HARRY v.d. HULST
ot. Gen. Linguistics Leiden
P.O. Box 9515
071-272105

Vowel Harmony in Hungarian: a Comparison of Segmental and Autosegmental Analyses

Harry van der Hulst
Dutch Lexicological Institute, Leiden

O. INTRODUCTION*

Clements (1976a) proposed to extend the domain of autosegmental phonology, developed in Goldsmith (1976) to account for tonal phenomena, to vowel and consonant harmony. Since then he has offered analyses within that framework of vowel harmony (VH) in Hungarian (Clements 1976b), Akan (Clements 1981, 1984) and Turkish (Clements & Sezer 1982). The analyses of Hungarian and Akan have been discussed in Vago (1980a) and Stewart (1983), respectively. Anderson (1980, 1982) questions the descriptive adequacy of the autosegmental approach to VH in general, and Ringen (1984) claims that the superiority of this approach has yet to be demonstrated. All critics of the autosegmental model implicitly or explicitly favor a segmental approach to vowel harmony, although there are significant differences among the segmental approaches.

It is my objective here to address the question whether or not VH should be handled autosegmentally. Given the existence of rival proposals within segmental and autosegmental schools my first task will be to find the "best" segmental and the "best" autosegmental approach.

Several segmental analyses of the facts of Hungarian VH have been proposed (Vago 1975, 1976, 1980c), Jensen (1978), Phelps (1978), Ringen (1978, 1980, 1982), Zonneveld (1980), Battistella (1982). An autosegmental analysis is given by Clements (1976b) and Booij (1984).[1]

The present article is organized as follows. In section 1 I present the Hungarian data, as they are reported in the literature.[2] Section 2 and 3 offer discussions of segmental and autosegmental analyses. In section 4 the analyses that have proved to be optimal will be compared and I shall conclude that the autosegmental model should be favored, among other things because it offers a principled solution to the abstractness controversy.

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1. THE DATA

Hungarian has the following surface vowel system, given here using the orthographic representation (cf. Vago 1980c: 2):

(1)

	-back				+back			
	-round		+round		-round		+round	
	-long	+long	-long	+long	-long	+long	-long	+long
+high	i	í	ü	ű			u	ú
-high		é	ö	ő			o	ó
-low								
+low	e					á	a	

The two short "low" vowels are usually transcribed as [ɛ] and [ɔ], i.e. they are higher than the long *á*, but lower than for example *é*. All vowels given here are also assumed to be underlying vowels by Vago, except for the *a*, which, although phonetically [+round], is represented by Vago as [-round] underlyingly. Its surface roundness is attributed to a low-level rounding rule (cf. Vago 1980c: 3). Nothing crucially depends on this decision as far as the analysis of VH is concerned. In addition Vago posits underlyingly a number of abstract vowels the discussion of which is postponed until section 2.

Harmony in Hungarian is manifested by the fact that words have either only front or only back vowels. Certain vowels, however (*i, í, é* and, according to some, also *e*) can co-occur with both sets of vowels and, as we will see in a moment, for the purpose of VH they behave as if they were not present. These vowels are called transparent (in Clements 1976b) or *neutral*. The type of VH can be classified as *root-controlled* (Vago 1980d, XIII), implying that the harmonic value of suffixes depends on the harmonic value of the root and *never* the other way around. Among the alternating suffixes we find the following alternation types:

(2) ű – ú
ü – u
ö – o – e
ő – ó
á – é
a – e

In the third case we find a three-way alternation. The vowel *e* appears after roots whose last vowel is [-round, -back] (cf. Vago 1980c: 18-20). Here I will not deal with this "rounding" harmony. Vago (1980c: 15) distinguishes four sets of non-alternating suffixes. The first two classes contain *i* or *é*, e.g.:

(3) a. -ig, -ni, -int, ... (Vago 1980c lists twelve such suffixes)
b. -ként, -ért, -né, ... (Vago lists ten such suffixes)

The vowels contained in these suffixes belong to the set of neutral vowels mentioned above. The other two classes of non-alternating suffixes (I ignore the reason for distinguishing between them) contain a vowel that belongs to the set of harmonic, i.e. alternating vowels:

(4) a. -kor, -us, -u, -kó, -a
b. -íroz, -ista, -izmus, -fikál, -íkus

Compounds and verbs preceded by separable enclitic prepositions (called preverbs) share the property that the vowels of their morphological parts (preverb and the root in the former case, and two roots in the latter case) may be disharmonic. There are no prefixes in Hungarian.

