How Morphological is Hungarian Vowel Harmony?

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Traditionally the interaction between phonology and morphology in Hungarian vowel harmony is assumed to be simple and minimal: it applies (i) within a morphologically circumscribed domain (the word, the last stem in compounds, excluding prefixes and some suffixes) and (ii) in the same way within this domain, whether the domain is morphologically simplex or complex (e.g., Vago 1980, Siptár & Törkenczy 2000). In this paper we argue for a much richer interaction between the morphological and phonological aspects of Hungarian vowel harmony and claim that it is highly morphologized, which manifests itself in (a) lexical conditioning, when phonologically arbitrary or underdetermined sets of words are associated with disparate sets of harmonic and other phonological behaviour and (b) paradigm-based regularities where consistency of behaviour within paradigms, i.e., paradigm uniformity, overrides otherwise applicable harmonic patterns.

We show that the quality of the vowel occurring after a stem before certain suffixes is unpredictable to a great extent. This vowel functions as a thematic vowel indicating morphological classes, i.e., declensions (§1). Some aspects of front/back harmony, namely, antiharmony of neutral-vowelled roots (N) and the vacillation in BN(N) roots, are inherently related to these morphological classes (§2). We then discuss a morphological constraint on vowel harmony, Harmonic Uniformity (§3). The paper ends by the conclusion that the types of behaviour mentioned above can be explained by postulating paradigm classes (e.g., Stump 2001, Blevins 2016) rather than by hypothesizing purely phonological processes (§4).

1 "Thematic" vowels

A short vowel shows up after consonant-final stems before a class of suffixes in extended paradigms in Hungarian.[1] After vowel-final stems (like **kɑpu** or **ollo**: below) there is no vowel before the same suffixes. The quality of this vowel is only partly governed by front/back harmony. All the stems in Table 1 contain back vowels, so we expect a back vowel before the suffixes (inflectional or derivational), in agreement with harmony. Although consistently back, this vowel may unpredictably be either **o** or **ɑ**. [2]

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1 The extended paradigm of a stem includes forms containing derivational affixes too (see Steriade 2000, Kenstowicz 2005).

2 The vowel inventory comprises seven short and seven long vowels. These are the back vowels: **u, uː, o, oː, ɑ, aː,** the front rounded vowels: **y, yː, ø, øː,** and the front unrounded vowels: **i, iː, e, eː, ɛ.** Some of the short long pairs differ in quality as shown by the transcription symbols.

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Stem	**PL**	**1SG.POSS**	**2SG.POSS**	**2PL.POSS**	**DISTR**	**ADJZ**	**VERBZ**
kɑpu ‘gate’ ollo: ‘scissors’	kɑpu-k ollo:-k	kɑpu-m ollo:-m	kɑpu-d ollo:-d	kɑpu-tok ollo:-tok	kɑpu-nke:nt ollo:-nke:nt	kɑpu-ʃ ollo:-ʃ	kɑpu-z- ollo:-z-
pa:r ‘pair’ go:l ‘goal’ pɑd ‘bench’ ʃɑrok ‘corner’	pa:r-**o**k go:l-**o**k pɑd-**o**k ʃɑrk-**o**k	pa:r-**o**m go:l-**o**m pɑd-**o**m ʃɑrk-**o**m	pa:r-**o**d go:l-**o**d pɑd-**o**d ʃɑrk-**o**d	pa:r-**o**tok go:l-**o**tok pɑd-**o**tok ʃɑrk-**o**tok	pa:r-**o**nke:nt go:l-**o**nke:nt pɑd-**o**nke:nt ʃɑrk-**o**nke:nt	pa:r-**o**ʃ go:l-**o**ʃ pɑd-**o**ʃ ʃɑrk-**o**ʃ	pa:r-**o**z- go:l-**o**z- pɑd-**o**z- ʃɑrk-**o**z-
ʋa:r ‘castle’ o:l ‘hutch’ hɑd ‘army’ ʃɑrok ‘heel’	ʋa:r-**ɑ**k o:l-**ɑ**k hɑd-**ɑ**k ʃɑrk-**ɑ**k	ʋa:r-**ɑ**m o:l-**ɑ**m hɑd-**ɑ**m ʃɑrk-**ɑ**m	ʋa:r-**ɑ**d o:l-**ɑ**d hɑd-**ɑ**d ʃɑrk-**ɑ**d	ʋa:r-**ɑ**tok o:l-**ɑ**tok hɑd-**ɑ**tok ʃɑrk-**ɑ**tok	ʋa:r-**ɑ**nke:nt o:l-**ɑ**nke:nt hɑd-**ɑ**nke:nt ʃɑrk-**ɑ**nke:nt	ʋa:r-**ɑ**ʃ o:l-**ɑ**ʃ hɑd-**ɑ**ʃ ʃɑrk-**ɑ**ʃ	ʋa:r-**ɑ**z- o:l-**ɑ**z- hɑd-**ɑ**z- ʃɑrk-**ɑ**z-

