Cser, András & Oszkó, Beatrix & Várnai, Zsuzsa. 2025.
The emergence of labial harmony in Old Hungarian.
Glossa: a journal of general linguistics 10(1). pp. 1–29.
DOI: https://doi.org/10.16995/glossa.10536

Open Library of Humanities

The emergence of labial harmony in Old Hungarian

András Cser, HUN-REN Hungarian Research Centre for Linguistics & Pázmány Péter Catholic University, HU, cser.andras@nytud.hun-ren.hu

Beatrix Oszkó, HUN-REN Hungarian Research Centre for Linguistics & University of Novi Sad, HU, oszko.beatrix@nytud.hun-ren.hu

Zsuzsa Várnai, HUN-REN Hungarian Research Centre for Linguistics, HU, varnai.zsuzsa@nytud.hunren.hu

Hungarian displays both backness harmony (inherited from Proto-Uralic) and labial harmony, the latter developing in Old Hungarian. This paper sets out to explain the fact that the emergence of labial harmony, i.e., the progressive spreading of the feature [labial] in Late Old Hungarian results from an apparent change in the earlier regressive direction of spreading for the same feature. The question addressed here is what caused the change in the direction of the spreading. The hypothesis advanced is that Early Old Hungarian regressive spreading of labiality did not affect lexical cues, since [labial] was a redundant feature; the spreading was motivated by purely coarticulatory mechanisms. However, as [labial] became a robust contrastive feature in the Old Hungarian period, it aligned with backness in its spreading direction to enhance lexical recognizability. The argument also implies that while labial harmony owes its origin to a pattern rooted in coarticulatory mechanisms, in its mature form it acquired a superimposed perceptual motivation.

1 Introduction

In Modern Hungarian, vowels take part in two types of harmony patterns: backness harmony and labial (or rounding) harmony (for a recent survey and analysis see Siptár & Törkenczy 2007: 157–170). These are exemplified in (1a) and (1b), respectively, from Standard Hungarian (the authors' native variety).

(1a) backness harmony: [kuːt-bɒn] 'well-INESS', [haːz-bɒn] 'house-INESS' vs. [siːn-bɛn] 'colour-INESS', [kød-bɛn] 'fog-INESS', [fyʃt-bɛn] 'smoke-INESS'

(1b) labial harmony: [siːn-ɛtɛk] 'colour-2PL' vs. [fyʃt-øtøk] 'smoke-2PL' (vs. [kaːr-otok] 'damage-2PL' via backness harmony)

Both types are progressive root-controlled harmony, but they differ from each other in important ways. Backness harmony is the older of the two, traced back as far as Proto-Uralic (Suomi 1983; Aikio 2022). It is also much more pervasive: it is triggered by all vowels, undergone by most vowels (though the front unrounded vowels [i iː eː ɛ] can be neutral), and it actively manifests itself in widespread alternations in many of the suffixes. By contrast, labial harmony has a much narrower scope; although it is a stable pattern, it only affects the short mid front vowels [ɛ] and [ø], and it seems to have appeared only in the Old Hungarian period.[1]

The fact that we set out to explain in this paper is that the emergence of labial harmony, i.e., the progressive spreading of the feature [labial] in Late Old Hungarian results from an apparent change in the earlier direction of spreading for the same feature. In Early Old Hungarian [labial] demonstrably spread regressively, from final syllables to vowels in the preceding syllables; in Late Old Hungarian, however, the spreading began to stabilize into the progressive pattern that has been preserved ever since. The question we address is this: what caused the change in the direction of the spreading?

The broader context of the issue is the much-discussed question of what motivates vowel harmony phenomena. The formal side of vowel harmony is commonly described in phonology as feature spreading, i.e, a subcase of assimilation (e.g. van der Hulst & van de Weijer 1995; Krämer 2003; Rose & Walker 2011). In terms of its motivation, two possible avenues of explanation have been explored in the literature. A coarticulatory basis is advocated by Ohala (1993; 1994a; 1994b, cf. also Mailhot 2010; 2013), with perceptual factors playing a role at the later stage of phonologization. An acoustic and perceptual basis is assumed by others (Nearey 1980; Suomi 1983; Kaun 1994; 1995; 2004), which explains among other things why labial harmony never occurs on its own (mainly because it is an enhancement of the F2 differences achieved primarily

[1] For recent surveys on vowel harmony and neutral vowels in Uralic and Hungarian see Törkenczy (2021), Fejes (2021; 2022), Rebrus & Törkenczy (2017; 2021), Rebrus, Szigetvári & Törkenczy (2019).

via a front–back contrast).[2] Przezdziecki (2000) demonstrates that coarticulatory phenomena and vowel harmony in Yoruba operate in the same direction with only a difference of graduality between them and concludes from this that harmony is indeed based in coarticulation. Beddor & Yavuz (1995) show that in Turkish vowel coarticulation and vowel harmony can have opposite direction; from this they conclude that while vowel harmony is based in coarticulation, its phonologized form, i.e. vowel harmony in the strict sense of the word, may be divorced from its original motivation and obey different regularities. Hansson (2001) as well as Gafos (1996; 1998; 2021) focus on a crucial distinction between spreading and copying, both of which can lead to harmony-like phenomena, but of which only the former involves coarticulation, i.e., contiguous articulation of a gesture extending across intervening segments. They argue that vowel harmony typically involves spreading, whereas consonant harmony – with the possible exception of coronal harmony – involves copying.

What will be presented in our paper resonates closely with the findings of Beddor & Yavuz (1995): coarticulatory spreading and phonologized vowel harmony go in opposite directions. There are two important differences, however. One is that in Turkish word stress is final, which influences the direction of coarticulation (but not that of vowel harmony); in Hungarian word stress has always been initial. The other difference is that in Beddor & Yavuz (1995) the two phenomena were studied in one and the same period, whereas in Hungarian a diachronic sequence is assumed.

Thus, our main concern is directionality; the hypothesis we advance is the following. Early Old Hungarian regressive spreading of labiality did not affect lexical cues (the recognizability of lexical items), since [labial] was a redundant or at most marginally contrastive feature; the spreading was probably motivated by simple coarticulatory mechanisms. However, as [labial] became a robust contrastive feature in the course of the Old Hungarian period due to a variety of sound changes, it aligned with backness (an inherited robust contrast) in its spreading direction to enhance lexical recognizability. The latter point crucially hinges on the general morphological character of the language throughout its documented history, viz. widespread agglutination without prefixation, lexical morphemes being on the left of word forms, followed by suffixes. The argument also implies that while labial harmony owes its origin to a pattern rooted in coarticulatory mechanisms, in its mature form it also acquired an important perceptual motivation. The central claim that this paper makes is that Old Hungarian labiality stopped spreading regressively onto roots and became a rightward-spreading harmonizing feature when it became lexically specified and thus crucial to identifiability.[3]

---

[2] In a similar vein it is argued in Joseph, Ko & Whitman (2020) that in the Transeurasian languages RTR harmony historically precedes labial harmony.

[3] On directionality in harmony systems in general see Hyman (2002), Rose & Walker (2011: 279–282) and Walker (2011).

We illustrate the role of harmony in lexical recognizability at this point with two examples from Modern Hungarian. The type of harmony crucial to the first is backness harmony. In the most recent period there is a noticeable (and perhaps growing) overlap between the realizations of two lexically and etymologically distinct vowels, [ɛ] and [aː] for many speakers of Standard Hungarian (see e.g. Gósy & Siptár 2015). Both vowels can be realized as [æ] with variable length depending on the consonantal environment, syllable structure and other factors. This leads to frequent confusion between minimal pairs such as *hely* [hɛj] 'place' and *háj* [haːj] 'fat' or *mert* [mɛrt] 'dare PST' and *márt* [maːrt] 'dip'. Since, however, independently of their actual realization, [ɛ] harmonizes as front, whereas [aː] harmonizes as back, suffixed forms are no longer ambiguous. This is shown in (2), with the overlapping vowels indicated as half-long [æˑ].

(2) *mártunk* [mæˑrtuŋk] 'dip 1PL', i.e. 'we dip' vs. *mertünk* [mæˑrtyŋk] 'dare PST 1PL' i.e. 'we dared'
hájtól [hæˑjtol] 'fat ABL' vs. *helytől* [hæˑjtøl] 'place ABL'

The second example concerns labial harmony in different Modern Hungarian dialects. The multiplicative-temporal suffix is invariant [ser] in certain dialects (Hegedűs 2001: 358), but in the majority of varieties (including Standard Modern Hungarian) it harmonizes both in backness and in labiality. Because of this, the words meaning 'once' vs. 'five times' (written *egyszer* and *ötször* in the standard orthography) have the forms given in (3) in the two types of dialects, respectively.

(3) dialect A: [ɛtsːer] 'once' vs. [øtsːer] 'five times'
dialect B: [ɛtsːer] 'once' vs. [øtsːør] 'five times'

In this particular pair of words, the difference is encoded only in the labiality of the vowels. If because of noise or lack of attention or some other masking factor the quality of the first vowel is missed by the hearer, in dialect A it is not recoverable, and information is lost. In dialect B, however, the stem vowel is recoverable because the harmonizing suffix indicates whether it was labial or not, hence the lexemes remain identifiable.

The specific understanding of the perceptual motivation of vowel harmony that is crucial to our hypothesis has this disambiguating capacity in its focus. The insight is essentially identical to that articulated in Baković (2003). In that paper root-outward harmony is seen as instrumental in achieving stem-identity, a property that ensures lexical identifiability at the expense of introducing alternations within affixes. This relation is encapsulated by Baković's (2003: 10–11) stem precedence generalization.[4] It is clear that contrastive features play a greater role in the identification of lexical items than redundant ones; hence the promotion of a redundant feature

[4] In Baković's argument opacity plays an important role; while Hungarian vowel harmony also displays opacity phenomena, these will not be discussed in the present paper.

to a contrastive status can change the way it interacts with the morphology. As we shall argue, this is what we see in the case of labiality in Old Hungarian vowels.

