HUNGARIAN VOWEL HARMONY MEETS OT*

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Hungarian vowel harmony has been described in a number of phonological frameworks, from pre-SPE (Hall 1938) to SPE (Jensen 1972; Vago 1974, 1980), Autosegmental phonology (Clements 1977), Lexical phonology (Jensen 1984), Government phonology (Polgárdi & Rebrus 1998) and Optimality theory (Ringen & Vago 1998b; Hayes & Cziráki-Londe 2006). According to Ringen & Vago (1998b:393), "no comprehensive and completely satisfactory account in a rule-based theory exists" for Hungarian vowel harmony. We submit that OT also does not solve the problems, and that indeed new ones arise. There is no completely satisfactory OT account of Hungarian vowel harmony, and a rule-based account seems to be the most satisfactory account after all.

1. Back and Round Harmony Types in Hungarian.

In (1) we give the phonetic vowel system of Hungarian, in the dialect that Polgárdi & Rebrus call the "high-mid ë" dialect, which distinguishes two front nonhigh short vowels, represented in Hungarian dialect studies as <ë> for the higher-mid and <e> for the lower mid, which is sometimes characterized as low (Ringen & Vago 1998b:408). Ringen & Vago use the phonetic symbol [ɛ] for this vowel, which however properly represents a lower-mid or lax mid vowel, while the symbol [æ] is the proper symbol for the low vowel. Without committing ourselves to the exact phonetic values of these two vowels, the important thing is that they are distinguished in this dialect, but neutralized in the standard variety of Budapest to [ɛ]. In terms of alternations, the lower [æ] alternates with the low back vowel [ɒ] and the mid <ë> alternates with the mid vowels [o] and [ö]. The nonlow front unrounded vowels are called neutral vowels: they can cooccur with back as well as front vowels, are transparent for backness harmony, and in some cases even have the properties of back vowels. Their behaviour can be related to the fact that they lack phonetic back counterparts, the blank cells in the heavy outline in (1).

In (2) we provide a sample of the harmony types that we will discuss. We use two suffixes for illustration, the two-way low-vowel alternating dative suffix *-nak/-nek* and the three-way mid-vowel alternating allative suffix *-hoz/-höz/-hëz*. The underlying representation of the suffixes is determined by the form they take in personal forms (2i).

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* An earlier version of this paper was presented at the Montréal–Ottawa–Toronto phonology workshop at Carleton University, Ottawa, March 12, 2010.

Actes du congrès annuel de l'Association canadienne de linguistique 2010.
Proceedings of the 2010 annual conference of the Canadian Linguistic Association.

(1) Phonetic vowel system of Hungarian (orthography is in italics)

	[–back]				[+back]			
	[–round]		[+round]		[–round]		[+round]	
	short	long	short	long	short	long	short	long
[+high]	*i* [i]	*í* [i:]	*ü* [ü]	*ű* [ü:]			*u* [u]	*ú* [u:]
[–high, –low]	*ë* [ɛ]	*é* [e:]	*ö* [ö]	*ő* [ö:]			*o* [o]	*ó* [o:]
[+low]	*e* [ä]					*á* [ɑ:]	*a* [ɒ]	

(2) Back and round harmony types in Hungarian.