Table 1. Back vowel between stem and suffix

Let us call stems that are followed by mid **o** before these suffixes -o- stems. This is the productive pattern for back harmonic nouns.[3] Stems that are followed by low **ɑ** in these cases are -a- stems. These have been referred to as lowering stems by Vago (1980), Nádasdy & Siptár (1994), Siptár & Törkenczy (2000). This pattern is not productive for nouns.

The paradigms of -o- stems and -a- stems exhibit phonologically unrelated but paradigmatically associated behaviour. This is exemplified in Table 2.[4]

	PL	**ACC**	**3SG.POSS**	**3PL.POSS**	**SUE**
-o- stem	pa:r-**o**k go:l-**o**k pɑd-**o**k ʃɑrk-**o**k	pa:r-t go:l-t pɑd-**o**t ʃɑrk-**o**t	pa:r-**j**ɑ go:l-**j**ɑ pɑd-**j**ɑ ʃɑrok-**j**ɑ	pa:r-**j**uk go:l-**j**uk pɑd-**j**uk ʃɑrok-**j**uk	pa:r-**o**n go:l-**o**n pɑd-**o**n ʃɑrk-**o**n
-a- stem	ʋa:r-**ɑ**k o:l-**ɑ**k hɑd-**ɑ**k ʃɑrk-**ɑ**k	ʋa:r-**ɑ**t o:l-**ɑ**t hɑd-**ɑ**t ʃɑrk-**ɑ**t	ʋa:r-**ɑ** o:l-**ɑ** hɑd-**ɑ** ʃɑrk-**ɑ**	ʋa:r-**u**k o:l-**u**k hɑd-**u**k ʃɑrk-**u**k	ʋa:r-**o**n o:l-**o**n hɑd-**o**n ʃɑrk-**o**n

Table 2. Suffix alternants by paradigm class, back stems

We can see that it is not only the thematic vowel that differs in the two paradigm classes. No vowel appears in the -o- class before the accusative suffix, **-t**, for stems that end in a vowel + coronal sonorant or fricative (**j**, **r**, **l**, **n**, **ɲ**, **s**, **z**, **ʃ**, **ʒ**) sequence, but the vowel **ɑ** does appear in the -a- class after the same stem-final consonants. A phonologically unrelated alternation, between yod and zero (**-jɑ**/**ɑ**), in the third person singular and plural possessive affix is found in the two paradigmatic classes: the yod appears in the -o- class,[5] but not in the -a- class. The difference in thematic vowel does not show up before the superessive suffix, the presuffixal vowel is **o** in both classes.

These alternations are paradigmatically associated, but they are essentially independent phonologically. Although there is a phonological connection among the forms in the paradigm of an -a- stem, namely, the stem is followed by a vowel in each suffixed form, which is not the case with a number of forms in an

3 In this paper we only discuss noun stems. For a discussion of the difference between nouns and adjectives with respect to this vowel, see Rebrus & Szigetvári 2022.

4 The data in Table 2 illustrate the typical productive pattern for VC-final nouns. Individual departures from this occur especially in the possessive forms, -o- stems may take yodless allomorphs and some -a- stems take yodful ones (cf. Papp 1975, Rácz & Rebrus 2012).

5 The yod is missing after sibilants and palatals in -o- stems too: **kos-ok, kos-ɑ** ‘dirt-PL, -3SG.POSS’; **gɑz-ok, gɑz-ɑ** ‘weed-PL, -3SG.POSS’; **fɑʒ-ok, fɑʒ-ɑ** ‘frost-PL, -3SG.POSS’; **la:ɲ-ok, la:ɲ-ɑ** ‘girl-PL, -3SG.POSS’. This is due to a markedness constraint which bans sibilant/palatal + yod sequences in the language. The nonsibilant, nonpalatal **t, d, n, l** followed by yod undergo automatic assimilation processes resulting in a palatal geminate (e.g., **pɑd-juk → pɑɟɟuk, sa:n-jɑ → sa:ɲɲɑ** ‘sleigh-3SG.POSS’, **go:l-juk → go:jjuk**). For the sake of simplicity, this process is not indicated in our transcriptions.