The paper is structured in the following way. In section 2 we discuss the nature of the data and present the Early Old Hungarian vowel system, which serves as our starting point. Then in section 3 we discuss those changes that led to a significant increase in the lexical frequency of labial vowels (especially front labial vowels, the chief protagonists of this paper). In section 4 we give a detailed presentation of regressive labialization, also highlighting those factors that were to prove essential in the reversal of the direction of spreading. In section 5 we present the emergence of progressive labialization, i.e., labial harmony that is almost identical structurally to its Modern Hungarian continuation. In section 6 we relate our analysis to two issues that are prominent in current theoretical debates. Section 7 concludes. In the Appendix and the accompanying files, the data are presented and explained in detail.

2 The Old Hungarian data and the vowel system

The Early Old Hungarian period (henceforth EOHu) covers the 10th–14th centuries AD. From this time very little continuous text remains; what we have is mostly onomastic material and glosses embedded in Latin, and occasionally Greek, texts. The Late Old Hungarian period (henceforth LOHu) covers the late 14th, the 15th and the early 16th centuries, its end conventionally identified as coinciding either with the destruction of Hungarian statehood by Ottoman invasion (1526) or with the printing of the first Hungarian book (1541). From the LOHu period we have extensive surviving material in the form of more than 40 codices (some incomplete) and a substantial corpus of minor texts (letters etc.). Most of the surviving OHu texts are freely accessible in searchable form in the Old Hungarian Corpus (http://omagyarkorpusz.nytud.hu/en-intro.html, cf. Simon 2014; Simon & Sass 2012), an online database which we used extensively in our research.

It is to be acknowledged that some of the phonological developments to be discussed in the paper, especially those in section 3, took place in EOHu, and therefore the pool of data on which their reconstruction is based is far smaller than would be ideal. The EOHu onomastic material, which could potentially provide a larger data pool, has not yet, as of this date, been organized into a usable data base. As is often the case with reconstruction, hypothesized changes are distilled from later patterns, so these hypotheses are not data-driven in the strongest sense of the word. Nevertheless, they still provide, at present, the most plausible explanations for the patterns seen at later stages. It is also true that numerically speaking the LOHu data pool is not large either, at least it is not comparable to what is available for some better documented languages. The hypotheses and the arguments we formulate are based at certain points on a higher number, at others on a smaller number of data. We are still confident that the larger picture that emerges will present a plausible scenario.

The EOHu vowel system is usually reconstructed as shown in **Table 1** (cf. Kiss & Pusztai 2003: 336, 344). The front/back contrast as well as the three-way height contrast is beyond doubt. The status of the back (or at least non-front) high unrounded vowel (here [ɯ]) is a moot question: there is a tradition of assuming such a sound, but it has never been generally accepted and has come under serious criticism recently (most prominently in Kis 2005). The contrast between [i] and [y] most probably had very low functional load and involved a great deal of variability (cf. Proto-Finno-Ugric **kitV* or **kütV* 'middle, gap' > Hu [køz] as per Benkő 1993–1994 s.v. *köz*); it is possible that some dialects of Pre-OHu or Early OHu had no [y] sound at all (cf. Bárczi 1958: 34–35).

	short		**long**	
	front	**back**	**front**	**back**
high	i y	u (ɯ?)	iː	
mid	e	o	eː	
low	ɛ	a		aː

Table 1: The EOHu vowel system.

It seems that no long labial vowels can be securely reconstructed at least for the earliest stage of EOHu (Bárczi 1958: 82; E. Abaffy 2003: 344). During this period, however, many long vowels appeared via various lengthening changes and contractions of short vowels with tautosyllabic approximants ([Vj, Vɣ, Vw] > [Vː], e.g. *[fɛɣ] > *[fɛɥ] > [føː] 'head', *[low] > [loː] 'horse', *[mundaj] > [mondaː] 'he said').[5] Many of these recent long vowels were labial, and these, along with the vowels discussed in the next section, came to play an important role in the emergence of labial harmony.

Table 2 shows the vowel system at the end of the OHu period, the stage that was reached by the time the changes discussed here were completed or at least had progressed significantly (Bárczi 1958: 107, E. Abaffy 2003: 346). Variation among dialects was widespread, but many details are unclear. Some dialects may have lacked front rounded vowels even in this

[5] When presenting OHu data, we disregard the widespread and well-attested variability whenever it would only add clutter to the exposition. For the same reason we give transcriptions in the main text rather than paleographic data or transliterations. The latter type of data are given in the notes, if at all, for illustration and in order to make it possible for the reader to search these for themselves more easily. They are, however, neither exhaustive, nor do they necessarily indicate first attestation. Variant forms are given in the main text only where they are crucial for clarification and/or argumentation. More complete datasets for two nouns and two affixes are given in separate files and analyzed in some detail in the Appendix. Relevant data can be found in more traditional formats in the standard etymological dictionary written in German, Benkő (1993–1994); its updated online version (uesz.nytud.hu) only works in Hungarian at this time. More complete data can be found in the Old Hungarian Corpus (see above), but in order to use that one needs thorough acquaintance with Old Hungarian paleography.

	short		long	
	front	back	front	back
high	i y	u	iː yː	uː
mid	e ø	o	eː øː	oː
low	ɛ	ɒ	ɛː	aː

Table 2: The LOHu vowel system.

period; some may have retained non-labial short [a]; some may have displayed a severely restricted length contrast, especially among the labial and/or the high vowels. By and large, when abstracting away from dialectal variation, the Modern Hungarian vowel system is nearly identical to the LOHu system; Modern Standard Hungarian has lost only [e] and [ɛː] and has not added any new vowels.

Table 3 shows the written forms for the OHu vowels. Since vowel length was not marked in the period, in the left column of the table we only indicate vowel qualities. Diacritics marking nasal consonants in OHu texts are not included.

vowel	written form
i	i, í, y, ÿ, ӱ
e	e, ė
ɛ	e, è
y	u, v, w, ý, yý, ú, u̇, ű, ẃ, iw, ev, eű, yw, yý
ø	o̧, ó, ó̧, o, u, v, ev, ew, eý, eű, ɵ, e̊
u	u, v, w
o	o
aː, ɒ	a

Table 3: The OHu vowel spellings.

3 The proliferation of labial vowels in Old Hungarian

Next to the two inherited labial vowels [u o], further labial vowels appeared in the OHu period via a series of sound changes; borrowings — mainly from Turkic — also increased their token frequency (see below). The precise chronology of the relevant sound changes is not always securely established and may have varied from dialect to dialect; but their outcomes are amply attested in the LOHu period at the latest. The changes are the following (Bárczi 1958: 47–61; E. Abaffy 2003: 323–327).

(i) Next to labial consonants, the short front vowels [i e] were frequently labialized early in this period; examples are given in (4), including inherited as well as borrowed words.

(4) Pre-OHu *[kiw-] > EOHu [kyvɛʃ][6] 'stony'
EOHu [fiʃt] > LOHu [fyʃt][7] 'smoke'.
Middle High German *biht* (cf. MoG *Beichte*) → LOHu [bøjt][8] 'fasting'
Middle High German *zweck* → LOHu [tsøvek][9] 'peg'
West Old Turkic **kertweliɣ* → EOHu [kørtveʎ][10] 'pear'

In EOHu [kørtveʎ] from Turkic **kertweliɣ* (Róna-Tas & Berta 2011: 602), the [w] affected the preceding vowel across a consonant cluster. In LOHu [tsøvek] from MHG *zweck* an epenthetic vowel was inserted to break up the complex onset, a non-existent structure in OHu. Such epenthesis was systematic in the language, and the vowel was either a copy of the following vowel, or [i] or [e] (for a detailed discussion see Nyirkos 1993); in the case of [tsøvek] the labial quality of the epenthetic vowel can be attributed to the following [v].

(ii) In the environment _[l]C[coronal], [e] and [ɛ] were labialized to [ø], and [a] was labialized to [o], as the examples in (3) show (cf. Dudás 2002; this may have taken place in the latter part of the EOHu period, but for many affected words attestation is later).

(5) EOHu [fɛld][11] > LOHu [føld][12] 'land'
EOHu [tɛl] 'ground' > LOHu [tɛlɛ] 'full' vs. [tølt] 'fill' with different suffixes[13]
Pre-OHu *[al-] 'sleep' > LOHu [aːlom][14] 'dream' vs. [olt][15] 'extinguish'

(iii) In an unconditioned change, [a] was labialized to [ɒ] by the end of the EOHu period, with long [aː] remaining intact: EOHu [kard] 'sword' > LOHu [kɒrd].[16]

(iv) In word-final position, a sequence of a vowel and an approximant systematically developed into a long vowel. We have seen a few examples above in section 2; two more examples are given

---

[6] *qweʃ-* (1193).
[7] *fyst-* (1240) vs. *füſt* (Vienna Codex, mid-15th century).
[8] *bewyth* (Lányi Codex 1519).
[9] *cwuek* (1429).
[10] *kurtuel* (Charter of Tihany 1055), *kortuelyes* (1252).
[11] *feld* (1086), but labialized *feuld* is attested as early as 1093.
[12] *fǫld* (Vienna Codex, mid-15th century), *fewld* (Festetics Codex, 1492–94).
[13] *thel(ed)* (place name, 1256) *tele tewlt* 'fills completely' (Jókai Codex, around 1440).
[14] *alom* (Jókai Codex, around 1440).
[15] *olt-* (Vienna Codex, mid-15th century).
[16] This change is not consistently shown in writing except for occasional <o> for the labialized variant, e.g. *cord-* for [kɒrd] (1319). Confusion of the letters *o* and *a* is evidenced already in the EOHu period for etymological *[a], but not for long [aː]; further evidence comes from descriptions by grammarians, the first one written in the 1540's as well as from various length alternations in MoHu, which always relate [aː] to [ɒ].

here for front labial vowels, since these are the ones of immediate interest to us. The general pattern here was *[iɣ *iw *eɣ *ew *ɛɣ *ɛw] > [iɥ eɥ] > [y: ø:]; when a vowel-initial suffix followed, the contraction to long vowel did not take place, which led to extensive alternations. For examples see (6).

