (Table 12).

Table 12

Mid unrounded vowels as  $V_2$  in a monophthong bigram

$V_1 \in$ back /u, o, a, $\gamma$ /	$V_1 \in$ front /y, ø, æ, e/	$V_2$	Rate of harmony (%)
136	355	e	72.3
574	4	$\gamma$	99.3

The lower rates of harmony for bigrams involving /e/ (but not / $\gamma$ /) lend weight to the idea that /e/ is variably neutral. I will also revisit some of the tables from Sections 2.1 and 2.2 under the assumption that /e/ could be transparent.

In Tables 3, 4, 5, 6, values marked with an asterisk were those tallies of the number of back+front or front+back bigrams that would decrease if /e/ were to be assessed as a transparent vowel rather than one in the front harmonic class. Below are modified versions of the original tables. The new ones, Tables 13, 14, 15, 16, contain the relevant rows and have been adjusted such that /e/ is removed from the set of front vowels and assumed to be transparent instead. Under this assumption, in all of these cases the rate of harmony increases to over 97%.

Table 13

High (rounded) and low (unrounded) back vowels as  $V_1$  in a monophthong bigram  
Adjusted from Table 3 to allow for transparency of /e/

$V_1$	$V_2 \in$ back /u, o, a, $\gamma$ /	$V_2 \in$ front /y, ø, æ, $\text{æ}/$	Rate of harmony (%)
u	412	1 28*	99.8 93.6
a	950	1 65*	99.9 93.6

Table 14

High (rounded) and low (unrounded) back vowels as  $V_2$  in a monophthong bigram  
Adjusted from Table 4 to allow for transparency of /e/

$V_1 \in$ back /u, o, a, $\gamma$ /	$V_1 \in$ front /y, ø, æ, $\text{æ}/$	$V_2$	Rate of harmony (%)
363	9 22*	u	97.6 94.3
1026	24 82*	a	97.7 92.6

Table 15

Mid back rounded vowels as  $V_1$  in a monophthong bigram  
Adjusted from Table 5 to allow for transparency of /e/

$V_1$	$V_2 \in$ back /u, o, a, $\gamma$ /	$V_2 \in$ front /y, ø, æ, $\text{æ}/$	Rate of harmony (%)
o	200	1 27*	99.5 88.1

Table 16

**Mid back rounded vowels as  $V_2$  in a monophthong bigram**  
**Adjusted from Table 6 to allow for transparency of /e/**

$V_1 \in$ back /u, o, a, ʏ/	$V_1 \in$ front /y, ø, æ, ɛ/	$V_2$	Rate of harmony (%)
34	0 6*	o	100.0 85.0

Additionally, if we consider Table 17, which extends Table 10 to include a third assumption that (c) both /i/ and /e/ could be transparent to harmony, then the rate of harmony in monophthong bigrams exceeds 99%.

Table 17

**Proportion of harmony between monophthong bigrams**  
**under varying assumptions about transparency, extension of Table 10**

Assumption	# Harmonic	Examples	# Disharmonic	Examples
(a) /i/ harmonic	3422 (73.4%)	y..e i..æ o..a	1241 (26.6%)	e..a i..u u..æ
(b) /i/ transparent	4407 (94.5%)	i..u y..e o..a	256 (5.5%)	e..a u..æ o..e
(c) /i/ transparent, /e/ variable	4623 (99.1%)	i..u o..a ɣ..e	40 (0.9%)	u..æ ɣ..y æ..a

### 3. Diphthongs

In this section, I analyze the diphthongs appearing in EDC-KE to shed light on question Q3. (8) and (9) contain harmonic words including at least one diphthong. There are also entries in the EDC-KE that contain internally-disharmonic diphthongs; these are discussed in Section 3.3.

(8) Back harmonic words containing at least one diphthong (KE from EDC-KE; SE from the author):

KE word	KE vowels	Gloss	SE word	SE vowels
(a) <i>suamõ</i>	ua..ɣ	can.1PL.PRES	<i>saame</i>	a:..e
(b) <i>aogud</i>	ao..u	hole.PL.NOM	<i>aogud</i>	au..u
(c) <i>mõisa</i>	ɣi..a	manor.SG.GEN	<i>mõisa</i>	ɣi..a
(d) <i>muidu</i>	ui..u	else	<i>muidu</i>	ui..u

(9) Front harmonic words containing at least one diphthong (KE from EDC-KE; SE from the author):