-o- stem, this cannot be captured in a traditional morphological framework, since this vowel is an integral part of the 3rd person possessives (present in all of its alternants), but not of the other person possessives, the plural or the accusative suffix. Abstract phonological treatments (abstract vowels, floating features, diacritics, etc.) can be devised to account for these alternations, however these are not only *ad hoc* but they also do not cover all phenomena connected to "lowering" stems (see Rebrus & Polgárdi 1997, Siptár & Törkenczy 2000). Stems and suffixes may both induce lowering. The syntactic and morphological category of a stem, whether it is a noun, an adjective, or a verb and whether it is inflected or not, also influences the presuffixal vowel. Any representational account has to incorporate not only all this information but also their interaction with further stem and suffix alternations. This would require that the representation contain an excessive amount of distinctions (cf. Rebrus & al. 1996).

Turning to stems containing front rounded vowels, we again find two lexical classes. Stems which are vocalically (i.e., phonologically) identical may select the front rounded **ø** or the front unrounded **ɛ** presuffixal vowel. Again, the choice of the vowel is partly governed by front/back harmony: both vowels are front. The choice of **ø** is the productive pattern, the choice of **ɛ** is unproductive in nouns. The two patterns are again accompanied by phonologically unrelated other alternations, as shown in Table 3.

	PL	ACC	3SG.POSS	3PL.POSS	SUE	gloss
-ö- stem	ʃyl-**øk** kø:r-**øk**	ʃyl-t kø:r-t	ʃyl-**j**ɛ kø:r-**j**ɛ	ʃyl-**j**yk kø:r-**j**yk	ʃyl-**øn** kø:r-**øn**	'porcupine' 'hearts'
-e- stem	fyl-**ɛk** øl-**ɛk**	fyl-**ɛt** øl-**ɛt**	fyl-**ɛ** øl-**ɛ**	fyl-**y**k øl-**y**k	fyl-**øn** øl-**øn**	'ear' 'lap'

Table 3. Suffix alternants by paradigm class, front rounded stems

As in the case of back vowels in Table 2, we find two different vowels before the plural suffix, the absence vs. presence of a vowel before the accusative suffix (if the stem ends in a coronal sonorant or fricative),[6] the presence vs. absence of yod in the possessive suffix. As before, there is no difference between the two classes in the vowel before the superessive suffix, both front/back and rounding harmony apply as expected.

Stems containing a front unrounded vowel also exhibit two different patterns that diverge in the accusative and possessive forms: as before, a vowel may be present or absent after a stem ending in a coronal sonorant or fricative in the accusative and the yod may be absent or present in possessive forms. Since the thematic vowel in the plural is **ɛ** in both cases, these are -e- stems, similarly to the second pattern in Table 3. Accordingly, the -e- class splits into three classes, one with a front rounded and two with a front unrounded vowel in the stem, as shown in Table 4.

	PL	ACC	3SG.POSS	3PL.POSS	SUE	gloss
-e- stem 1 (rounded)	fyl-**ɛk**	fyl-**ɛt**	fyl-**ɛ**	fyl-**y**k	fyl-**øn**	'ear'
-e- stem 2 (unrounded)	jɛl-**ɛk**	jɛl-**ɛt**	jɛl-**ɛ**	jɛl-**y**k	jɛl-**ɛn**	'sign'
-e- stem 3 (unrounded)	kɛl-**ɛk**	kɛl-t	kɛl-**j**ɛ	kɛl-**j**yk	kɛl-**ɛn**	'kale'

Table 4. Suffix alternants by paradigm class, -e- stems

We thus have six paradigm classes defined by their presuffixal vowel, their vowel in the accusative, the yod in third-person possessive, and the vowel of the superessive, which only distinguishes -e- stem 1 and the other two -e- stems.

2 Front/back harmony

Hungarian exhibits two types of vowel harmony, front/back harmony and rounding harmony. The

6 Thus, rounding harmony is suspended both in the accusative and the plural for -e- stems. Rounding harmony is not expected in 3SG.POSS though: a rounded front vowel is not available in the **ɛ**/**ɑ** alternation that the 3SG.POSS displays.

former exhibits transparency (front unrounded vowels are potentially skipped) and antiharmony (a front unrounded stem may select a back suffix vowel). We look at these two phenomena and interpret them as instantiations of stems belonging to distinct paradigm classes, which were set up in §1 for independent reasons.