		Nominative	*dative /-næk/*	*allative /-hoz/*
a.	back vowel words	torok ‘throat’	torok-nak	torok-hoz
		város ‘city’	város-nak	város-hoz
b.	front vowel words	török ‘Turkish’	törörk-nek	török-höz
		tök ‘pumpkin’	tök-nek	tök-höz
		fésű ‘comb’	fésű-nek	fésű-höz
c.	front neutral vowels	víz ‘water’	víz-nek	víz-hëz
		vér ‘blood’	vér-nek	vér-hëz
d.	back neutral vowels	híd ‘bridge’	híd-nak	híd-hoz
		cél ‘goal’	cél-nak	cél-hoz
e.	disharmonic words	sofőr ‘driver’	sofőr-nek	sofőr-höz
		nüansz ‘nuance’	nüansz-nak	nüansz-hoz
f.	mixed vowel words	bika ‘bull’	biká-nak	biká-hoz
		radír ‘eraser’	radír-nak	radír-hoz
		tányér ‘plate’	tányér-nak	tányér-hoz
		havër ‘pal’	havër-nak	havër-hoz
		Tibor ‘Tiberias’	Tibor-nak	Tibor-hoz
		Tib-i ‘little T.’	Tib-i-nek	Tib-i-hëz
g.	doublets	Ágnes ‘Agnes’	Ágnes-nak	Ágnes-hoz
			Ágnes-nek	Ágnes-hëz
		konkrét	konkrét-nak	konkrét-hoz
			konkrét-nek	konkrét-hëz
		Ág-i ‘little A.’	Ág-i-nak	Ág-i-hoz
h.	disharmonic mixed vowels	József	József-nek	József-hëz
i.	personal forms		nekem ‘to me’	hozzam ‘toward me’

In (3) we list some properties that we consider to be necessary for an explanatory account of Hungarian vowel harmony.

(3) Characteristics of a satisfactory analysis:

a) Link neutral vowels to the overall vowel inventory.

b) Provide a principled, nonarbitrary way of determining neutral vowels.
c) Employ natural, potentially universal rules or constraints.
d) Fully specify outputs for all features up to phonetic implementation.
e) Adhere to Locality.

2. An Unsatisfactory OT Account of Hungarian Vowel Harmony.

Ringen & Vago (1998b) present an OT analysis of Hungarian vowel harmony that fails to meet the criteria in (3). Central to their analysis is the constraint Ident-IO$_{harm/root}$ (4).

(4) Ident-IO$_{harm/root}$ (R&V:397)
Correspondent input and output harmonic root vowels have identical specifications for [αback] (harmonic vowels are those specified as low or round).

This constraint stipulates the harmonic vowels, and by implication the neutral vowels, and thereby fails to link vowel neutrality to the inventory. It is a highly unnatural, language-specific constraint. The restriction to harmonic root vowels allows neutral vowels to be unspecified for [back] in the output in forms like *hídnak* and *radírnak*. This is a somewhat roundabout way to circumvent locality requirements in forms like *radírnak,* where a neutral vowel intervenes between back harmonic vowels, and implies a covert serialism, where some "later" process specifies some neutral vowels as [–back].

The inventory is established by unrelated constraints, most critically, by the markedness constraint (5) (R&V:398).[1]

(5) (R&V:398).
***i$_{\Lambda}$**
Vowels which are [+back] and [–low] must be specified as ROUND.

R&V assume a number of other constraints, such as the following:

(6) Other constraints in R&V.
a. Ident-IO$_{back}$
Correspondent input and output segments have identical specifications for [αback].

b. Specify
Segments should be specified for features.

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[1] R&V assume ROUND is privative; we assume it is binary [±round].

c. $Max_{subseg/root}$
Every subsegment which belongs to a root morpheme in the input must be present in the output.

d. Align-R
No vowel intervenes between the right edge of [back] and the right edge of the prosodic word.

e. Lo/R
A low vowel is [ROUND] iff it is short and back.

The tableaux in (7)–(9) show how these constraints operate in some cases involving neutral vowels.