KE word	KE vowels	Gloss	SE word	SE vowels
(a) <i>iemäl</i>	ie:..æ	away	<i>eemal</i>	e:..a
(b) <i>küümine</i>	æy:..i..e	walking.SG.NOM	<i>käimine</i>	æi:..i..e
(c) <i>päevä</i>	æe..æ	day.SG.GEN	<i>päeva</i>	æe..a
(d) <i>üijäb</i>	yi..æ	shout.2SG.PRES	<i>hüüab</i>	y:..a

There are 1,325 instances of diphthongs found in EDC-KE. Table 18 presents a summary of these diphthongs (Table 18 is identical to Table 2 but also gives the reader a sense of the frequency of each combination; see Table 24 in Appendix A for more detailed frequency information). For comparison, recall

that Table 1 shows the diphthongs that occur in SE. While there are more diphthong forms in KE than in SE, it is not the case that all of the additional diphthongs are the result of harmony. There are also other processes at play that produce diphthongs in KE, and these are briefly addressed in Section 4.1.

The interaction of diphthongs with harmony is not well studied in KE, or for that matter in many of the world’s languages. I take two different approaches to the investigation of VH in diphthongs. First, I consider intra-syllabic harmony (that is, harmony between the two members of a single diphthong), and then I consider inter-syllabic harmony in vowel bigrams including at least one diphthong.

Table 18

Diphthongs occurring in the EDC  
 Small font corresponds to diphthongs with up to 10 occurrences,  
 normal font 11–50, and large font over 50

		V <sub>2</sub>								
		i	e	ɑ	o	u	ɤ	æ	ø	y
V <sub>1</sub>	i		ie	ia	io	iu	iɤ	iæ	–	–
	e	ei		eɑ	eo	eu	–	eæ	–	ey
	ɑ	ɑi	ɑe		ɑo	ɑu	ɑɤ	–	–	–
	o	oi	oe	oɑ		ou	oɤ	–	–	–
	u	ui	ue	uɑ	uo		uɤ	uæ	–	–
	ɤ	ɤi	ɤe	ɤɑ	ɤo	ɤu		–	–	ɤy
	æ	æi	æe	æɑ	æo	æu	–		æø	æy
	ø	øi	–	–	–	øu	–	–		øy
	y	yi	ye	–	–	–	–	–	yø	

### 3.1. Intra-syllabic harmony in diphthongs

Of the 1,325 diphthongs in the corpus, if it is assumed that /i/ is the only transparent vowel, then the proportion of diphthongs satisfying back/front harmony is 86.0%. If, however, the set of transparent vowels is broadened to include /e/ then diphthongs are internally harmonic at the much higher proportion of 98.0% (see Table 19). Intra-syllabic harmony occurs at a lower rate than for monophthong bigrams when only /i/ is assumed to be transparent, but at a similar rate when both /i/ and /e/ are supposed to be transparent. Again, if it is assumed that /e/ in diphthongs, as in monophthong sequences, can be transparent, the vast majority of disharmony is explained.

### 3.2. Inter-syllabic harmony involving diphthongs

There are 12 monophthong-diphthong sequences and 962 diphthong-monophthong sequences in EDC-KE. As for monophthong bigrams and intra-syllable vowel pairs, harmony is satisfied the majority of the time if only /i/ is supposed to be transparent, but almost always if /e/ is also included as a potential transparent vowel. See Tables 20 and 21.

Table 19

**Proportion of intra-syllabic harmony  
under varying assumptions about transparency**

Assumption	# Harmonic	Examples	# Disharmonic	Examples
(b) /i/ transparent	1139 (86.0%)	iu ye oi oa	186 (14.0%)	ea uæ oe ue
(c) /i/ transparent, /e/ variable	1299 (98.0%)	iu ye uɣ æe	26 (2.0%)	uæ ɣy æa

Table 20

**Proportion of inter-syllabic harmony of diphthong-monophthong  
sequences under varying assumptions about transparency**

Assumption	# Harmonic	Examples	# Disharmonic	Examples
(b) /i/ transparent	6 (50.0%)	a..ua e..æe e..ie	6 (50.0%)	u..ei a..ie
(c) /i/ transparent, /e/ variable	12 (100.0%)	a..ua e..æe u..ei	0 (0.0%)	–

Table 21

**Proportion of inter-syllabic harmony of monophthong-diphthong  
sequences under varying assumptions about transparency**