2.1 *Antiharmony as paradigm class* Only stems that contain a single front unrounded vowel may be antiharmonic. Such a stem selects the back (B) variant of an alternating suffix, even though the stem vowel is front (F). The thematic vowel after an antiharmonic stem may either be mid or low, similarly to back stems (shown in Table 1). We provide examples in Table 5.

Harmonic classes	**Paradigm classes**	**PL**	**1PL.POSS**	**DAT**	**ALL**	**ABL**	**gloss**
front (harmonic)	-e- stem	hi:r-**ɛk** si:n-**ɛk** se:l-**ɛk** ke:j-**ɛk**	hi:r-**y**nk si:n-**y**nk se:l-**y**nk ke:j-**y**nk	hi:r-n**ɛk** si:n-n**ɛk** se:l-n**ɛk** ke:j-n**ɛk**	hi:r-h**ɛz** si:n-h**ɛz** se:l-h**ɛz** ke:j-h**ɛz**	hi:r-t**ø**:l si:n-t**ø**:l se:l-t**ø**:l ke:j-t**ø**:l	‘news’ ‘colour’ ‘edge’ ‘lust’
back (antiharmonic)	-o- stem	ʃi:r-**o**k ki:n-**o**k ʦe:l-**o**k	ʃi:r-**u**nk ki:n-**u**nk ʦe:l-**u**nk	ʃi:r-n**ɑ**k ki:n-n**ɑ**k ʦe:l-n**ɑ**k	ʃi:r-h**o**z ki:n-h**o**z ʦe:l-h**o**z	ʃi:r-t**o**:l ki:n-t**o**:l ʦe:l-t**o**:l	‘grave’ ‘torture’ ‘goal’
	-a- stem	di:j-**ɑ**k in-**ɑ**k he:j-**ɑ**k	di:j-**u**nk in-**u**nk he:j-**u**nk	di:j-n**ɑ**k i:n-n**ɑ**k he:j-n**ɑ**k	di:j-h**o**z i:n-h**o**z he:j-h**o**z	di:j-t**o**:l i:n-t**o**:l he:j-t**o**:l	‘prize’ ‘tendon’ ‘crust’

Table 5. Harmonic and antiharmonic stems

The paradigm classes in Table 5 are lexically arbitrary, since the phonological make-up of the words belonging to the three classes are identical in all the relevant details. Nevertheless, there are phonological restrictions on their class membership: all the stems that belong to the antiharmonic -o- and -a- classes are monosyllabic and their vowel is one of the set {**i i**: **e**:}. The only restriction on the -e- classes is that the last vowel of the stem must be front unrounded (**i i**: **e**: **ɛ**) or front rounded (**y y**: **ø ø**:).

2.2 *Transparency: “mixed” ...BN(N) roots*[7] By default the harmonic class of a root is determined by its last vowel. However, if this vowel is neutral (N = {**i i**: **e**: **ɛ**}), harmony may follow a preceding vowel (with differing probabilities, see Hayes and Cziráky Londe 2006). Examples are given in Table 6.[8]

Harmonic classes	**Paradigm classes**	**PL**	**DAT**	**gloss**
front/back (optionally transparent)	-e/o- stem	sɑliʦil-**ɛk**/**o**k sɑte:n-**ɛk**/**o**k burɛk-**ɛk**/**o**k	sɑliʦil-n**ɛk**/n**ɑ**k sɑte:n-n**ɛk**/n**ɑ**k burɛk-n**ɛk**/n**ɑ**k	‘salicylic acid’ ‘satin’ ‘burek’
front (transparent)	-e- stem	pɑrtnɛr-**ɛk** mɑjone:z-**ɛk** oksige:n-**ɛk**	pɑrtnɛr-n**ɛk** mɑjone:z-n**ɛk** oksige:n-n**ɛk**	‘partner’ ‘mayonnaise’ ‘oxygen’
back (obligatorily transparent)	-o- stem	a:priliʃ-**o**k ɑʦe:l-**o**k mɑtɛk-**o**k	a:priliʃ-n**ɑ**k ɑʦe:l-n**ɑ**k mɑtɛk-n**ɑ**k	‘April’ ‘steel’ ‘maths’
	-a- stem	fɑzɛk-**ɑ**k	fɑze:k-n**ɑ**k	‘pot’

Table 6. Front, back, and vacillating classes of harmonically mixed roots

7 We are talking about monomorphemic stems (i.e., roots) here. Stems that are morphologically complex typically follow the harmony of their root, as required by Harmonic Uniformity (see §3).