Let us now turn our attention to simple (monomorphemic) roots. Following the classification provided in Vago (1976, 1978 and 1980c) we may distinguish the following types:

(a) *harmonic roots*
Roots of this type consist of either back or front vowels, giving *back vowel roots* or *front vowel roots*, respectively. Their affixes (if alternating) are also either back or front, depending on the root:

				nak/nek 'dat.'	*tól/től* 'abl.'
(5)					
	a. [+back]	város	'city'	városnak	várostól
		ház	'house'	háznak	háztól
	b. [−back]	öröm	'joy'	örömnek	örömtől

(b) *disharmonic roots*
In roots of this type, mostly loans, we find back and front rounded vowels combined. Alternating suffixes take the value of the last vowel:

(6)	a. soffőr 'chauffeur'	soffőrnek
	zsonglőr 'juggler'	zsonglőrnek
	kosztüm 'costume'	kosztümnek
	b. amőba 'amoeba'	amőbának
	bűró 'bureau'	bűrónak

(c) *mixed roots*
In this category we find roots consisting of *back* (rounded) vowels with neutral, i.e. *front unrounded*, vowels. Roots of this kind have generated a certain amount of controversy. To facilitate discussion *four* types are distinghuished:

(7) i. mixed A (mixed neutral)
ii. mixed B (mixed vacillating)
iii. mixed C (mixed harmonic)
iv. mixed D (mixed vacillating disharmonic)

(c.i) *mixed A (mixed neutral)*
Roots of this type have a neutral vowel in their last syllable and back vowels in the preceding syllable(s). They select suffixes with back vowels, determined by the first non-neutral vowel preceding the neutral vowel in the final syllable:

(8)	radír 'eraser'	tányér 'plate'
	taxi 'taxi'	kávé 'coffee'
	bázis 'base'	

Let us observe here immediately that cases of this type with an *e* in the final syllable appear to be missing, although, as we will see below, words with *e* in the final syllable do occur in Hungarian. Vago (1980a: 173) mentions one example *maszek* 'self employed', but this word is somewhat special, since it is an acronym form *ma*gán *szek*tor meaning 'private sector'.[3] Moreover others claim that this word belongs to the *mixed B* category, to be discussed below.[4] The absence of cases where *e* appears as neutral may lead to the view that *e* is not neutral, i.e. that the set of neutral vowels consist of front unrounded *nonlow* vowels.

There are also roots that contain neutral vowels to the left of a non-neutral vowel:

(9)	bika 'bull'	béka 'frog'
	Tibor 'id'	szivar 'cigar'
	iskola 'school'	Ilona 'id'
	példa 'example	csíra 'germ'

Evidence for their "neutrality" is lacking here because there are no prefixes in Hungarian, so it is not possible to say whether there is a difference between words with *e* in the first syllable and words with one of the other three neutral vowels in that position.

(c. ii) *Mixed B (mixed vacillating)*
Roots with *e* in the final syllable do occur in Hungarian, but it appears that they typically tolerate both [-back] and [+back] suffix alternants:

(10)	Ágnes 'id'	szalamander 'salamander'
	dzsungel 'jungle'	bankett 'banquet'

Chevrolet 'id'	zsáner 'genre'
haver 'friend'	kódex 'codex'

Most of the words of this class are fairly recent borrowings. In this class we also find a few examples with final *é*:

(11) Tihamér 'id' · kabaré 'cabaret'
financér 'financier' · konkrét 'concrete'
affér 'affair'

and examples with more than one of the neutral vowels:

(12) analízis 'analysis'
aszpirin 'aspirin'
agresszív 'agressive'

(c. iii) *mixed C (mixed harmonic)*
This class consists of roots that are like the roots in the previous class in that they end in a syllable with *e* but unlike them in that they only have front suffixes. According to Vago this set includes the following words "and a few others" (Vago 1978):

(13) József 'Jozef'
október 'October'

Clements (1976b: 61) mentions specifically the group of words with *e* in absolute final position (*dózse* 'dog', *forte* 'forte') all of which take front vowel suffixes.

Words ending in two front unrounded vowels usually belong to the previous group. But if the final vowel is either *e* or *é* we find, according to Clements (1976b: 61), very few exceptions to the generalization that such roots take front suffixes only.

(14) oxigén 'oxygen' · november 'November'
operett 'operetta' · varieté 'variety'
acetilén 'acetylene'

An exception he mentions is *klarinét* that belongs to category *mixed A* (neutral), since it takes back suffixes only.