(7) *radírnak* (R&V (12) p. 399) [symbols somewhat normalized]

rɒdi:r+näk	*ɨʌ	Id-$IO_{harm/rt}$	Align-R	Spec	Id-IO_{bk}
rɒdi:r+näk			*!*		
rɒdɨ:r+nɒk	*!				**
☺ rɒdI:r+nɒk				*	**
rädi:r+näk		*!			*

(8) *hídnak* (R&V (14) p. 400, with floating feature [+back])

/hi:d^{+bk}+näk	*ɨʌ	Id-$IO_{harm/rt}$	Align-R	$Max_{subseg/rt}$	Spec	Id-IO_{bk}
☺ hI:d-nɒk					*	**
hi:d-näk				*!		
hi:d-nɒk			*!			*
hɨ:d-nɒk	*!					**

(9) unsuffixed *híd* (R&V (15), p. 400 plus Align-R & Spec)

/hi:d/$^{+bk}$	*ɨʌ	Id-$IO_{harm/rt}$	Align-R	$Max_{subseg/rt}$	Spec
hɨ:d	*!				
☺ hi:d				*	
hI:d				*	*!

An anomaly appears here in that the *output* vowel /i:/ is specified for [back] in the unsuffixed form of *híd* but left *un*specified for [back] in the suffixed form *hídnak* and in all forms of *radír*. This is because a vowel intervenes between the [–back] specification of the neutral vowel and the right edge of the prosodic word. Having the neutral vowel unspecified avoids Align-R violations in these cases and gives the appearance of conforming to locality in the case of *radírnak*.

R&V cite Itô, Mester, & Padgett (1995) as providing some justification for the view of underspecified outputs in OT. However, in IM&P's analysis of Japanese Rendaku, output nasals can be underspecified for voicing on the assumption of a universal of phonetic interpretation that requires voicing on sonorants. The situation with neutral vowels in Hungarian is in no way comparable to the Japanese case, since there is no universal phonetic interpretation of nonlow, nonround vowels as nonback. The vowels /ɨ, ʌ/ exist phonetically in many languages, just not in Hungarian. The result is that R&V are faced with a problem of covert serialism, the need for a "later" principle to specify neutral vowels as phonetically front. This might be seen as an argument for stratal OT, but we will see later that such a solution is also untenable.

R&V note that "[m]ost recent analyses have used floating [+back] features to characterize this class of exceptions"; namely, the neutral vowel words like *híd* that require [+back] suffixes. This leads to the problem that the floating [+back] feature could also be associated with roots with front rounded vowels like *tök* 'pumpkin,' predicting back suffixes on these also. R&V claim that such a situation is precluded by the ranking of Id-IO$_{harm/rt}$ and Align-R over Max$_{subseg/rt}$. But in fact the result for *hídnak* does not depend on the ranking of Align-R over Max$_{subseg/root}$, which is why we used a dotted line between these two constraints in (8), and indeed predicts that there could be a language like Hungarian with the opposite ranking of these two constraints. In such a language a form *töknak* would be predicted for a root *tök* with a floating [+back], as shown in tableau (10). We claim that no such harmony system could exist.

(10) **töknak* with Max$_{subseg/root}$»Align-R (based on R&V (17), p. 401)

The ☺ is the winner under this ranking; the ☹ is R&V's winner with Align-R»Max$_{subseg/rt}$

/tök^{+bk}+näk	*ɨʌ	Id-IO$_{harm/rt}$	Max$_{subseg/rt}$	Align-R	Spec	Id-IO$_{bk}$
☹ tök-näk			*!			
☺ tök-nɒk				*		*
tok-nɒk		*!				**
tOk-nɒk		*!			*	**

3. Vowel harmony and markedness.

Kiparsky & Pajusalu (2003) provide a more nuanced approach that relies on constraints that can reasonably be regarded as universal, and that relate neutrality to the inventory. They do not consider Hungarian, but investigate a variety of Balto-Finnic languages plus Uyghur (Turkic) and Khanty (Ob-Ugric). They observe that vowel harmony is typically structure preserving: all lexically contrastive vowels participate in harmony, but /i/ and /e/ in Finnish do not undergo backing in back contexts because they have no back counterparts in the surface inventory. Estonian has the back counterpart of /e/ as a phoneme /õ/=[ʌ]

and, and in those dialects of Estonian that have vowel harmony, these vowels participate in harmony.