8 There is a significant difference in the harmonic vacillation of the alternating vowel in consonant-initial suffixes and the thematic vowel: the latter vacillates much less. Here we abstract away from this difference. For details, see Rebrus & al. 2022.

The roots belonging to the vacillating -e/o- class are subject to both phonological and lexical ("semantic") restrictions (more on which in §2.3). When a vacillating root contains a single neutral vowel after a back vowel, the neutral vowel may be **e**: or **ɛ**, but it may not be **i(**:**)**, B**i** roots are consistently back harmonic. When a vacillating root contains two neutral vowels after a back vowel, the last one may not be **ɛ**. That is, vacillating roots are BN′ and BNN″, where N′ = {**e**: **ɛ**} (the nonhigh front unrounded vowels) and N″ = {**i i**: **e**:} (the nonlow front unrounded vowels). This restriction cannot be circumscribed phonologically in a unified way, which is a problem for representational analyses to neutrality.

The BN′ and BNN″ roots described above phonologically do not all vacillate to an equal degree or with an unbiassed preference for F or B. There are lexical differences: recent loans that occur in educated language use, so-called "cultural" roots exhibit a strong preference for being front harmonic, i.e., for belonging to an -e- class (Forró 2013). Not so recent loans, especially roots that are highly frequent (e.g., **a**:**priliʃ, konkre**:**t** 'factual') and/or diminutive (e.g., **mɑtɛk, kolɛs** 'dorm') or "familiar" (e.g, **fɑtɛr** 'dad', **hɑvɛr** 'pal') in their usage tend to be back harmonic, i.e., to belong to the -o- class. (The -a- class root in Table 6 is not a loanword, it is of Finno-Ugric origin.) It is the BN′ and BNN″ loan roots that do not belong to any of these "semantic" sets that show strong and unbiassed vacillation (Rebrus et al. to appear).

2.3 *Harmonic uncertainty* We have seen that roots containing a back vowel followed by one or more neutral vowels often vacillate harmonically (in practice this means one or two neutral vowels since strings of more than two Ns after a B vowel in roots are excessively rare). Thus BN and BNN roots are in the zone of variation (Hayes et al. 2009). Variation can be seen as a manifestation of harmonic uncertainty since speakers cannot unambiguously/categorically decide whether these items are front or back harmonic and therefore vacillate in their usage (stochastically). There are factors that reduce uncertainty by curtailing the possibilities. They are (i) phonological: the Height Effect and the Count Effect, the quality and the number of the neutral vowels, respectively (Hayes & Cziráky Londe 2006), (ii) "semantic": familiar and cultural roots, and also (iii) morphological: Harmonic Uniformity. We discuss (i) and (ii) in the paragraphs below and (iii) in §3 in detail

According to the Height Effect, the higher the neutral vowel in a BN root, the more likely its back harmonicity (i.e. transparency increases with height). Indeed, B**i(**:**)** roots are in the back harmonic class, B**e**: roots are more likely to vacillate, but some are exclusively back harmonic, B**ɛ** roots also vacillate, but some are exclusively front harmonic. The Height Effect also manifests itself in lexical variation: most antiharmonic roots have **i(**:**)**, a few have **e**:**,** while those with **ɛ** all vacillate**.** According to the Count Effect, the larger the number of neutral vowels after a back vowel in a vacillating root, the more likely it is front harmonic. As we have seen, this boils down to the difference between BN and BNN.[9] Both effects decrease uncertainty in the zone of variation by increasing the likelihood that certain BN and BNN patterns belong to either the nonvacillating back, or the nonvacillating front harmonic class. These factors are surveyed in Table 7.

Harmonic behaviour	**Back: class -o- (or -a-)**	**Front: class -e-**	**F/B vacillation: class -e/o-**
no variation	[…B], […Bi(:)]	[…FN(N)], [NN(N)], [BNɛ]	
lexical variation (antiharmony)	[N]	[N]	
lexical variation and vacillation (transparency)	[…BN′], […BNN″]	[…Bɛ]	[…BN′], […BNN″]

Table 7. Harmonic (paradigmatic) class membership: phonological factors

As shown in §2.2, the etymological provenance, the frequency, and stylistic features of roots, loosely referred to as "semantic" factors, also decrease the uncertainty of their harmonic class membership. Table 8 collects these factors.