(6) Turkic **äriɣ* → Pre-OHu *[ɛriɣ] > OHu [ɛrø:][17] 'strength' vs. *[ɛriɣe] > [ɛreje][18] 'strength-3SG', i.e. 'his strength'
Pre-OHu *[fiw] > *[fiɥ] > OHu [fy:][19] 'grass'

The four changes briefly described here significantly increased the number of rounded vowels in the language in various phonological environments. To these one must add the many loanwords that were adopted in the Pre-OHu or the EOHu period; these further increased the number of front labial vowels either directly or by providing input to the above sound changes. Here belong borrowings mainly from the Turkic languages with which speakers of Hungarian came into contact in the steppe region (Pre-OHu period) and the Carpathian basin (EOHu period). In (6) above the word [ɛrø:] 'strength' is a Turkic loanword; some more examples are given in (7).

(7) Turkic loanwords in OHu: [ɟy:sy:] 'thimble', [økør] 'ox', [øzøn] 'flood', [sy:tʃ] 'furrier', [bøltʃ] 'wise'

In the next section we turn to yet another labialization process, that involving word-final vowels, whose labiality exerted an assimilatory influence on preceding vowels and thus introduced regressive spreading. This needs to be discussed in a separate section because it played a crucial role in the development of labial harmony and because it showed a complex interaction with morphology.

4 Final and regressive labialization

The available data show quite clearly that short word-final vowels became high and then labial within the period spanning Pre-OHu and EOHu (Bárczi 1958: 17–24; E. Abaffy 2003: 321–323). These vowels harmonized in backness: they were realized as [u] after back vowels, and as [y] after front vowels. The closing was apparently exceptionless; the labialization shows a few exceptions (i.e. [i]-final words). The effects of the two changes are seen both in inherited and in borrowed vocabulary. However, since the final short high vowels themselves were lost by the latter half of the thirteenth century, their attestation in terms of numbers is rather poor. Examples are given in (8).

---

[17] *ereu(s)* (1211), *ő́rő́u(ſch)* (Königsberg Fragment and its Ribbons, mid-14th century); *èrǫ(s)* (Vienna Codex, mid-15th century) (cf. also Róna-Tas – Berta 2011: 335–338).

[18] *èrèiè* (Vienna Codex, mid-15th century); *ereýe* (Festetics Codex, 1492–94).

[19] *-fw, phÿw* (Beszterce Glossary, around 1395).

(8) Proto-Finno-Ugric **kunta* ‘clan’ > EOHu [hodu] > LOHu [hɒd] ‘war band’[20]
Proto-Ugric **ukta* ‘track’ > EOHu [utu] > LOHu [uːt] ‘road’[21]
Proto-Ugric **seŋkV* ‘nail, peg’ > EOHu [segy] > LOHu [seg] ‘protrusion, nail’[22]
EOHu [taʃi] proper name, att. 10th c. > [tɒʃu] ar. 1200 > LOHu [tɒʃ] place name[23]
Italian *venedigo* ‘Venetian’ → EOHu [vɛndegy] > LOHu [vɛnde(ː)g] ‘foreigner, guest’[24]

In suffixed forms, we see extensive variation in the labiality of stem-final vowels throughout the OHu period. Thus, for instance, the plural of the EOHu word [beregy] > LOHu [bereg] or [berek] ‘grove’ can be either [ber(e)kek] or [ber(e)køk], where the final [k] is the plural suffix.[25] The most commonly accepted explanation for this variation is analogical transfer of the labial vowel from unsuffixed forms, where the vowel was in final position and hence labialized. This explanation, elaborated in great detail in D. Bartha (1964), rests on the three observations introduced in this section: (i) word-final original short vowels are invariably high and overwhelmingly round in EOHu, (ii) the same word-final short vowels are lost by the mid-thirteenth century, (iii) the same short vowels show variation in rounding and/or height before suffixes, where they were not lost. But the explanation also rests on a crucial assumption, viz., that in the case of variation it is the unrounded and/or lower vowel that is the original; to take the previous example, [ber(e)kek], rather than [ber(e)køk], is assumed to be the older form of ‘groves’.

This assumption itself is based on an observation: from the earliest period of attestation onwards, short vowels before suffixes (the original stem-final vowels) are lexically specific and cannot be derived from the phonological environment in a significant — and conceiveably very old — part of the word stock. This is true even in Modern Hungarian, but is exemplified here by five EOHu adjectives formed with the suffix *s*: [feːɲyʃ] ‘shining’ vs. [eːzeʃ] ‘sweet’ vs. [sɛrɛlmɛʃ] ‘beloved’ vs. [utɒʃ] ‘having a road’ vs. [vilaːguʃ] ‘light-coloured’.[26] It is also to be noted that even in Modern Hungarian, many short monomorphemic stems of Finno-Ugric provenance are lexically specified as taking suffixes with a low vowel (e.g. MoHu [haːzɒk] plural and [haːzɒt]

---

[20] *hodu* (Charter of Tihany, 1055), *had* (Vienna Codex, mid-15th century).

[21] *utu* (Charter of Tihany, 1055), *ut* (Munich Codex, 1466).

[22] *zegu(holmu)* (ar. 1200), *zeg* (Czech Codex, 1513).

[23] *τασῆς* (ar. 950, with the Greek genitive suffix *ς*) > *tosu* (1138) > *taas* (1391).

[24] *vẽdegu* (1135), *vèndeg* (Munich Codex, 1466).

[25] *berekek(ọn)* ‘in the groves’ (Tihany Codex, 1530–1532), *berkọ́k(eth)* with the accusative suffix (Jordánszky Codex, 1519). The syncopation of the internal vowel in the latter form is a frequent change in OHu, and the lowering of [y] to [ø] is fully regular in non-initial syllables. For more examples of the vowel variation see (9), (10) and (11) below.

[26] The first is attested in the Königsberg Fragment (early 13th century), the second in the Lamentations of Mary (late 13th century), the third in the Funeral Sermon (late 12th century), the last two in charters dating to the late 13th century, all cited here from D. Bartha (1964: 20). The front-back difference is governed by inherited backness harmony.

accusative of [haːz] ‘house’, [lovɒk] plural and [lovɒt] accusative of [loː] ‘horse’). The majority pattern, to which most loanwords adhere, is to take the same suffixes with a mid vowel (if any, e.g. [gaːzok] plural and [gaːst] accusative of [gaːz] ‘gas’). Thus, the low stem-final vowel certainly represents a very old pattern. Generally speaking, with respect to Old Hungarian, it is concluded on the basis of such observations that when not high, these vowels represent the original variant of the stem-final vowel.

For the argument we shall adhere to this assumption, though things are complicated by several factors, not least among them the adoption of loanwords, which often received stem-final vowels on the analogy of the inherited vocabulary.[27] But the picture is muddied further by the general lowering of short vowels whereby many of the high vowels became mid vowels in LOHu (witness [ber(e)køk] rather than *[ber(e)kyk] as the plural of [berek] in LOHu).

As was first systematically argued in Losonczi (1915) (for a recent discussion see Dudás 2004), the labialization of final short vowels and the analogical introduction of these labialized vowels into non-final (i.e. pre-suffix) position had a pervasive effect on the phonological form of words in many dialects of OHu. This effect can be described as the regressive labialization of front vowels, a tendency that becomes visible already in the EOHu period. It became a widely and robustly attested phenomenon, resulting in pervasive but phonologically patterned variation. The geographical aspect of this variation, while interesting in the context of historical dialectology, will not be discussed in this paper (but see Juhász 2018). As was said above, when reconstructing the phonological origins of labialization, Losonczi attributed the initial effect to the final short labial vowel, which itself was lost before LOHu times. In fact, long final labial vowels, usually resulting from the contraction of vowel + approximant sequences, as shown in (6) above, had the same effect (Berrár 1961). The attested variation from the OHu period is exemplified in (9).

(9) [beregy], [bereg], [berek], [berøg], [børøk] ‘grove’[28]
[nemeʃ], [nemøʃ], [nømøʃ] ‘noble’[29]
[kirist], [kirest], [kerøst], [kørøst] ‘cross’[30]
[vɛndegy], [vɛnde(:)g], [vɛndøg] ‘foreigner’[31]

[27] For instance, the very first continuous text, the Funeral Sermon (around 1190) includes the name *Adam* in the accusative in the form [aːdaːmut], where the [u] has no etymological source but was clearly added on the analogy of labialized word-final vowels (*t* is the accusative suffix).

[28] *beregu* (1214), *beruch(yo)*, *berek(iou)* (1213), 1233: *bereg* (1233), *berugh* (1328), *buruk(yo)* (1310) (these data cited from Dudás 2004).

[29] *nemes, nemǫs, nǫmǫs* (Nagyszombat Codex, 1512–1513).

[30] *kereʒt* (Gyulafehérvár lines, first half of 14th c.), *kyreʒt(nek)* (Jókai Codex, ar. 1440), *keruzt* (1253), *kuruzt* (1272); *kǫrǫzt(fan)* (Czech Codex, 1513).

[31] *vẽdegu* (1135), *vèndeg* (Munich Codex, 1466), *vendug* (1211).