The analysis of K&P adheres strictly to locality. Their constraint Agree(F) (11) requires that adjacent segments have the same value for F. Unlike R&V's Align-R (6d), Agree(Bk) is violated when a neutral vowel appears adjacent to a harmonic back vowel. A form like *radírnak* contains two violations of Agree(Bk).

(11) K&P, p. 223
Agree(F): Adjacent segments must have the same value of the feature [F].

Kiparsky & Pajusalu note that this is a problem: "The very existence of transparent neutral vowels…immediately raises a theoretical puzzle: why should the doubly disharmonic *...a...i...a...* ever be preferable to *...a...i...ä...,* which has just one disharmonic transition?" (K&P, p. 220). K&P suggest that the answer lies in three typological generalizations (12).

(12) Typological generalizations (K&P, p. 221).

a. *Unmarkedness*. Neutral vowels are unmarked for the harmonic feature. The unmarked value for [back] is [–back] for nonlow nonround vowels and [+back] for other vowels.

b. *Uniformity*. All neutral vowels with a given value [αF] of the harmonic feature will be either opaque or transparent.

c. *Asymmetry*. Transparent vowels have a predictable feature value: [–back] in back harmony systems.

We will see that Hungarian meets the requirements of Unmarkedness and Asymmetry. Uniformity is not met in the case of doublets, where forms like *Ágnes*, *konkrét* have a neutral vowel that may be either opaque or transparent.

K&P set up two featural markedness constraints (13).

(13) Featural markedness (K&P, p. 222)

a. $\begin{bmatrix}\text{–Lo}\\ \text{–Rd}\end{bmatrix} \Rightarrow$ [–Bk] (mnemonically: *ɨ, *õ)

b. [–Bk] $\Rightarrow \begin{bmatrix}\text{–Lo}\\ \text{–Rd}\end{bmatrix}$ (mnemonically: *ä, *ö, *ü; abbreviated as *äöü)

K&P appeal to the idea of conjoined constraints to disfavour disharmony involving marked vowels, conjoining Agree(Bk) with the markedness constraint disallowing {ä, ö, ü}. K&P propose to restrict the freedom in the specification of the domain of conjoined constraints, proposing one domain where the conjoined constraints are violated anywhere in the string, and the other domain where the

minimal substrings that contain the violations overlap. This gives two versions of the conjoined constraint, as in (14).

(14) Conjunctions of Agree with featural markedness (K&P, p. 229).
a. Generalized Marked Harmony: a domain may not contain both a vowel marked for F and a vowel disharmonic for F.

b. Core Marked Harmony: a vowel may not be both marked for F and disharmonic for F.

K&P also propose a number of positional faithfulness constraints, such as (15).

(15) IdentRoot(Bk): an [αback] input segment in a root must not have a [–αback] output correspondent.

The ranking Generalized MH » Agr(Bk) gives the transparent configuration *...a...i...a...* in Finnish, because all vowels are unmarked, and a rival candidate *...a...i...ä,* though better on agreement, contains a marked vowel, /ä/.

(16) Finnish: transparent /i/. (K&P: (17), p. 230).

/[a i] ä/	…	Generalized MH	Agr(Bk)	…
☞ a i a			**	
a i ä		*!	*	

K&P develop a factorial typology based on the three constraints Generalized MH,*äöü, and Agr(Back). With *äöü top ranked the system of Vepsian is derived (K&P (21); here the ranking of the other two constraints doesn't matter.

(17) Vepsian (K&P (21), p. 231).

*äöü » Generalized MH, Agr(Bk)
[ä i] a ☞ ä i a (*ä i ä)
[a i] ä ☞ a i a (*a i ä)
[i] a ☞ i a (*i ä)

With Agr(Back) top ranked, we get the system of Khanty (K&P(22)); again the ranking of the other two constraints is irrelevant.