Assumption	# Harmonic	Examples	# Disharmonic	Examples
(b) /i/ transparent	747 (77.7%)	ui..a iæ..e uo..ɣ	215 (22.3%)	ia..e yi..u
(c) /i/ transparent, /e/ variable	930 (96.7%)	ia..e iæ..e uo..ɣ	32 (3.3%)	yi..u

### 3.3. Disharmony involving diphthongs

Of particular interest are the few diphthong-monophthong sequences that do remain disharmonic once /i/ and /e/ do the work of accounting for any disharmony. They are enumerated in Table 22. Forms a—e have an internally-harmonic diphthong (iV or Vi) paired with a disharmonic monophthong; forms f—i have an internally-harmonic diphthong (not involving /i/) paired with a disharmonic monophthong; forms j—l have an internally-disharmonic diphthong paired with a non-neutral vowel.

**Vowel sequences that involve diphthongs and are disharmonic  
even if /e/ is considered to be variably transparent**

Group 1	Group 2	Group 3
(a) iæ..ɑ (1)	(f) yø..ɑ (2)	(j) uæ..ɑ (2)
(b) æi..ɑ (1)	(g) ye..ɑ (1)	(k) uæ..ʏ (3)
(c) yi..u (2)	(h) æe..ɑ (7)	(l) ʏy..u (2)
(d) øi..ɑ (3)	(i) æy..ɑ (3)	
(e) æi..u (1)		

Though it is these sequences that might be able offer the best insight into how diphthongs relate to the broader pattern of VH in KE, they are in fact so infrequent (28 of 962 diphthong-monophthong sequences in a corpus of word types, or 38 of 2,381 in a corpus of word tokens) that it would be ill-advised to attempt any sort of generalization based on these forms alone. Whether they represent inter-speaker variation, slips of the tongue, or any other minor noise, we cannot unfortunately use these data points to say anything about the behaviour of diphthongs in KE VH. Additionally, the presence of [uæ] in KE is discussed below in Section 4.1, which provides a potential explanation for the existence of this internally-disharmonic diphthong, addressing 5 of the 28 disharmonic sequences in Table 22.

(10) Words containing at least one internally-disharmonic diphthong (KE from EDC-KE; SE from the author):

KE word	KE vowels	Gloss	SE word	SE vowels
(a) <i>ruäde</i>	uæ..e	collar.PL.GEN	<i>kraede</i>	æe..e
(b) <i>puättega</i>	uæ::e..ɑ	boat.PL.COM	<i>paatidega</i>	ɑ::i..e..ɑ
(c) <i>jõühu</i>	ʏy::u	Christmas.SG.PART	<i>jõuhut</i>	ʏu::u

#### 4. Discussion and conclusions

In this section I begin by discussing some of the issues related to vowel harmony phenomena in KE. Section 4.1 explores KE diphthongs, including a potential explanation for one that surfaces as internally disharmonic. Section 4.2 situates KE vowel harmony within the typology of its close relatives, and Section 4.3 presents directions for future work on KE VH. Finally, Section 4.4 concludes.

##### 4.1. Sources of diphthongs in Kihnu Estonian

The set of diphthongs occurring in SE (Table 1) includes some that are internally harmonic and others that are not. The set of KE diphthongs is larger than that of SE; however, it is not simply the case that all of the additions are the result of VH. Several of the diphthongs present in KE correspond to long low and mid SE vowels; for example, KE [ʏe] corresponds to SE [ʏ:] whereas KE [uɑ] and [uæ] correspond to SE [ɑ:] (Asu, Lippus, Niit, Türk 2012). Thus although VH is a fairly robust phenomenon in KE, there are diphthongs in the dialect that are internally disharmonic for independent reasons that are primarily outside the scope of this paper. That said, however, given that [uæ] is by far the most frequently occurring diphthong in EDC-KE (it represents 20 of 26 instances of internally-disharmonic diphthongs in a corpus of types, or 34 of

40 in a corpus of tokens), I will briefly overview a potential account for this particular diphthong.

Sang (2009) investigates what he refers to as a "phonotactic collision" in KE. Palatalization on the consonant following a back vowel in the stressed (initial) syllable often surfaces metathetically as [e]-quality on that stressed vowel. Consider KE *su<sup>e</sup>pp* (Sang 2009 : 812) vs SE *sup<sup>j</sup>*. In the case of long [ɑ:], which as mentioned above can appear as [ua] in KE, this has the effect of fronting the second member of the diphthong: *paat<sup>j</sup>/puat<sup>j</sup>/puɑ<sup>e</sup>t/puät*. Of course, as Sang points out, this resulting diphthong goes against VH patterns otherwise apparent in KE. This insight into palatalization and metathesis is one potential explanation for a large portion of the internally-disharmonic diphthongs occurring in EDC-KE.