[ɟeɲery:], [ɟeɲerø:], [ɟeɲyry:], [ɟøɲørø:], [ɟøɲøry:] ‘delightful’[32]
[keɲerel], [keɲeryl], [keɲørøl], [køɲørøl], [køɲøryl] ‘have mercy on someone’[33]
[idø:], [ydø:] ‘time’ (< *[idɛɣ]) vs. [idɛje] ‘time-3SG’ (< *[idɛɣe])[34]

The variation is extensive, but patterned: descriptively, a labial vowel resulting from regressive labialization implies a labial vowel to its right but not to its left.[35] The word for ‘riverside, grove’ can be any of the forms listed in (9), but it cannot be +[børeg] or +[børek]; ‘noble’ cannot be +[nømeʃ], ‘delightful’ cannot be +[ɟøɲery:], and so on. The forms marked here with + are either completely absent from the OHu corpus or are vanishingly rare.[36] Even in the 20th century Hungarian dialects showed extensive variation in labiality among the front vowels which tended to pattern along the same lines (Imre 1971: 203–212). This latter observation, as well as the variation observed in OHu, was crucial for Losonczi’s argument that the feature [labial] had spread regressively from the final syllable of the word.

In view of the fact that Hungarian most likely always had initial word stress, it is frequently claimed in the literature that both final and regressive labialization were essentially a form of vowel reduction (Bárczi 1958: 20; E. Abaffy 2003: 330). Indeed, in word-final position it seems to have been the precursor to the complete loss of short vowels (see the data in (8) above). Nevertheless, whether we regard it as reduction in any sense or not is immaterial for our purposes. It may have been reduction word-finally, but the regressive spreading affected stressed vowels as well (cf. the first syllable in [nømøʃ] ‘noble’, [ɟøɲøry:] ‘delightful’ etc. in (9) above), which would be highly unlikely in the case of a reductive process.

As was said above, regressive labialization was a robust but variable tendency. Furthermore, it interacted with two other tendencies which proved crucial in the emergence of the progressive spreading of labiality. One was the paradigmatic levelling of stem-final vowels, the other was the set of changes that labialized front vowels in the stressed — or at least non-final — syllables of

---

[32] *ǵenerú(sege)* (Nagyszombat Codex, 1512–1513), *gýenerew* (Festetics Codex, 1492–94), *ǵenerǫ(segbe)* (Bod Codex, early 16th c.), *genewrw(sege)* (Pozsony Codex, 1520), *ǵǫnǫrǫ(sege)* (Bod Codex, early 16th c.); *ǵǫńǫrý(ségh)* (Székely-udvarhely Codex, 1526–1528). In the OHu data it is not always clear whether paleographic *w, v, u, ev* or *ew* etc. mark [y], [y:], [ø] or [ø:] because of the general lowering tendency of short vowels in the period, the frequent lack of length marking, and the ubiquitous inertia of writing traditions. From the point of view of labialization, our chief concern here, this is immaterial, since we have no reason to believe that the relevant letters or letter combinations ever denoted unrounded [i] or [e].

[33] *kenerel* (Letter 25, 1511), *kenerwl(ned)* (Teleki Codex, 1525–1531), *keńurǫl(ǫnc)* (Debrecen Codex, 1519), *kǫńǫrül* (Guary Codex, before 1508); *kǫńǫrǫl* (Döbrentei Codex, 1508).

[34] *idǫ* (Bod Codex, early 16th c.); *vdǫ*, *idèie* (Vienna Codex, mid-15th century).

[35] This implication is not valid for those front labial vowels that emerged due to the consonantal environment, e.g. [tølt] ‘fill’ or [føld] ‘land’ could have a labial vowel regardless of the following (see section 3 above).

[36] The appearance of such forms in certain Middle Hungarian dialects points to complex issues of later lexicalization not to be discussed here.

words. The latter set of changes was presented in section 3 above; the paradigmatic levelling, or analogical transfer, was introduced earlier in this section.

Word-final short vowels were lost in the course of the thirteenth century at the latest — indeed after certain consonants considerably earlier. As was seen above, final short vowels had been labialized in most words before being apocopated altogether. When such a stem was suffixed, however, the phonological conditions (viz. word-final position) were not present, hence alternations between a labial and a non-labial vowel resulted (EOHu [beregy] 'grove' vs. *[beregek] > LOHu [ber(e)kek] PL). Subsequently these alternations were variably levelled within paradigms, which resulted in labial front vowels appearing before suffixes as well. Examples from LOHu are given in (10).

(10) [ber(e)kek] or [ber(e)køk] 'grove-PL' (cf. [bereg] or [berek] 'grove')[37]
[kɛrtɛk] – [kɛrtøk] 'garden-PL' (cf. [kɛrt] 'garden')[38]
[kɛrtɛʃ] – [kɛrtyʃ] 'garden-ADJ' (cf. [kɛrt] 'garden')[39]

This paradigmatic levelling and redistribution of stem-final vowels proceeded with many exceptions and varies among dialects to this day. Add to this that several of the labializing changes presented in section 3 had exceptions or were undone via morphological levelling, and this explains why the resulting picture appears chaotic at first. There were three variable processes interacting with each other: regressive labialization, morphological levelling in stem-final position and the conditioned labializing changes affecting non-final vowels. There is, however, a very important observation to be made with respect to the precise relation between the first two of these processes: the regressive spreading of labiality presupposed morphological levelling to a labial vowel in stem-final position, but not vice versa.[40] This generalization emerges quite clearly from the variation apparent in LOHu, as is exemplified by the data in (11). These show the attested variant forms of the words [ɟɛrmekek] 'child-PL' and [piʃpekek] 'bishop-PL'[41] (singular [ɟɛrmek] and [piʃpek], respectively).

---

[37] See note 25 above.

[38] *kertek(et)* (The Legend of Saint Margaret, 1510), *kertők* (Jordánszky Codex, 1516–1519).

[39] *kertus-* (1037), *kertes* (1221).

[40] This observation is expressed in Losonczi's (1915) hypothesis that it was not the word-final labialized vowel *per se* that caused regressive labialization but the word-final labialized vowel *when transferred analogically* to pre-suffix position.

[41] Whether the word for 'bishop' was borrowed immediately from (Bavarian) German, from (North-East) Italian or from (South-West) Slavonic, the form encountered in the donor language was most probably *[piʃkup] (ultimately from Latin/Greek *episcopus*). However, already the earliest Old Hungarian attestations show both consonantal metathesis and non-labial replacement of the second vowel, with labial (front) variants appearing subsequently (Benkő 1993–1994 s.v. *püspök*). All occurrences of these two nouns found in the codices in the OHC are given in separate data files and described in detail in the Appendix.

(11) no levelling, no regressive labialization: [ɟɛrmekek], [piʃpekek][42]
levelling, no regressive labialization: [ɟɛrmekøk], [piʃpekøk][43]
levelling and regressive labialization: [ɟɛrmøkøk], [piʃpøkøk], [pyʃpøkøk][44]

The variants that do not seem to exist are those with regressive labialization but no levelling before the suffix (⁺[ɟɛrmøkek], ⁺[piʃpøkek]).[45] This is consistent with what one sees in unsuffixed forms (or forms with obscured suffixation). In both types it appears that labiality in a short front vowel had to be licensed either by the consonantal environment, as in [fyʃt] 'smoke' or [tølt] 'fill' (see section 3), or by a labial vowel in a following syllable, as in [ɟøɲøry:] 'delightful' or [kørøst] 'cross' (see (9) above). At this stage in the history of the language, in a putative form ⁺[ɟɛrmøkek] neither licensing factor would have been available.

Figure 1 provides a summary of this section by presenting the sequence of changes through the example of the singular vs. plural form of the 'child' word. Some simplifications have been made but these do not impinge on the points being made. The fact that some of the forms are unattested (e.g. the 'child' word with final [y]) is irrelevant because they represent types (final [y] is attested in other lexical items). The forms themselves are given in the middle two columns, while comments are given in the first and last columns regarding the highlighted parts of the forms.

comments on singular	singular forms	plural forms	comments on plural
labialized final vowel	*[ɟɛrmek**y**]	[ɟɛrmek**e**k]	putative original stem-final vowel, preserved before suffix
	*[ɟɛrmek**y**]	*[ɟɛrmek**y**k] ~ [ɟɛrmekek]	labial vowel analogically transferred from unsuffixed form
final vowel lost	[ɟɛrmek]	[ɟɛrmek**ø**k] ~ [ɟɛrmekek]	regular [y] > [ø] lowering
	[ɟɛrmek]	[ɟɛrm**ø**køk] ~ [ɟɛrmekøk] ~ [ɟɛrmekek]	regressive labialization of stem-internal vowel
labial vowel analogically transferred from suffixed form	[ɟɛrm**ø**k] ~ [ɟɛrmek]	[ɟɛrmøkøk] ~ [ɟɛrmekøk] ~ [ɟɛrmekek]	

Figure 1: Conspectus of final and regressive labialization.

[42] *gèrmėkėc* (Vienna Codex, mid-15th century), *pispekek* (Jókai Codex, around 1440).
[43] *gÿermekóket, pÿspekók* (Érdy Codex, around 1526).
[44] *germǫkǫc* (Guary Codex, before 1508), *pÿspǫkǫk* (Czech Codex, 1513), *pẃspǫkǫk* (Peer Codex, early 16th c.).
[45] Incidentally in Modern Standard Hungarian these words have been lexicalized as [ɟɛrmɛk] (plural [ɟɛrmɛkɛk]) vs. [pyʃpøk] (plural [pyʃpøkøk]).

5 The emergence of progressive labial harmony

With the token frequency of front (as well as back) labial vowels growing steadily throughout the OHu period, and Turkic loanwords such as [økør] 'ox', [øzøn] 'flood' also increasing the number of front labial vowels, the conditions were finally given for progressive labial harmony to appear, which would be structurally similar to the inherited backness harmony. Is it possible to get a grasp of the details of the process whereby regressive labial spreading turned into progressive labial spreading? And is it possible to find the motivation for this apparent reversal of direction? We believe that the answer to both questions is positive. Many details that cumulatively contribute to an answer to the former of the two questions can be culled from the time-honoured historical grammars of Hungarian, most comprehensively Benkő (1991; 1992). These, however, need to be placed into a proper context so that these findings will contribute to our understanding of the general properties of harmony systems. As we see it, the process of the reversal of spreading direction took place along the following lines.