(18) Khanty (K&P (22), p. 231).
Agr(Bk) » Generalized MH, *äöü
[ä i] a ☞ ä i ä (*ä i a)
[a i] ä ☞ a i ä (*a i a)
[i] a ☞ i ä (*i a)

With Generalized MH top ranked, we get two possibilities depending on the ranking of the other constraints. With Generalized MH»Agr(Back)»*äöü we get

Finnish ((K&P(19)).

(19) Finnish ((K&P(19)) p. 230
Generalized MH » Agr(Bk) » *äöü
[ä i] a ☞ ä i ä (*ä i a)
[a i] ä ☞ a i a (*a i ä)
[i] a ☞ i ä (*i a)

And with Generalized MH»*äöü»Agr(Back) we get Uyghur (K&P(20), p. 230).

(20) Uygur (K&P(20)) p. 230
Generalized MH » *äöü » Agr(Bk)
[ä i] a ☞ ä i ä (*ä i a)
[a i] ä ☞ a i a (*a i ä)
[i] a ☞ i a (*i ä)

4. Hungarian is not the same as Finnish.

Ringen (1975:97) claims that "…Hungarian is seen to have exactly the same vowel harmony rule as does Finnish." From our current perspective, however, it seems that Hungarian differs from Finnish in a number of essential respects, so that the factorial typology developed by K&P does not account for Hungarian. In order to apply K&P's constraints to *radírnak* we need some additional constraints.

(21) Additional featural markedness constraint needed for Hungarian.
*ɒ
i.e., [+low] ⇒ [–round] (mnemonically: *ɒ) (ɒ is marked for [round] but unmarked for [back])

(≠R&V's Lo/R: A low vowel is [ROUND] iff it is short and back.)

The tableau in (22) gives the analysis that we assume Kiparsky & Pajusalu would have for *radírnak,* adding R&V's constraint Lo/R. The ranking required here, Generalized MH » Agr(Bk) » *äöü , is like Finnish.

(22) *radírnak,* with constraints from K&P and R&V.

/rɒdír + näk/	Lo/ R	Ident (Lo)	Gen MH	Core MH	Agr(Bk)	*äöü	*ɒ
☺ rɒdír-nɒk					**		**
rɒdír-nɑk	*!				**		*
rɒdír-nëk		*!			*		*
rɒdír-näk			*!		*	*	*

The tableau in (23) gives the analysis K&P would presumably have for *víz-nëk.* Again, the ranking Generalized MH » Agr(Bk) » *äöü is like Finnish.

(23) *víznëk* (K&P plus R&V's Lo/R) Generalized MH » Agr(Bk) » *äöü (like Finnish)

/víz + näk/	Lo/R	Ident (Lo)	Gen MH	Core MH	Agr (Bk)	*äöü	*ɒ
☺ víz-näk						*	
víz-nëk		*!					
víz-nɑk	*!				*		
víz-nɒk					*!		*

The languages investigated by Kiparsky & Pajusalu do not have words like *híd* in Hungarian, where a root containing only neutral vowels requires back harmony in suffixes. Kiparsky (1968) claimed that words like *híd* were simply exceptions to vowel harmony:

(24) VH as fronting rule; all suffixes have [+back] vowels underlyingly.
/híd/ [–VH]: does not condition fronting.
Critique: (1) some suffixes must have [–back] underlying vowels, as indicated by personal forms. (2) predicts the possibility of roots like /tök/ being marked [–VH] giving **tök-nak,* which are absolutely excluded forms.

If we assume that K&P would employ a floating feature [+back] feature, as in Ringen & Vago's analysis, and add some additional constraints, Kiparsky & Pajusalu's analysis of *hídnak* would look like (25).