9 The Height Effect and the Count Effect can have a combined effect. Essentially, a higher NN string is more transparent than a lower one. For a detailed discussion, see Rebrus and Törkenczy 2016.

Stem phonology	**Back: class -o- (or -a-)** (obligatorily transparent)	**Front: class -e-** (obligatorily opaque)	**F/B vacillation: class -e/o-** (optionally transparent)
[Bɛ]	familiar: **mɑtɛk**	cultural: **pɑrtnɛr**	neither: **burɛk**
[Be:]	familiar: **ɑtse:l**	cultural: **mɑjone:z**	neither: **sɑte:n**
[BNN″]	familiar: **a:priliʃ**	cultural: **oksige:n**	neither: **sɑlitsil**

Table 8. Harmonic (paradigmatic) class membership: "semantic" factors

3 Harmonic Uniformity

Harmonic Uniformity (HU) is a morphological limitation on harmonic class membership. HU requires that the harmonic property of a root (F, B, or F/B) be uniform throughout its extended paradigm (e.g., Rebrus & Szigetvári 2016, Rebrus & Törkenczy. 2017, Rebrus et al. 2017). As a consequence of HU all harmonically alternating suffixes in the paradigm of a stem have identical harmonic properties, i.e., they are all front, or back, or vacillating. Furthermore, a suffixed stem belongs to the same harmonic class (F, B, or F/B) as its root. This morphological effect overrides otherwise applicable phonological patterns (variation due to the Height Effect and the Count Effect) and thus creates otherwise nonoccurring harmonic patterns. We exemplify these cases in Table 9.

roots ↓ suffixes →	**B**	**F**	**B/F**
B: hi:d-n**ɑ**k ɑtse:l-n**ɑ**k	hi:d-i-n**ɑ**k ɑtse:l-e:-n**ɑ**k	—	—
F: ʋi:z-n**ɛ**k pɑrtnɛr-n**ɛ**k	—	ʋi:z-i-nɛk pɑrtnɛr-e:-nɛk	—
F/B: ɑte:n-n**ɑ**k/nɛk burɛk-n**ɑ**k/nɛk	—	—	ɑte:n-i-n**ɑ**k/nɛk burɛk-e:-n**ɑ**k/nɛk

Table 9. The effects of Harmonic Uniformity

While an unaffixed [NN] stem is front harmonic ([NN]F), an affixed [[N]N] stem will either be front harmonic (if its root is front harmonic: [N]F → [[N]N]F, e.g., **ʋi:z-nɛk** 'water-DAT' → **ʋi:z-i-nɛk** '-ADJZ-DAT') or back harmonic (if its root is antiharmonic: [N]B → [[N]N]B, e.g., **hi:d-nɑk** 'bridge-DAT' → **hi:d-i-nɑk** '-ADJZ-DAT', cf. the suffixation of **didi-nɛk** 'tit-DAT', which is identical phonologically in the relevant details, but whose stem is morphologically simplex). In this case, HU seems to transmit the uncertainty about the harmonic property of an [N] root to a morphologically complex [N]N stem, although otherwise [NN] as a base for suffixation is unambiguously front harmonic. However, given the information about the morphological complexity of a stem and the harmonic class of its root, the harmonic class of the stem is not uncertain since it is uniquely determined by the harmonic class of its root. Phonological information in itself is not enough to determine the harmonic class.