(c. iv) *mixed D: vacillating disharmonic roots*
Among the roots with more than two syllables Vago (1978) mentions a group that he calls vacillating disharmonic. In this group of roots consist-

ing of minimally three syllables we find disharmonic non-neutral vowels combined with neutral vowels:

(15) rökamié / rekamié 'sofa'
föderatív / federatív 'federal'
föderális / federális 'federal'

(d) *neutral vowel roots*

Among the roots containing only neutral vowels, we find about 60 examples that select a back suffix alternant (16a), two with *é* and the other with *i* or *í*. The majority of neutral vowel roots selects a front vowel alternant (16b):

(16) a. híd 'bridge'
nyíl 'arrow'
cél 'aim'
héj 'crust'
b. szid 'scold'
víz 'water'
vér 'blood'
kert 'garden'
kép 'picture'
szín 'colour'
szegény 'poor'

This completes the survey of root and suffix types. There are two additional matters that I wish to mention here, since this will facilitate the discussion below.

In passing I have referred to the fact that the neutrality of *e* is controversial. Before proceeding to the next section let us summarize some of the properties of the front unrounded vowel *e*, focussing on the differences between this vowel and *é*, *i* and *í*. From the "typology" given above three differences between the two sets of vowels can be inferred (cf. Ringen 1978: 110-111).

(17) i. There are no suffixes with neutral *e* (cf. 3)
ii. There are no neutral vowel roots with *e* taking back suffixes (cf. 16a)
iii. There are no mixed roots with *e* in the final syllable taking back suffixes only

Let us immediately observe, however, that not all of these properties are unique for *e*. Firstly, *í* does not occur in neutral suffixes either. Secondly, there are only two neutral vowel roots with *é* that take back suffixes (against over 60 with *i* or *í*).

The second point concerns the morphological process of diminutive formation, i.e. the formation of "pet names" on the basis of proper names. The relevance of this word formation process for the study of VH was first pointed out in Vago (1975). Pet names can be formed by taking the first syllable plus the following consonant of a polysyllabic word and adding the suffix *-i-* to it. This formation can be suffixed by case endings showing its harmonic behaviour:

(18) a. Klára → Klár + i + nak
b. Tibor → Tib + i + nek

The forms in (18) show that the truncated roots behave just like monosyllabic roots with a back or neutral vowel respectively. Hence after truncation of the final syllable the vowel quality of the vowel found in the first syllable determines the affix shape.

In the next section I will give an account of the phenomena described above within various versions of the autosegmental model.

2. THE AUTOSEGMENTAL ANALYSIS

In this section I will first summarize the analysis presented in Clements (1976b). Then I offer an alternative with respect to the treatment of neutral vowels. Finally I discuss a proposal advanced in Booij (1984), which offers yet another account of neutral vowels.

2.1. Clements (1976b)

The analysis offered by Clements (1976b) runs as follows. Harmonic roots are composed of a segmental tier and a tier on which the autosegment [B] is represented (pp. 52-53):

(19) In the case of regular front or back vowel roots, only one such [auto]segment is assigned in the lexical representation.

It is further assumed that as a universal convention, alternating suffixes are assigned no such autosegment in their underlying representation. Thus the underlying representation for such forms as *Kláránál* will be as follows:

[(20)] k l Á r Á + n Á l
+B

> [...]
> In order to assure the well-formedness of such representations, [...] a convention termed the Well-formedness Condition (WFC) is introduced:
> a. All vowels are associated with at least one harmony autosegment;
> b. All harmony autosegments are associated with at least one vowel;
> c. Association lines do not cross.

(21) is the result of changes operating on (20) so that it meets the WFC:

(21) kláránál
+B

Suffixes with neutral vowels are represented without an autosegment (as alternating suffixes). When they follow a back vowel root the following representation will result after application of the WFC:

(22) klÁr + I + nÁl → klárɨnál
+B WFC +B

The resulting segment *ɨ* does not occur in the phonetic representation. Clements assumes that there is a fronting rule changing *ɨ* into *i* leading to the representation:

(23) klár + i + nál
+B −B +B

He leaves open the question of how this fronting rule has to be formulated and how it operates.[5] Here I will assume that the rule is formulated as follows:

(24) +B → −B
$\begin{bmatrix}\text{-round}\\ \text{-low}\end{bmatrix}$

Let us now turn to the various types of roots that somehow diverge from the harmonic pattern, turning first to disharmonic roots (Clements 1976b, 54):

> It is common practice in generative phonology to assign such forms diacritic features indicating that they do not undergo the relevant rule(s). In the present framework, however, such a treatment is impermissable since there are *no* rules of vowel harmony: vowel harmony is the result of a universally-defined convention, the WFC, applying to lexical representation of the appropriate form.
> [...]
> Within our framework, nonalternating vowels have two sources. On the one hand they may, like the neutral vowel of the diminutive suffix in *Klárinál*, occur freely in both front and back words, having no effect upon vowel harmony. Such vowels can be called *transparent* [i.e. *neutral*; HvdH]: they do not interrupt single spans of harmony, and their phonetic shape is accounted for by low level neutralization rules, as we saw in the discussion just above. On the other hand we find vowels which, while occurring in both front vowel words and back vowel words, influence vowel harmony in the sense that they impose their harmonic category upon other vowels. These vowels can be called *opaque*. In underlying representations they always occur either associated with an autosegment or else in a domain *governed* by that autosegment [...]