(25) *hídnak* with floating [+back], K&P plus other constraints

/hi:d^{+bk}+näk/	Ident Root (Bk)	Lo /R	Ident (Lo)	Max $_{subseg/rt}$	Gen MH	Core MH	Agr (Bk)	*äöü	* ɒ
☺ híd-nɒk							*		*
híd-nɑk		*!					*		
híd-näk				*!				*	
híd-nëk			*!	*					

This analysis with a floating [+back] subsegment is potentially subject to the same criticism as the analysis with exception features (Kiparsky 1968) and Ringen & Vago's analysis (8), namely that roots with harmonic front vowels can also be provided with a floating feature [+back] and emerge with back harmonic suffixes. This is shown in tableau (26) for *tök+näk,* given the ranking Max$_{subseg/rt}$ » Gen MH.

(26) **töknak* with floating [+back], K&P plus other constraints; $Max_{subseg/rt}$ » Gen MH. The ☺ is the winner under this ranking; the ☹ (correct form *töknäk*) is the winner with Gen MH»$Max_{subseg/rt}$

/tö:k^{+bk}+näk/	Ident Root (Bk)	Lo/R	Ident (Lo)	$Max_{subseg/rt}$	Gen MH	Core MH	Agr (Bk)	*äöü	*ɒ
☺ tök- nɒk					*	*	*	*	*
tök- nɑk		*!			*	*	*	*	
☹ tök-näk				*!				**	
tök-nëk			*!	*				*	
tok-nɒk	*!								*

5. Stratal OT.

Another possible approach within OT involves multiple strata. This could imitate the rule-based approach by ranking the constraint banning back nonlow nonround vowels low on the first stratum, so that these vowels would remain in the output of this stratum, then ranking this constraint high on stratum 2 so that such vowels would not emerge phonetically. In order for this to work in cases like *hídnak,* a new constraint is needed, Ident Suffix (Bk), ranked low on stratum 1 but ranked high on stratum 2 to prevent the phonetic emergence of front suffixes with this (abstract) back vowel root.

(27) *hídnak* in stratal OT

a. Stratum 1 (low ranked: *ɨʌ, Ident Suffix(Bk))

/hɨ:d+näk/	Ident Root (Bk)	Lo/R	Ident (Lo)	Gen MH	Core MH	Agr (Bk)	*äöü	*ɒ	*ɨʌ	Ident Suffix (Bk)
☺ hɨ:d-nɒk								*	*	*
hɨ:d-nɑk		*!							*	*
hɨ:d-näk				*!	**	*	*		*	
hɨ:d-nëk			*!	*	*	*			*	
hi:d-nɒk	*!					*		*		*

b. Stratum 2 (high ranked: *ɨʌ, Ident Suffix(Bk))

/hɨ:d+nɒk/	*ɨʌ	Ident Suffix (Bk)	Ident Root(Bk)	Lo/R	Ident (Lo)	Gen MH	Core MH	Agr (Bk)	*äöü	*ɒ
☺ hi:d-nɒk			*					*		*
hi:d-nɑk			*	*!				*		
hi:d-näk		*!	*						*	
hi:d-nëk		*!	*		*					
hɨ:d-nɒk	*!									*

6. Rounding harmony.

In addition to backness harmony, Hungarian displays a limited form of rounding harmony, manifest in short mid vowels only. It occurs in three-way alternating suffixes such as *-hoz/-höz/-hëz* and with some epenthetic vowels illustrated in (28).

(28)

nom.	*acc.*	*pl.*	
bokor	bokrot	bokrot	'bush'
ökör	ökröt	ökrök	'ox'
vëdër	vëdrët	vëdrëk	'pail'

With rules, this is accounted for with an Unrounding rule (operating after backness harmony) that converts /ö/ to /ë/ when it follows a nonround vowel. Ringen & Vago propose a constraint Link[ROUND] (29) for these cases.[2]

(29) Link[ROUND] (R&V:407)
[ROUND] may be linked to a short (monomoraic) mid front suffix vowel only if it is also linked to a preceding vowel.