It seems certain that many of the suffixes that were affected by stable progressive labial harmony beginning in LOHu had earlier had a labial vowel, that is, they can be reconstructed with [u] or [y] in EOHu. There are two reasons for this. One is that the vowels in several of these suffixes result from the labialization and levelling of etymological stem-final vowels, which were reassigned to affixes subsequent to the loss of word-final short high vowels. The example in (12) shows the most plausible path to the development of the vowelled superessive suffix [on/en/øn] via reanalysis of stem-final high vowels followed by the lowering of [y] to [ø]. Many other suffixes acquired vowelled variants in this way.

(12) EOHu [beregy], [beregy-n] > [bereg], [beregy-n] > LOHu [bereg], [bereg-øn] 'grove' NOM vs. SUPERESS

The other reason is that some of these suffixes result from the grammaticalization of nouns that had an etymological labial vowel. A good example is the allative suffix [hoz/hez/høz], which derives from a Proto-Ugric noun reconstructed as **kuć^V* 'side' (Benkő 1993–1994 s.v. *hozzá*). Systematic sound changes resulted in *[xuz] > EOHu [huz] with variable lowering to [hoz]; in this period this word is already attested in a grammaticalized form (*ozchuz* 'to it' in the late 12th c.). At some stage, probably during the EOHu period, it underwent backness harmony and developed the front variant [høz] after front-vowelled stems. Backness harmony for this suffix is securely established for the LOHu period; this simply means that it had aligned by this time with other suffixes not resulting from grammaticalization, and we see the same happening to other suffixes grammaticalized from nouns (e.g. inessive [bɒn/bɛn]).

In several codices within the LOHu corpus the back variant of the allative suffix was [hoz], the front variant [høz]; in some, however, a non-labial variant [hez] appeared (for

a full conspectus of the data see the Appendix and the relevant data file). The relationship between the two front allomorphs in some of the corpus is one of free variation, with the labial form dominating. In some codices, however, the progressive harmonizing pattern appears in which after front vowelled stems the labiality of the last vowel before the suffix determines the labiality of the vowel in the suffix itself. But how did the delabialized variants appear in the first place? Their emergence can be explained on the analogy of unlevelled suffixed forms such as [ɟɛrmekek] 'child-PL' and [piʃpekek] 'bishop-PL' (see (11) above). Since both the morphological levelling of stem-final vowels and the regressive spreading of labiality were variable, but the latter presupposed the former, there was a varied but restricted set of analogical patterns that a suffix of the same type as the allative could follow. With a suffix for which the original/default front variant was labial, these patterns were as given in (13); the example is [ɟɛrmek] 'child' in the allative and in the plural.

(13) [ɟɛrmekhøz] analogous to [ɟɛrmekøk] — ([høz] default variant)
[ɟɛrmøkhøz] analogous to [ɟɛrmøkøk] — ([høz] default variant)
[ɟɛrmekhez] analogous to [ɟɛrmekek] — ([hez] innovative variant)

The crucial point here is that the appearance of the innovative non-labial variant was based on an existing pattern in which there was neither stem-final levelling, nor (by implication) regressive spreading of labiality. Since this resulted in forms in which a non-labial suffix vowel followed a non-labial stem vowel, such forms could easily be reanalysed as resulting from progressive spreading of the [–labial] feature value. It is also important that since there were no (or nearly no) forms of the type $^{+}$[ɟɛrmøkek] — because of the implicational relation between stem-final levelling and regressive spreading —, there was no pattern on which forms such as $^{+}$[ɟɛrmøkhez] could be analogically created. This must have contributed to the perception that the relation between a labial vowel in the stem and a labial vowel in the suffix (in this order) was rule-governed.

The changes affecting suffixes such as allative [hoz/hez/høz] exemplify reanalysis resulting in the progressive spreading of [–labial]. The progressive spreading of [+labial] also appears in certain dialects in the LOHu period. In a group of closely related texts called the Hussite Bible, where suffixes similar to the allative show exceptionless labial harmony, we also see the first clear instances of labiality appearing on suffix vowels that are certain to be etymologically non-labial. Examples include the conditional suffix [ne] and the 3rd singular suffix [e]. In both the original [e:] shortened when in word-final position (this was a systematic sound change in all dialects); in the language variety represented by the Hussite Bible this shortened [e] was progressively labialized after front labial vowels (see 14). Here we see the progressive spreading of [+labial] onto short front vowels next to the progressive spreading of [–labial].

(14) [jø:nø] ‘come-COND’, i.e. ‘he would come’ vs. [jø:ne:nɛk] ‘come-COND-3PL’ (stem [jø:])[46]
[by:nø] ‘sin-3SG’, i.e. ‘his sin’ vs. [by:ne:t] ‘sin-3SG-ACC’ (stem [by:n])[47]
[føldø] ‘land-3SG’, i.e. ‘his land’ vs. [følde:t] ‘land-3SG-ACC’, [følde:bɛ] ‘land-3SG-ILLAT’ (stem [føld])[48]

Another suffix that began showing progressive labial harmony with [+labial] spreading, though not in the same dialect at this time yet, was multiplicative-temporal [ser] (see Benkő 1992: 370–372, for a full conspectus of the data see the Appendix and the relevant data file). This was grammaticalized from a noun meaning ‘order, sequence’ originally (Benkő 1993–1994 s.v. *szer*2). In a large part of the OHu corpus it shows no harmony at all; in some LOHu codices it shows consistent backness harmony, appearing as [sor] after back vowels and as [ser] or [sør] in free variation after front vowels, independently of the labiality of the preceding vowel. Interestingly, in the Hussite Bible, which shows innovative progressive labial harmony for some affixes, [ser] is invariant[49] — this may reflect its status as not fully grammaticalized in that language variety. There are very few codices (e.g. the Virginia Codex, written in the early 16th c.), in which [ser] already shows consistent harmony both in backness and in labiality, see (15).

(15) [hɛtɛtsːer] ‘seventh time’, [ɛløːsør] ‘first time’, [hɒrmɒtsːor] ‘third time’[50]

Thus, progressive labial harmony emerged quite consistently for a variety of suffixes both in verbal and in nominal inflection, and it replaced the variability based on regressive labial spreading. In this way the feature of labiality became capable of fulfilling a disambiguating function with respect to lexical stems by spreading over a portion of word forms, but via a process controlled by the stem rather than by the final syllable of words. It became capable of contributing to lexical identifiability, thus assuming a perceptually relevant function next to the coarticulatory pattern in which it originated.

The following period, Middle Hungarian, shows the stabilization of labial harmony for many of the suffixes, among them the recently grammaticalised multiplicative-temporal [ser]. For reasons beyond the scope of this paper, the only such suffixes were those with mid vowels (with [e] later lowering to [ɛ] in the dialects on which Modern Standard Hungarian is based). High vowels never participated in progressive labial harmony, and long vowels did so only marginally for a brief period.[51]

---

[46] *iǫnǫ, iǫnenèc* (Munich Codex, 1466).

[47] *bünǫ, bünet* (Vienna Codex, mid-15th c.).

[48] *fǫldǫ, fǫldet, fǫldebe* (Apor Codex, around 1500).

[49] *ǫtʒer* [øtser] ‘five times’, *haromʒer* [haːromser] ‘three times’ (Munich Codex, 1466), cf. the examples in (3) in section 1.

[50] *hetedzer, harmadzor, elwzewr* (Virginia Codex, early 16th c.).

[51] Interestingly, while the 3PL suffix had a non-high vowel (e.g. OHu/MiHu [haːz-ok] ‘their house’), it displayed a weak capacity to partake in labial harmony. For reasons not clearly understood, its vowel became high later (MoHu [haːz-uk]), and the suffix has entirely stopped partaking in labial harmony. Some suffixes with long mid vowels displayed a weak propensity to partake in labial harmony in certain dialects of LOHu, but they stopped doing so altogether by MiHu (see Cser et al. to appear).

6 Perspectives for further research

As we see it, there are two specific aspects of the analysis presented above that may be of further theoretical or typological interest. We offer no more here than tentative remarks regarding these. The first (directionality) has been inherent throughout the discussion; the second (implications for feature theory) less so.

One aspect concerns the direction of the harmonic process. Hyman (2002: 25–26) compares the findings regarding vowel harmony to Hansson's (2001) findings regarding consonant harmony and comes to the conclusion that both types predominantly display two major patterns of directionality: one is sensitive to morphological structure (root- or stem-controlled), the other is insensitive to morphological structure and typically proceeds right-to-left. The emergence of OHu labial harmony represents a shift from the latter to the former type. As was pointed out earlier, a similar difference was described in Beddor & Yavuz (1995) in Modern Turkish between vowel coarticulation and vowel harmony (see also Conklin 2019). It is interesting that the two languages have different stress patterns, but word stress is redundant in both. It has also been claimed (e.g. Nicolaidis 1999, Recasens 2015) that while stress clearly influences the direction of coarticulatory spreading, this impact can be moderated by intervening consonants. Whether any such effect exists in the OHu data is for future research to determine.