#### 4.2. Typology and genealogy

To situate KE with respect to its closest linguistic relatives, we turn to the typology of Finnic languages. Many of these languages demonstrate varying degrees of back/front VH. One extreme has Northern (Standard) Estonian and Livonian, with quite severe positional restrictions for vowels in non-initial syllables, which does not permit any VH at all. At the other extreme are East Votic and Northern Seto, both of which have four alternating pairs of vowels and only one vowel, /i/, that is restricted to initial syllables only. Figure 2 (Kiparsky, Pajusalu 2003 : 219) illustrates.

Balto-Finnic	Estonian	Initial syllables	Non-initial syll.	Harmonic alternations
East Votic	N. Seto	<i>u o a ü ö ä i</i> <i>e õ ĩ</i>	<i>u o a ü ö ä i</i> <i>e õ</i>	<i>u~ü, o~ö,</i> <i>a~ä, e~õ</i>
Votic dial.	S. Seto	<i>u o a ü ö ä i</i> <i>e õ ĩ</i>	<i>u o a ü ä i e</i> <i>õ</i>	<i>u~ü, a~ä,</i> <i>e~õ</i>
Finnish	N.E.	<i>u o a ü ö ä i</i> <i>e</i>	<i>u o a ü ö ä i</i> <i>e</i>	<i>u~ü, o~ö,</i> <i>a~ä</i>
West Votic	N.Tarto	<i>u o a ü ö ä i</i> <i>e õ ĩ</i>	<i>u o a ä i e õ</i>	<i>a~ä, e~õ</i>
Enarve Veps	S.W.	<i>u o a ü ö ä i</i> <i>e õ</i>	<i>u a ü ä i e</i>	<i>u~ü, a~ä</i>
Veps dial.	Western	<i>u o a ü ö ä i</i> <i>e õ</i>	<i>u a ä i e</i>	<i>a~ä</i>
Livonian	Northern	<i>u o a ü ö ä i</i> <i>e õ</i>	<i>u a i e</i>	—

Figure 2. Kiparsky, Pajusalu 2003, example (1).

This typology also includes languages with only one transparent vowel (e.g. /i/ in Votic) as well as those with two (e.g. /i, e/ in Finnish). In general, neutral vowels in this typology are those that have no (or a positionally restricted) corresponding segment with the opposite backness, so the transparency of /e/ in a language such as Finnish is tied to the fact that /ɤ/ is not a Finnish phoneme. KE is unique in that its specific characteristics are not exemplified in this typology. Its VH behaviour is somewhat similar to that of Southern Seto, with alternating pairs /ɑ/-/æ/ and /u/-/y/ and transparent

/i/, but with no /i/ and with /e/ varying between harmonic with /ɤ/ (like Southern Seto) and transparent (like Finnish).

The variable status of /e/ in KE brings up the question of the source of this variability. Many scholars argue that the existence of any /ɤ/ at all is an innovation in the southern Finnic languages, while others claim that /ɤ/ was already present in the common ancestor of the Finnic languages and that the northern languages merged /ɤ/ with its counterpart /e/ (Häkkinen 2019; Kallio 2012; 2014). Thus, it is unclear at this point whether non-initial /ɤ/ in KE is an extension of VH to non-initial /e/ in back harmony contexts, or whether KE simply never completed the \*ɤ, \*e > \*e merger from Proto-Finnic on its way to Northern Estonian.

### 4.3. Future work

All of the Finnic languages that do have VH are analyzed as harmonizing from left to right. This is closely related to the positional restrictions evident in many of the languages (including those without VH), in that the initial syllable, having the full range of vowel contrasts, is the one whose vowel determines the backness of the following vowels in the word. Whether the trigger of harmony is interpreted as the vowel in the first syllable or the primary stressed syllable, we run into challenges when the first syllable's vowel is transparent. The manner in which KE VH proceeds in a context such as this requires further investigation, including morphologically-informed analysis.

In addition to the question of how the harmony trigger is defined, there are also several other directions that further study of KE VH could take. The first is to revisit the corpus data with an eye to morphology, in order to determine (for instance) whether there are certain suffixes that never alternate, or if particular morphological contexts are more or less prone to produce transparent behaviour of /e/. A second option, since Estonian vowels contrast for length, is to investigate potential differences in how short vs long vowels participate in harmony. A third possible focus is to determine whether there is any evidence for gradient and/or count effects of transparency (as in Hungarian, for example; see Rebrus, Törkenczy 2016).