The tableau in (30) illustrates this constraint in the case of *vízhëz*.

(30) *vízhëz* (K&P plus R&V's Link (Rd))

/vi:z+hoz/	Gen MH	Core MH	Link (Rd)	Agr (Bk)	*äöü
☺ vi:z-hëz					
vi:z-höz			*!		*
vi:z-hoz				*!	

[2] Ringen & Vago (1998b) assume that [round] is privative, despite their argument (1998a) that binary [±round] is required even in an optimality theoretic analysis.

With the markedness approach of Kiparsky & Pajusalu, it is not possible to distinguish between /o/ and /ë/ on the basis of markedness, since both vowels are unmarked for [back]. With a transparent neutral vowel in *radírhoz,* it is necessary to add a constraint Ident(Rd), ranked above Agr (Bk) to eliminate the otherwise favoured output *[rɒdírhëz], as shown in (31).

(31) *radírhoz* (K&P plus R&V's Link(Rd); Ident(Rd) » Agr(Bk)

/rɒdír + hoz/	Gen MH	Core MH	Link (Rd)	Ident (Rd)	Agr (Bk)	*äöü	*ɒ
☺ rɒdír-hoz					**		*
rɒdír-hëz				*!	*		*
rɒdír-höz	*!		*		*	*	*

But this ranking incorrectly predicts *vízhoz,* shown in (32).

(32) *vízhëz* (Ranking needed for *radírhoz;* Ident(Rd) » Agr(Bk))

/vi:z+hoz/	Gen MH	Core MH	Link (Rd)	Ident (Rd)	Agr (Back)	*äöü
vi:z-hëz				*!		
vi:z-höz			*!			*
☹ vi:z-hoz					*	

So *vízhëz* requires a different ranking, Agr (Bk) » Ident(Rd), which would not be correct for *radírhoz.*

(33) Constraints reranked Agr (Bk) » Ident(Rd)

/vi:z+hoz/	Gen MH	Core MH	Link (Rd)	Agr (Bk)	Ident (Rd)	*äöü
☺ vi:z-hëz					*	
vi:z-höz			*!			*
vi:z-hoz				*!		

There are several indications that Link(Rd) is not the correct analysis of rounding harmony. One is that it does not account for the patterns of rounding harmony in epenthetic vowels in (28), since these vowels are not in a suffix. Another is a derivational suffix *-nok/-nök,* which lacks the nonround alternant.

(34)

szónok	'orator'	(szó 'word')
elnök	'chairman'	(el- 'forth')
mérnök	'engineer'	(mér 'measure')
hírnök	'messenger'	(hír 'news')

In a rule-based framework this alternation is easily accounted for by marking this suffix as an exception to Unrounding. With privative [round], Ringen &

Vago (1998b), following Polgárdi & Rebrus (1998), suggest that the words in (34) are monomorphemic, despite their transparently derived status and the lack of any independent evidence for this position.

7. Rule-based analysis.

We suggest that the most satisfactory analysis requires rules, since OT accounts incur too many problems, from highly stipulative language-specific constraints like (4) to the necessity of morpheme-specific rankings. Our analysis relies on underspecification and abstract underlying representations, as in some previous rule-based analyses; but we think ours is the most straightforward.

(35) Underspecification (Kiparsky 1982: 54).
No feature can appear marked both + and – in the same environment in the lexicon.

(36) Rules
a. Vowel Harmony (VH; cyclic): Assimilate vowels in [±back] iteratively left-to-right.
b. Unrounding (UR): ö → ë / $\begin{bmatrix} \text{V} \\ \text{–round} \end{bmatrix}$ C_0 _____
c. Default: [ ] → [–back]
d. Absolute Neutralization (AN; postcyclic):
$\begin{bmatrix} \text{V} \\ \text{–low} \\ \text{–round} \end{bmatrix}$ → [–back]

(37) Principles.
a. Redundancy Rule Ordering Constraint (RROC: Archangeli 1984: 85):[3] A redundancy rule assigning "a" to F, where "a" is "+" or "–", is automatically ordered prior to the first rule referring to [aF] in [its] structural description.
b. Strict Cycle Condition: cyclic rules (including Vowel Harmony) can change structure only in derived environments (Kiparsky 1982).
c. Elsewhere Condition: Vowel Harmony takes precedence over the Default rule where both would be applicable (Archangeli 1984: 83).