Analyses of Old High German umlaut, a change structurally similar to the first (regressive) phase of labial spreading in EOHu, correctly highlight the role of coarticulatory factors in the process (e.g. Iverson & Salmons 2003; Walker 2011: 111–115). There are, however, some indications that perceptual factors may have played a minor role too; in particular, Walker (2011: 113–114) points this out on the basis of the interaction between umlaut and stress. Perceptual factors may indeed have played a functional role in umlaut since this change frequently accompanied suffixation and thereby contributed to the secondary marking of grammatical differences (e.g. plural vs. singular for nouns, gradation for adjectives, present vs. past for weak verbs). One could perhaps argue for a similar perceptual motivation for OHu regressive labialization if such patterns had ever emerged, e.g. singular [ɟɛrmøk(y)] vs. plural [ɟɛrmekek] or vice versa, singular [ɟɛrmek] vs. plural [ɟɛrmøkøk] with a consistent distinction in labiality corresponding to number. It is just possible (see Appendix) that the language variety of the Érdy Codex represents the latter case, but we cannot be entirely certain. What is then typologically interesting in the OHu case is a shift from a regressive spreading pattern with a basis predominantly in coarticulation to a progressive spreading pattern with a basis probably still in coarticulation but with an important perceptual function superimposed on it.

The other aspect concerns the implications of the phenomena and their analysis for a hierarchical theory of features (as advocated and applied in Dresher 2009; see further Dresher & Zhang 2005; Ko 2011; Oxford 2015; Hall & Hall 2016). One basic tenet of this theory is that there is an intimate relationship between contrastivity and phonological activity: non-contrastive

features are typically phonologically inactive. With special reference to harmony phenomena, Dresher & Zhang (2005: 55) say that "only segments with a contrastive specification for a feature [F] can trigger harmony based on [F]." While this clearly implies a categorical notion of contrastive status, Hall & Hall (2016) interpret Dresher's hierarchical model of features as involving a continuum of contrastiveness, marginally contrastive features being those that are low in the hierarchy and thus do not take scope over other features. The analysis we have presented resonates with this interpretation: indeed, when labiality began to spread regressively in the EOHu period, it was either a redundant or a marginally contrastive feature, just appearing at the lowest level in the feature hierarchy. As Hall & Hall (2016) say, "contrasts with low scope might… be expected to be diachronically unstable—either emerging or disappearing … —and synchronically more susceptible to neutralization… Similarly, but potentially independently, contrasts with low entropy may offer less evidence to the learner, and consequently also be diachronically precarious." While labiality became a robust contrastive feature in LOHu, it displays a certain amount of dialectal variability even today.

It is interesting to note that Meadow Mari, a distantly related language, also developed a very limited form of labial harmony independently of Hungarian (Fejes 2022: 26–27). In that language, however, labiality takes precedence over backness, another harmonizing feature, i.e., in the [o] ~ [e] ~ [ø] alternating series the back vowel appears only if labial harmony allows it, e.g. the inessive of 'Moscow' is [moskva-ʃte] rather than *[moskva-ʃto] because [a] is unrounded, despite the conflict in the backness of vowels (example from Fejes 2022: 26). What this probably means in terms of the hierarchical theory of features is that labiality takes scope over backness in Meadow Mari, whereas the reverse is true in (Old) Hungarian. Of course, a full analysis along these lines is impossible to undertake in this paper.

7 Conclusion

We have presented what we believe to be a plausible account of the emergence of labial harmony in Old Hungarian. The roots of the diachronic sequence of events go back to a stage that is poorly documented, and thus reconstructions need to be projected backwards, in some cases on the basis of very little data. For some phenomena, later and better documented stages already show lexicalized reflexes rather than change in progress, but even these can be helpful in formulating hypotheses about how a given state of the language came into being. The limited amount of data at our disposal necessarily means that no strict quantitative methodology can be applied. Significantly, however, the data that exist do not contradict the claims that have been articulated here, and we are confident that the main thrust of the argument will stand the test of time.

The emergence of progressive labial harmony in late Old Hungarian can be traced to two factors affecting labiality in Pre- and Early Old Hungarian. One is the regressive spreading of labiality from word-final position onto short front vowels, most probably a coarticulatory process;

the other is the gradual stabilization of labiality as a contrastive feature in the vowel system. At the beginning of the OHu period, the labiality of vowels was a redundant feature, or at most a feature with marginal distinctive function. However, in the wake of (i) phonological changes that increased the number of front labial vowels, (ii) the adoption of loanwords including such vowels, and (iii) the enhancement by labialization of the contrast between [aː] and [ɒ] (< [a]), by LOHu labiality was a robustly entrenched contrastive feature. This meant that its role in the identification of lexical morphemes, i.e. the left of word forms, became as crucial as that of [±front] (which had always been a progressively spreading feature). Gradually, stems came to be lexicalized with vowels specified for labiality and, parallel to this, several affixes with mid vowels began to display consistent stem-controlled labial harmony. The latter development can clearly be understood as a step towards increased lexical identifiability (cf. also Suomi 1983 and Baković 2003), and this change in the contrastive force of labiality explains the reversal in the direction of its spreading. The perceptual motivation of progressive harmony – after the shift in direction – as purported here is to be understood as provided by this increase in its role in lexical identifiability.

Appendix

The data for regressive labialization in the two nouns ‘bishop’ and ‘child’ as well as for labial harmony in the allative and the multiplicative suffixes are given in a separate file with a separate readme file that give technical explanation (Data_1, Data_2, Data_3, Data_4, Data_5, Data_Readme, respectively). Here we explain how the data were gathered and what they show.

Data for regressive labialization

We present two words we also used as examples in the main text, viz. [piʃpek]/[piʃpøk]/[pyʃpøk] ‘bishop’ and [ɟɛrmek]/[ɟɛrmøk] ‘child’. These are attested in the corpus in large enough numbers that the variation can be meaningfully presented. For the former word, we collected all forms from the corpus that included the written sequence <sp> (with different variants of the letter <s>), for the latter all word forms that included <rm> (with different variants of the letter <r>). From the resulting list we manually selected all forms that belonged to the lexemes in question and did automated searches for these particular forms. We checked the resulting dataset of all their occurrences for problematic (e.g. truncated or erroneously entered) forms and looked at them individually to decide whether they needed to be excluded or not. The whole procedure resulted in 874 data rows for ‘bishop’ and 1017 data rows for ‘child’. In each data row we have added information on the precise locus of the given data point as well as morphological information describing the endings (or labeling the endingless nominative (singular) as such).

The endings are classified into two categories. Those marked Type A (such as the plural or the accusative ending) are preceded by a vowel that may continue a historical stem-final vowel (cf. **Figure 1** in the main text); those marked Type B are either not preceded by such a vowel at all (such as the allative or the inessive ending) or are preceded by a vowel that had been crucially altered by early sound changes (such as the possessive 3Sing ending). From the point of view of tracking regressive labialization only endings of Type A immediately following the stem are of interest in theory; labialized stem vowels before affixes of Type B or in unsuffixed forms are assumed to result from analogical extension affecting the stem, i.e., lexicalization of the labialized vowel. In fact, for both words there appears to be extensive lexicalization of either the non-labialized stem form, or its labialized variant (in the case of ‘bishop’, two variants). Dependence on suffixation is no longer transparent with one or two important exceptions to be highlighted below.

Data for ‘bishop’

For this word many codices consistently use the non-labial variant [piʃpek] (the Cornides, Dominic, Horváth, Gömöry, Jókai, Székelyudvarhely, Virginia, Jordánszky Codices, the Legend of Saint Margaret, Parables, the first hand of the Érdy Codex). In some the right-labialized [piʃpøk] is the dominant or only form (the Döbrentei, Kazinczy, Weszprémy, Tihany Codices as

well as the first hand of the Debrecen Codex and the second hand of the Érdy Codex). In three codices (Munich, Peer, Vienna) only the fully labialized form [pyʃpøk] is attested. In all three types there is great variety in how many forms any individual codex includes.

There are two codices that deserve special mention at this point. In the Érsekújvár Codex, written most probably by five different hands, the only form for the first hand is non-labial. For the remaining four hands there is great variety, with a number of non-labial and fully labial forms but also including more than thirty forms written <pwspek> exclusively used by the second and the third hands. This writing suggests the exceptional sound shape [pyʃpek], unattested anywhere else in the entire corpus. If this was phonological reality, it shows that for these speakers there was no regressive labialization but the first vowel was labialized between the two labial consonants (cf. the first sound change described in section 3 of the main text). (There are two similar forms reported in the Teleki Codex, but since the original of that work is now lost, we have not been able to check them.)

The other text to mention here is the Nádor Codex. In this work there are 24 occurrences of the word 'bishop'; of these 6 are non-labial, and of these six four are unsuffixed nominatives and two include a suffix Type B each. Both unsuffixed and Type B-suffixed forms seem to be variable regarding the labiality of the second stem syllable. By contrast, the three forms that include a suffix Type A (all plurals) are all right-labialized (i.e. [piʃpøkøk]). While these numbers are obviously too small to allow any generalization, it is just vaguely possible that this pattern is close to a diachronic stage where suffixed forms containing the original stem-final vowel showed consistent regressive labialization whereas all other forms showed incipient and variable analogical transfer of the labiality of the vowel in the last stem syllable.

Data for 'child'

In the significant majority of the codices this word has no labial vowel at all. In some (the Czech, Guary, Kazinczy, Nádor, Nagyszombat, Tihany, Winkler Codices, the first hand of the Debrecen Codex, as well as the Lázár Codex except for the first hand) a form with a labial second vowel (i.e. [jɛrmøk]) appears to have been lexicalized.

The variety represented by the two hands of the Érdy Codex, however, gives a hint of the transitional stage of regressive labialization. In this work there are 68 instances of 'child'; of these, 11 are suffixed. All the suffixed forms have Type A suffixes (four different morphemes) immediately following the stem, and all these forms have a labial vowel both before the suffix and in the second syllable of the stem (e.g. plural [jɛrmøkøk]). The unsuffixed forms, however, are overwhelmingly non-labial (51 out of 57 [jɛrmek] vs. 6 [jɛrmøk]). This variety, then, may possibly preserve a diachronic stage at which regressive labialization in suffixed forms was already present, but the labiality of the stem vowel was not yet generalized to unsuffixed forms.