In other cases (related to transparency), HU promotes the inheritance of the harmonic property of a root. A [BNN] root typically vacillates harmonically: [BNN]B/F. A suffixed [BN]N stem, however, will follow the harmonic property of its [BN] root, where the Height Effect or "semantic" properties often determine harmonicity. The BN root **ɑtse:l** 'steel' is not a recent loan and it is back harmonic (**ɑtse:l-nɑk** '-DAT'), therefore the suffixed stem [BN]N **ɑtse:l-e**: is also back harmonic: **ɑtse:l-e:-nɑk** '-POSR-DAT' (cf. the monomorphemic **ɑte:ne**: 'Athene', which vacillates: **ɑte:ne:-nɑk/nɛk** '-DAT'). Likewise, since the cultural BN root **pɑrtnɛr** 'partner' is front harmonic (**pɑrtnɛr-nɛk** '-DAT'), the [BN]N suffixed stem **pɑrtnɛr-e**: is also front harmonic: **pɑrtnɛr-e:-nɛk** '-POSR-DAT' (cf. the monomorphemic **ɑlɛrge:n** 'allergen', which vacillates: **ɑlɛrge:n-nɑk/nɛk** '-DAT'). The harmonic vacillation of a root is also inherited: the BN roots **ɑte:n** 'Athens' and **burɛk** 'burek' vacillate (**ɑte:n-nɑk/nɛk** '-DAT', **burɛk-nɑk/nɛk** '-DAT'), as a consequence their suffixed stems also do so: **ɑte:n-i-nɑk/nɛk** '-ADJZ-DAT', **burɛk-e:-nɑk/nɛk** '-POSR-DAT'. We do not find cases where the harmonic property of a stem (B, F, or B/F) would differ from that of its root. Thus, in all its applications HU results in the reduction of harmonic uncertainty because the poly-

morphemic contexts for harmony are more reliable than the corresponding monomorphemic ones (Rebrus et al. 2020).

Harmonic Uniformity does not affect strictly locally determined alternations. Rounding harmony is *phonologically* local. Some suffixes are sensitive to rounding harmony, they have three alternants, one for front rounded, another for front unrounded, and a third for back harmonic stems. The front rounded harmonic property of the root does not prevail throughout the paradigm, any front unrounded suffix blocks rounding harmony.

roots ↓ **suffixes →**	**front rounded**	**front unrounded**
front rounded: tøk-h**ø**z ‘pumpkin-ALL’	tøk-ynk-h**ø**z ‘-1PL.POSS-ALL’	tøk-e:-h**ɛ**z ‘-POSR-ALL’
front unrounded: pe:k-h**ɛ**z ‘baker-ALL’	pe:k-ynk-h**ø**z ‘-1PL.POSS-ALL’	pe:k-e:-h**ɛ**z ‘-POSR-ALL’

Table 10. Phonological locality

The examples in Table 10 illustrate the phonological locality of rounding harmony: the allative suffix **-høz/hɛz/hoz** occurs in its front rounded variant after a front rounded root, like **tøk,** but its front unrounded variant after a front unrounded root, like **pe**:**k.** Since the 1PL.POSS suffix has a front rounded variant the allative suffix occurs in its front rounded variant after it: **tøk-ynk-høz.** Since this suffix has no front unrounded variant, the front rounded one occurs after a front unrounded root too, which in turn is followed by the front rounded variant of the allative suffix: **pe**:**k-ynk-høz,** thus the harmonic unroundedness of the root is not inherited by the stem **pe**:**k-ynk.** On the contrary, the invariant possessor **-e**: contains a front unrounded vowel, after which the allative suffix can only be front unrounded (if the root is front): **tøk-e**:**-hɛz, pe**:**k-e**:**-hɛz.** Thus there are no vowels transparent to rounding harmony.[10]

Harmonic uniformity is a paradigm uniformity constraint maintaining the stability of the *harmonic* class (B, F, or B/F) within the extended paradigm of a root. No such paradigmatic uniformity is enforced for the choice of *thematic* vowels (i.e., the paradigm classes introduced in §1) in inflectional or extended paradigms. The inflectional class of a stem is determined by the final suffix, not the root (i.e., determined strictly locally) and therefore it is not uniform throughout the paradigm. A stem that belongs to the -a- class may contain a root that belongs to the -o- class, and vice versa, as shown by the examples in Table 11.

roots ↓ **suffixes →**	**-o- class**	**-a- class**
-o- class: (jog-ok, jog-ot ‘law-PL, -ACC’)	jog-a:s-**o**k ‘-NOMZ-PL’	jog-uk-**ɑ**t ‘-3PL.POSS-ACC’
-a- class: (fog-ɑk, fog-ɑk ‘tooth-PL, -ACC’)	fog-a:s-**o**k ‘-NOMZ-PL’	fog-uk-**ɑ**t ‘-3PL.POSS-ACC’

Table 11. Paradigm class changes within the paradigm: -o- vs. -a- class

The class membership of a stem (as opposed to a root) is not entirely unpredictable. A back harmonic stem ending in a derivational suffix typically belongs to the -o- class (see the middle column in Table 11). Nominal inflection, on the other hand, consistently creates stems that belong to the -a- class when the root is back harmonic (see the last column in Table 11) resulting in the lack of uniformity in paradigm class membership both in extended and inflectional paradigms. A similar distinction is found in front harmonic stems, which belong to the -ö- class and -e- class, corresponding to the -o- class and -a- class in back stems, respectively. This is shown in Table 12, which is remarkably similar to Table 10, though this time the lack of labial harmony in the last column is not due to the unroundedness of the vowel of the first suffix, but to the fact that it is an inflectional suffix. (Due to the scarcity of C-final front rounded nominal stems suffixed by a front rounded derivational suffix, we could only give an example containing a verbal root.)