(38) Underlying representations. (+, –, 0 are values for [±back]; where relevant [–R] = [–round] is also indicated.)

[[város]-näk]	[[város]-hoz]	[[öröm]-näk]	[[öröm]-hoz]
+ 0 0	+ 0 +	0 0 0	0 0 +

[3] Archangeli uses "a" for α.

[[híd]-näk]	[[híd]-hoz]	[[radír]-näk]	[[radír]-hoz]
+ 0	+ +	+ 0 0	+ 0 +
[[víz]-näk]	[[víz]-hoz]	[[sofőr]-näk]	[[sofőr]-hoz]
0 0	0 +	+ – 0	+ – +
[[büró]-näk]	[[büró]-hoz]	[[józsef]-näk]	[[józsef]-hoz]
0 + 0	0 + +	+ – 0	+ – +
[[tibor]-näk]	[[tibor]-hoz]	[[tib-i]-näk]	[[tib-i]-hoz]
0 + 0	0 + +	0 0 0	0 0 +
[[ágnës]-näk]	[[ágnës]-hoz]	[[ágnës]-näk]	[[ágnës]-hoz]
+ – 0	+ – +	+ 0 0	+ 0 +

We assume that, in most cases, [back] is specified either [+back] or unspecified [0back], with the default being [–back]. Neutral vowels are linked to the inventory by the combination of this default specification and the rule of Absolute Neutralization. If neutral vowels are underlyingly specified [+back] as in *híd* or become [+back] by assimilation on the first cycle, as in *radír,* they condition back harmony in suffixes and are phonetically realized as [–back] by virtue of AN. They may also be underlyingly unspecified for [back], as in *víz,* in which case they are realized as [–back] by default specification. Forms like **töknak* are excluded in a principled way: the root vowel is underlyingly unspecified for [back] and so realized by default as [–back], conditioning front harmony in suffixes. Since there is no need for a floating [+back] for *híd,* we can simply assume that there are no floating features. If there were a floating [+back] associated with *tök,* it would associate with the stem as well as suffixes, giving **tok(nak)* rather than **tök(nak)*. The rules of Vowel Harmony and Unrounding are natural assimilations that fully respect locality; neutral vowels assimilate then neutralize in cases like *radír*. AN functions to exclude marked vowels *ɨ *ʌ. Disharmonic forms like *sofőr* are accounted for by marking both vowels for [back], the first [+back] and the second [–back]. In the context of a preceding [+back] vowel in the same morpheme a specification [–back] is not redundant, so that the principles of underspecification allow (indeed require) it to be specified [–back] in this context. That is, in this context, only [–back] and [0back] can be specified. This extends to the name *József,* whose second vowel is actually not neutral, since it is phonetically [+low] in the dialect under consideration. The name *Ágnes* is actually ambiguous between inputs whose second vowel is specified or not for [–back], giving the observed vacillation. The name *Tibor* has only the second vowel marked [+back]; suffixes attached to it assimilate to this second vowel. In the truncated form of the name, this second vowel is deleted and the word behaves as expected like most words with only neutral vowels in taking front suffixes. Finally, outputs are fully specified. Our

analysis meets the requirements in (3) that we suggested were needed in an adequate analysis, whereas the two OT approaches we discussed do not.

Due to lack of space we omit the derivations. The reader can easily verify that these principles, rules, and underlying representations are sufficient to derive all the relevant forms in a relatively simple and natural way.

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