Data for the allative suffix

The data for allative forms were collected in the following way. First, we collected all forms marked as All(ative) from the morphologically analyzed part of the corpus and from these we selected the forms including the palatal variants. We then collected all forms whose final sequence was normalized to <hez> or <höz> in the normalized but not morphologically analyzed part of the corpus (scil. these being the MoHu spellings for the palatal variants of the suffix). Finally, we collected all forms from the remaining (considerably larger) part of corpus that end in the letter <z> (and different variants thereof). From the resulting list we manually selected all forms that end in the allative suffix and did automated searches for these particular forms. We checked the resulting dataset of all their occurrences for problematic (erroneously entered) forms and looked at them individually to decide whether they needed to be excluded or not. Since after back vowels the suffix variant was invariably back ([hoz]), we left these forms out of the search entirely. The whole procedure resulted in 1927 data rows. In each data row we have added information on the precise locus of the given data point and have indicated whether the vowel in the last syllable before the suffix is labial or non-labial, and whether the vowel of the suffix itself is labial or non-labial. The former of the two vowels is referred to as root vowel irrespective of its actual morphological status. We have also added an approximate gloss to each item (leaving out morphosyntactic details irrelevant to the query).

All codices without exception show palatal harmony for this suffix, so we take that as a given in the following. A considerable number of the codices only show palatal harmony and generally have a labial suffix vowel irrespective of the preceding vowel (e.g. the Guary, Kazinczy, Tihany, Lázár, Sándor Codices or the second hand of the Székelyudvarhely Codex). These would be representative of the most archaic language variety within the relevant time span. Some codices show weak labial harmony in the sense that the labial variant often appears after non-labial vowels too (e.g. the Debrecen, Érdy, Nagyszombat, Nádor, Weszprémy Codices). Nevertheless, the palatal variants can also show a certain degree of free variation, which may even lead to labial root vowels being followed by non-labial suffixes in a small minority of the cases (e.g. in the Érsekújvár, Nádor, Nagyszombat Codices). Some codices show consistent harmony (e.g. Jókai, Munich, Vienna, Apor, Döbrentei). Finally, the language variety represented by a minority of the codices appears to have generalized the non-labial suffix variant for palatal words (e.g. the Dominic, Horváth, Keszthely Codices or the Legend of Saint Margaret). (For some codices it is impossible to tell with certainty which type they belong to on account of the small number of data.)

Data for the multiplicative suffix

The data for multiplicative forms were collected in the following way. First we collected all forms marked as Mult(iplicative) from the morphologically analyzed part of the corpus. We then

collected all forms whose final sequence was normalized to <szer> or <ször> or <szor> (the MoHu spellings) in the normalized but also in the morphologically analyzed part of the corpus. The analyzed part of the corpus needed to be checked again because some multiplicative forms are tagged as adverbs. Finally, we collected all forms from the remaining part of corpus that end in the letter <r> (and different variants thereof). From the resulting list we manually selected all forms that end in the multiplicative suffix and did automated searches for these particular forms. We checked the resulting dataset of all their occurrences for problematic forms and looked at them individually to decide whether they needed to be excluded or not. The whole procedure resulted in 3030 data rows. In each data row we have added information on the precise locus of the given data point and have indicated whether the vowel in the last syllable before the suffix is back, front labial or front non-labial, and whether the vowel of the suffix itself is back, front labial or front non-labial. The former of the two vowels is referred to as root vowel irrespective of its actual morphological status. We have also added an approximate gloss to each item consisting simply of a numerical expression. In reality, a gloss such as '3' is to be understood as covering a range of expressions and their uses meaning 'three times', 'for the third time', 'third (as in a list)'.

Some of the codices show the original form [ser] invariably, without any form of harmony, e.g. the Vienna, Cornides (with two labial variants out of 216), Horváth, Munich Codices or The Legend of St Margaret. Some codices show backness harmony without labial harmony, i.e., only [ser] and [sor], but not [sør], e.g. the Apor and Teleki Codices or the second half of the Székelyudvarhely Codex. The latter two show an interesting feature in back-vowelled forms: although the suffix variant is systematically back after back-vowelled stems in their language variety, for the single lexical item meaning 'second' they mostly show a front-vowelled variant [ma:ʃotsːer] rather than the expected [ma:ʃotsːor], as opposed to [hɒrmɒtsːor] 'for the third time' and so on. Another pattern is for the bipartite harmony to involve [sør] rather than [ser] after front vowelled-stems, i.e., the backness alternation is between [sør] vs. [sor]. This is seen in the Czech, Guary, Kazinczy and Tihany Codices; note that the same codices also have only labial variants for the allative suffix (see above), with which the multiplicative suffix appears to have aligned as regards its harmony pattern in their language variety. Some codices attained a stage where three suffix variants are already in use, but only backness harmony is consistent, and even that only one way. In the Érsekújvár Codex the variant [sor] only combines with back-vowelled stems; the two front variants, however, can appear after any kind of stem (including back) without any apparent regularity. The Nagyszombat Codex shows consistent backness harmony but after front stems there appears to be free variation between the front labial and the front non-labial suffix variants. And finally, there are those few codices in which three-way harmony is consistent; most notably the Virginia Codex, the Booklet on the Dignity of the Apostles, or the Peer Codex (with only 12 data).

Abbreviations

ABL: ablative

ACC: accusative

ADJ: adjective

ADV: adverb

ALLAT: allative

COND: conditional

EOHu: Early Old Hungarian

ILLAT: illatve

INESS: inessive

LOHu: Late Old Hungarian

MHG: Middle High German

MiHu: Middle Hungarian

NOM: nominative

OHu: Old Hungarian

PL: plural

SG: singular

SUPERESS: superessive

Supplementary files

Data_1 lists all occurrences of the word 'bishop' in the codices, respectively, as well as its derivatives.

Data_2 lists all occurrences of the word 'child' in the codices, respectively, as well as its derivatives.

Data_3 lists all occurrences of word forms affixed with the allative suffix in the codices.

Data_4 lists all occurrences of word forms affixed with the multiplicative suffix in the codices.

Data_5 includes all the remaining data referred to throughout the paper; these are presented here for illustration rather than any kind of quantitative inquiry. Sources are indicated from which the data were taken.

Data_readme gives a more detailed explanation to the data file.

The data referenced above can be found here: https://doi.org/10.16995/glossa.10536.s1

Funding information

The research was supported by the Eötvös Loránd Research Network (HUN-REN) grant *KSZF-14/2023 Fehér foltok*; part of the research was supported by by the Faculty of Humanities and Social Sciences of Pázmány Péter Catholic University (project number PPKE-BTK-KUT-23-2).

Acknowledgements

We are greateful to Ágnes Kalivoda for her help in data collection.

Competing interests

The authors have no competing interests to declare.

References

Aikio, Ante. 2022. Proto-Uralic. In Bakró-Nagy, Marianne & Laakso, Johanna & Skribnik, Elena (eds.), *The Oxford Guide to the Uralic Languages*, 3–27. Oxford: Oxford University Press. DOI: https://doi.org/10.1093/oso/9780198767664.003.0001

Baković, Eric. 2003. Vowel harmony and stem identity. *San Diego Linguistic Papers* 1. 1–42.

Bárczi, Géza. 1958. *Magyar hangtörténet* [Hungarian historical phonology]. 2nd edition. Budapest: Tankönyvkiadó.

Beddor, Patrice S. & Yavuz, Handan Kopkalli. 1995. The Relation between Vowel-to-Vowel Coarticulation and Vowel Harmony in Turkish. *Proceedings of the 13th International Congress of Phonetic Sciences*, 44–51. Stockholm.

Benkő, Loránd (ed.). 1991. *A magyar nyelv történeti nyelvtana* [The historical grammar of Hungarian]. Vol. 1. Budapest: Akadémiai.

Benkő, Loránd (ed.). 1992. *A magyar nyelv történeti nyelvtana* [The historical grammar of Hungarian]. Vol. 2/1. Budapest: Akadémiai.

Benkő, Loránd (ed.). 1993–1994. *Etymologisches Wörterbuch des Ungarischen*. Budapest: Akadémiai. DOI: https://doi.org/10.33339/fuf.119577

Berrár, Jolán. 1961. Az üdő ~ ideje tőtípusról [On stems of the type üdő ~ ideje]. *Magyar Nyelv* 57. 31–39.

Conklin, Jenna T. 2019. *The roles of vowel harmony and stress in predicting vowel-to-vowel coarticulation*. West Lafayette, Indiana: Purdue University PhD Dissertation.

Cser, András, Beatrix Oszkó & Zsuzsa Várnai. to appear (2025). The vowels that almost harmonized: On Old Hungarian long vowels. *Acta Linguistica Academica.*

D. Bartha, Katalin. 1964. *Tővégi magánhangzóink története a XVI. század közepéig* [The history of stem-final vowels in Hungarian to the mid-16th century]. Budapest: Akadémiai.

Dresher, B. Elan. 2009. *The Contrastive Hierarchy in Phonology*. Cambridge: Cambridge University Press.

Dresher, B. Elan & Xi Zhang. 2005. Contrast and Phonological Activity in Manchu Vowel Systems. *Canadian Journal of Linguistics/Revue canadienne de linguistique* 50. 45–82.

Dudás, Györgyi. 2002. A *föld* és a *völgy* labializációs változásai az ómagyar korban [Old Hungarian labialization in *föld* and *völgy*]. *Magyar nyelvjárások* 40. 21–34.

Dudás, Györgyi. 2004. A szóvég felől induló labializáció az ómagyar korban [Old Hungarian regressive labialization]. *Helynévtörténeti tanulmányok* 1. 167–182.

E. Abaffy, Erzsébet. 2003. Hangtörténet (Ómagyar kor) [Historical phonology (Old Hungarian)]. In Kiss, Jenő & Pusztai, Ferenc (eds.), *Magyar nyelvtörténet* [The history of the Hungarian language], 301–351. Budapest: Osiris.