10 Cf. front/back harmony, where front unrounded vowels may be transparent: in **pa**:**r-e**:**-hoz** ‘pair-POSR-ALL’ the invariant front possessor suffix does not interfere with front/back harmony, the allative suffix is back after it, as required by HU.

roots ↓ **suffixes →**	**-ö- class**	**-e- class**
-ö- class: (dønt-øk, -ød 'decide-1SG, -2SG.DEF')	dønt-nøk-**øk** '-NOMZ-PL'	dønt-øtt-**ɛk** '-PAST-3PL'
-e- class: (yɟ-ɛk, yɟ-ɛt 'affair-PL, -ACC')	yɟ-nøk-**øk** '-NOMZ-PL'	yɟ-yk-**ɛt** '-3PL.POSS-ACC'

Table 12. Paradigm class changes within the paradigm: -ö- vs. -e- class

However, the data in Table 13 show that the neat correspondence is undermined by the phonological locality of rounding harmony. An -ö- class stem followed by a derivational suffix that does not have a front rounded alternant cannot have the front rounded thematic vowel **ø** after this suffix, because rounding cannot "spread through" the front unrounded vowel of the previous suffix: **øːr-ʃeːg-ɛk.** That is, a stem may remain in the -ö- class after suffixation only if the following two conditions are simultaneously met: (i) the suffix is derivational and (ii) the suffix has a front rounded alternant. The latter condition is in fact rather rarely met.

roots ↓ **suffixes →**	**-e- class**	**-e- class**
-ö- class: (øːr-øk, -t 'guard-PL, -ACC')	øːr-ʃeːg-**ɛk** '-NOMZ-PL'	øːr-yk-**ɛt** '-3PL.POSS-ACC'
-e- class: (neːp-ɛk, neːp-ɛt 'people-PL, -ACC')	neːp-ʃeːg-**ɛk** '-NOMZ-PL'	neːp-yk-**ɛt** '-3PL.POSS-ACC'

Table 13. Paradigm class changes within the paradigm affected by the locality of rounding harmony

To conclude, the purview of HU is exclusively front/back harmony, that is, the harmonic class of roots (and stems derived from them). It does not apply either to the phonologically local rounding harmony, or the morphologically local selection of thematic vowels, neither of which govern the choice between a front and a back vowel.

4 Conclusions

We have shown that not all phenomena traditionally assumed to fall within the domain of vowel harmony in Hungarian are indeed phonological, they are co-determined by potentially conflicting requirements imposed on forms by phonology, i.e., the vocalic makeup of stems, and morphology, i.e., lexical information (paradigmatic classes, based on "semantic" properties) and paradigm uniformity. Rounding harmony is local, thus it is not subject to the paradigmatic constraint we call Harmonic Uniformity, however, it may be blocked by a morphological factor: the thematic vowel is not rounded after a stem-final front rounded vowel if the stem belongs to the paradigmatic class of -e- stem 1 (e.g., **fyl-høz** vs. **fyl-ɛk**). Front/back harmony is similarly constrained, a stem containing a front unrounded vowel may belong to any of the paradigmatic classes of -e-, -o-, or -a- stems (e.g., **siːn-ɛk, seːl-ɛk** vs. **kiːn-ok, ʦeːl-ok** vs. **in-ɑk, heːj-ɑk**). HU, which is limited to front/back harmony, is another principle that requires morphological information about a stem and makes it impossible to determine its harmonic properties simply by examining its vowels (e.g., **didi-nɛk** vs. **hiːd-i-nɑk, ɑteːneː-nɛk/nɑk** vs. **ɑʦeːl-eː-nɑk**), but nevertheless it reduces harmonic uncertainty in the zone of variation by making a stem's harmonic behaviour predictable from that of its root independently of the phonological complications that suffixation may introduce.

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