### 4.4. Conclusion

I have taken a corpus-based approach in this paper, lending support to the analysis of /ɑ/-/æ/ and /u/-/y/ as harmonic alternating pairs and /i/ as transparent in KE. Evidence as to participation of /o/-/ø/ is inconclusive in this corpus. However, data from EDC-KE demonstrate that in KE, the variability in the harmony behaviour of the /e/-/ɤ/ pair might be understood to be linked to /e/'s potential as a second transparent vowel. I have also begun to describe the harmony behaviour of diphthongs in KE, and situated the dialect within the typology of its Finnic relatives.

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**Appendices**

**A. Corpus data summaries**

Table 23

**Number of instances of each monophthong bigram found in EDC-KE**

		V <sub>2</sub>								
		i	e	a	o	u	ɤ	æ	ø	y
V <sub>1</sub>	i	143	204	189	1	109	59	71	0	2
	e	111	191	58	6	13	3	157	0	10
	a	317	64	526	3	184	237	0	0	1
	o	81	26	84	30	25	61	1	0	0
	u	150	27	193	1	90	128	1	0	0
	ɤ	79	19	223	0	64	148	2	0	0
	æ	90	104	17	0	7	1	127	0	17
	ø	7	3	2	0	0	0	0	0	0
y	42	57	5	0	2	1	66	0	23	

Table 24

**Number of instances of each diphthong found in EDC-KE**

		V <sub>2</sub>								
		i	e	a	o	u	ɤ	æ	ø	y
V <sub>1</sub>	i		84	15	35	19	3	71	0	0
	e	64		16	11	9	0	7	0	8
	a	67	56		37	52	60	0	0	0
	o	23	23	9		3	8	0	0	0
	u	36	16	97	50		88	20	0	0
	ɤ	70	29	1	2	33		0	0	2
	æ	29	38	1	1	1	0		4	39
	ø	4	0	0	0	1	0	0		1
y	6	46	0	0	0	0	0	30		

КАЙЛИ ВЕСИК (Ванкувер)

**ГАРМОНИЯ ГЛАСНЫХ В КИХНУСКОМ ДИАЛЕКТЕ ЭСТОНСКОГО ЯЗЫКА  
КОРПУСНЫЙ АНАЛИЗ**

Автор исследует гармонию гласных в кихнуском диалекте эстонского языка. Данные Эстонского Диалектного Корпуса (<https://www.murre.ut.ee/mkweb/murdekorpus.html>) использованы для описания гармонии в этом диалекте — малоизвестном в литературе феномене. Описанные в прошлом тенденции катего-

риальной гармонии (пары /u/-/y/ и /ɑ/-/æ/) и транспарентность (/i/) подтверждены. Однако корпус не предоставляет достаточно данных для подтверждения или опровержения прошлого описания пары (/o/-/ø/) как не участвующей в гармонии. Более того, пара (/e/-/ɛ/), ранее описанная как переменная, исследована подробнее, с предложением, что /e/ — второй транспарентный гласный. Гармония гласных изучена и в богатом инвентаре дифтонгов кихнуского диалекта, где внутрислоговая гармония в дифтонгах и межслововая гармония между монофтонгами встречаются сравнительно часто.

*KAILI VESIK* (Vancouver)

**EESTI KEELE KIHNU MURRAKU VOKAALHARMOONIA:  
KORPUSEPÕHINE UURIMUS**

Töös käsitletakse eesti keele Kihnu murraku vokaalharmooniat eesti murdekorpusel (<https://www.murre.ut.ee/mkweb/murdekorpus.html>) andmete põhjal. Seni on Kihnu vokaalharmooniat vähe uuritud. Varem väidetud /u/-/y/ ja /ɑ/-/æ/ järjekindel harmoonia ning /i/ neutraalsus leiavad kinnitust. Korpus pakub aga ebapiisavalt otseid tõendeid, et toetada või ümber lükata varasemaid väiteid, et puudub /o/-/ø/ harmoonia. Seni varieeruvaks peetud /e/-/ɛ/ suhet uuritakse põhjalikumalt ja väidetakse, et /e/ võib samuti olla neutraalne vokaal. Vokaalharmooniat vaadeldakse ka Kihnu murraku rohketel diftongidel, millest selgub, et diftongide silbisine harmoonia ning monoftongide silbivaheline harmoonia ilmnevad sarnasel määral.