Fejes, László. 2021. On Finnic and Khanty vowel harmony: domains, slopes and their role in typology. *Journal de la Société Finno-ougrienne* 98. 113–148. DOI: https://doi.org/10.33340/susa.95344

Fejes, László. 2022. A general characterization of vowel harmony in Uralic languages. *Finnish Journal of Linguistics* 35. 7–50.

Gafos, Adamantios. 1996. *The articulatory basis of locality in phonology*. Baltomire: Johns Hopkins University doctoral dissertation. [Published 1999, Routledge.]

Gafos, Diamandis. 1998. Eliminating long-distance consonantal spreading. *Natural Language & Linguistic Theory* 16(2). 223–278. DOI: https://doi.org/10.1023/A:1005968600965

Gafos, Adamantios. 2021. Consonant harmony, disharmony, memory and time scales. *Proceedings of the Society for Computation in Linguistics* 4. 188–205.

Gósy, Mária & Siptár, Péter. 2015. Abstractness or complexity? The case of Hungarian /a:/. In É. Kiss, Katalin & Surányi, Balázs & Dékány, Éva (eds.), *Approaches to Hungarian. Volume 14. Papers from the 2013 Piliscsaba Conference,* 147–165. Amsterdam & Philadelphia: John Benjamins. DOI: https://doi.org/10.1075/atoh.14.06gos

Hall, Daniel Currie & Hall, Kathleen Currie. 2016. Marginal contrasts and the Contrastivist Hypothesis. *Glossa: A Journal of General Linguistics* 1(1): 50. 1–23. DOI: https://doi.org/10.5334/gjgl.245

Hansson, Gunnar Ólafur. 2001. *Theoretical and typological issues in consonant harmony*. Berkeley, CA: UC Berkeley doctoral dissertation.

Hegedűs, Attila. 2001. A nyelvjárási alaktani jelenségek [Morphological phenomena in the dialects]. In Kiss, Jenő (ed.). *Magyar dialektológia* [Hungarian dialectology], 351–361. Budapest: Osiris.

Hyman, Larry. 2002. *Is there a right-to-left bias in vowel harmony?* Ms. University of California, Berkeley.

Imre, Samu. 1971. *A mai magyar nyelvjárások rendszere* [The system of modern Hungarian dialects]. Budapest: Akadémiai.

Iverson, Gregory K. & Salmons, Joseph C. 2003. The ingenerate motivation of sound change. In Hickey, Raymond (ed.), *Motives for language change*, 199–212. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511486937.013

Joseph, Andrew & Ko, Seongyeon & Whitman, John. 2020. A comparative approach to the vowel systems and harmonies in the Transeurasian languages and beyond. In Robbeets, Martine & Savelyev, Alexander (eds.), *The Oxford guide to the Transeurasian languages*, 486–508. Oxford: Oxford University Press. DOI: https://doi.org/10.1093/oso/9780198804628.003.0030

Juhász, Dezső. 2018. A nyelvjárások történetéből [On the history of dialects]. In Kiss, Jenő & Pusztai, Ferenc (eds.), *A magyar nyelvtörténet kézikönyve* [Handbook of the history of Hungarian], 314–349. Budapest: Tinta.

Kaun, Abigail R. 1994. An Optimality Theoretic account of rounding harmony typology. *West Coast Conference on Formal Linguistics* 13. 78–92.

Kaun, Abigail R. 1995. *The typology of rounding harmony: An optimality theoretic approach*. PhD dissertation, University of California, Los Angeles.

Kaun, Abigail. 2004. The typology of rounding harmony. In Hayes, Bruce & Kirchner, Robert & Steriade, Donca (eds.), *Phonetically based phonology*, 87–116. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511486401.004

Kis, Tamás. 2005. A veláris ï a magyarban [Velar ï in Hungarian]. *Magyar Nyelvjárások* 43. 5–26.

Kiss, Jenő & Pusztai, Ferenc (eds.). 2003. *Magyar nyelvtörténet* [The history of Hungarian]. Budapest: Osiris.

Ko, Seongyeon. 2011. Vowel Contrast and Vowel Harmony Shift in the Mongolic Languages. *Language Research* 47. 23–43.

Krämer, Martin. 2003. *Vowel harmony and correspondence theory*. Mouton: Walter de Gruyter. DOI: https://doi.org/10.1515/9783110197310

Losonczi, Zoltán. 1915. Az ö-zés története I. [The history of *e* ~ *ö* variation I.] *Nyelvtudományi Közlemények* 44. 373–406.

Mailhot, Frédéric. 2010. *Modelling the acquisition and evolution of vowel harmony*. Ottawa: Carleton University PhD thesis.

Mailhot, Frédéric. 2013. Modeling the emergence of vowel harmony through iterated learning. In Yu, Alan C. L. (ed.), *Origins of sound change: Approaches to phonologization*, 247–261. Oxford: Oxford University Press. DOI: https://doi.org/10.1093/acprof:oso/9780199573745.003.0012

Nearey, Terrance M. 1980. On the physical interpretation of vowel quality: cinefluorographic and acoustic evidence. *Journal of Phonetics* 8. 213–241. DOI: https://doi.org/10.1016/S0095-4470(19)31466-4

Nicolaidis, Katerina. 1999. The influence of stress on V-to-V coarticulation: an electropalatographic study. In *Proceedings of the ICPhS 1999*, 1087–1090. San Francisco.

Nyirkos, István. 1993. *Az inetimologikus magánhangzók a magyarban* [Epenthetic vowels in Hungarian]. Debrecen: KLTE.

Ohala, John J. 1993. Coarticulation and phonology. *Language and Speech* 36. 155–170. DOI: https://doi.org/10.1177/002383099303600303

Ohala, John J. 1994a. Hierarchies of environments for sound variation; plus implications for 'neutral' vowels in vowel harmony. *Acta Linguistica Hafniensa* 27. 371–382. DOI: https://doi.org/10.1080/03740463.1994.10420414

Ohala, John J. 1994b. Towards a universal, phonetically-based, theory of vowel harmony. In *Proceedings of the Third International Conference on Spoken Language Processing*, 491–494. Yokohama. DOI: https://doi.org/10.21437/ICSLP.1994-113

Oxford, Will. 2015. Patterns of contrast in phonological change: Evidence from Algonquian vowel systems. *Language* 91. 308–357.

Przezdziecki, Marek. 2000. Vowel harmony and vowel-to-vowel coarticulation in three dialects of Yoruba. *Working Papers of the Cornell Phonetics Laboratory* 13. 105–124.

Rebrus, Péter & Törkenczy, Miklós. 2017. Co-patterns, subpatterns and conflicting generalizations in Hungarian vowel harmony. In Lipták, Anikó & van der Hulst, Harry (eds.), *Approaches to Hungarian 15. Papers from the 2015 Leiden conference,* 135–156. Amsterdam: John Benjamins. DOI: https://doi.org/10.1075/atoh.15.05reb

Rebrus, Péter & Törkenczy, Miklós. 2021. Harmonic Uniformity and Hungarian front/back harmony. *Acta Linguistica Academica* 68. 175–206. DOI: https://doi.org/10.1556/2062.2021.00475

Rebrus, Péter & Szigetvári, Péter & Törkenczy, Miklós. 2019. Variation, the Height Effect, and disharmony in Hungarian front/back harmony. *Supplemental Proceedings of the 2019 Annual Meeting on Phonology*. Washington, DC: Linguistic Society of America. DOI: https://doi.org/10.3765/amp.v8i0.4750

Recasens, Daniel. 2015. The Effect of Stress and Speech Rate on Vowel Coarticulation in Catalan Vowel–Consonant–Vowel Sequences. *Journal of Speech Language and Hearing Research* 58(5). 1407–1424. DOI: https://doi.org/10.1044/2015_JSLHR-S-14-0196

Róna-Tas, András & Berta Árpád. 2011. *West Old Turkic*. Wiesbaden: Harrassowitz.

Rose, Sharon & Walker, Rachel. 2011. Harmony systems. In Goldsmith, John & Riggle, Jason & Yu, Alan C. L. (eds.), *Handbook of phonological theory*. Second Edition, 240–290. Oxford: Blackwell. DOI: https://doi.org/10.1002/9781444343069.ch8

Simon, Eszter. 2014. Corpus building from Old Hungarian codices. In É. Kiss, Katalin (ed.), *The evolution of functional left peripheries in Hungarian syntax*, 224–236. Oxford: Oxford University Press.

Simon, Eszter & Sass, Bálint. 2012. Nyelvtechnológia és kulturális örökség, avagy korpuszépítés ómagyar kódexekből [Language technology and cultural heritage, or corpus building from Old Hungarian codices]. In Prószéky, Gábor & Váradi, Tamás (eds.), *Nyelvtechnológiai kutatások* [Research on language technology], 243–264. Budapest: Akadémiai. DOI: https://doi.org/10.1007/978-3-642-30379-1_4

Siptár, Péter & Törkenczy, Miklós. 2007. *The phonology of Hungarian*. Oxford: Oxford University Press.

Suomi, Kari. 1983. Palatal harmony: A perceptually motivated phenomenon? *Nordic Journal of Linguistics* 6. 1–35. DOI: https://doi.org/10.1017/S0332586500000949

Törkenczy, Miklós. 2021. Hungarian vowel harmony. In Aronoff, Mark (ed.), *Oxford bibliographies in linguistics*. New York: Oxford University Press. DOI: https://doi.org/10.1093/obo/9780199772810-0134

van der Hulst, Harry & van de Weijer, Jeroen. 1995. Vowel harmony. In Goldsmith, John (ed.), *Handbook of phonological theory*, 495–534. Cambridge, MA & Oxford: Blackwell.

Walker, Rachel. 2011. *Vowel patterns in language*. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511973710