Disharmonic roots then are represented with opaque, i.e. lexically associated vowels:[6]

```
(25)   k o sz t ü m
         |      |
        +B     -B
```

This mode of representation explains why suffixes added to disharmonic roots harmonize with the last vowel. Let us now turn to mixed vowel roots. Clements adopts the view that *i, í, e* and *é* are neutral (p. 55):

> Our principal assumption will be that neutral root vowels are bound to the autosegment '[-back]' in all occurrences. The only exception will be certain vowel roots such as *hid*, which are marked as exceptions to this morpheme structure condition.

So when occurring in suffixes neutral vowels are represented as harmonic vowels (i.e. unassociated to an autosegment), but when occurring in roots they are represented as opaque vowels (i.e. as lexically associated). Clements adduces two arguments in favour of this view. Firstly, the diminutive formation of the name *Tibor* takes front suffixes, as we have seen in (18):

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(26)   Tib + i + nél
          \  |  /
            -B
```

The source of the autosegment [-B] must be, as Clements reasons, the first vowel of the full form. The second argument involves neutral vowel roots. Such roots take (unless they are exceptions to the morpheme structure condition just mentioned) front suffixes. Again this shows, according to Clements, that neutral vowels must be associated to an autosegment [-B].

Clements must now account for the fact that mixed vowel roots may take back suffixes, despite the fact that the neutral vowel in the final syllable is associated to the autosegment [-B]. Let me recall the crucial facts (ignoring some details):

(27) i. roots ending in *i, í* and *é* typically take back suffixes (if a back vowel precedes, e.g. *radír* in 8)
ii. roots ending in *e* typically take front or back suffixes (whatever the preceding vowel; e.g. *Ágnes* in 10)
iii. roots ending in two front vowels typically take front or back suffixes (e.g. *analízis* in 12)

To account for the forms in (27i) Clements assumes an obligatory rule (28) that deletes the autosegment [-B]. The forms in (27ii) are exempted from this rule by a readjustment rule, not cited here. To account for the vacillating character of the form in (27ii & iii) Clements assumes in addition an optional deletion rule (29):

(28)
$$\begin{array}{lllll} V & C_o & V_n & C_o & + \\ | & & | & & \\ +B & & -B & \rightarrow & \emptyset \end{array}$$
where V_n = neutral vowel

(29)
$$\begin{array}{l} V \\ | \\ +B \end{array} \left(\begin{array}{lll} C_o & V_n & \\ & | & \\ & -B & \rightarrow \emptyset \end{array} \right)_Q \; C_o \; +$$

The readjustment rule marks all roots ending in *e* (and also some ending in *é*) as [-28]. These roots will then be subject to the optional rule in (29), but a form like *József* is also marked as [-29]. Furthermore roots ending in a sequence ...$V_nC_oe(')C_o$ (cf. 14) are marked [-29]. To see how the rules apply consider the following derivation:

(30) a. rAdír + tÓl
$$\begin{array}{c} | \\ +B \; -B \end{array}$$
-WFC→ b. radír + től
$$\begin{array}{c} | \;\; \diagdown\diagup \\ +B \quad -B \end{array}$$
-(28)→

c. radÍr + tÓl   d. radɨr tól

+B Ø   -WFC→   +B

Finally the fronting rule in (24) turns *ɨ* into *i*. Roots ending in *e* or more than one front unrounded vowel either only undergo the WFC (in which case *e* acts as harmonic) or the same four steps given for *radír*, with the difference that step c is due to rule (29) in those cases (in which case it acts as neutral).

The analysis that Clements proposes has a consequence with respect to the representation of the vowel *e*. Vago (1980a) points out that in suffixes this vowel must be [+low] since it alternates with the low vowel *a*. In roots, however, the *e* must be specified as [-low], at least if it occurs in the final syllable. To see this consider the vacillating mixed root *Ágnes*. This root may take either front or back suffixes. Back suffixes arise if the optional rule (27) applies, deleting the autosegment that is associated to the vowel in the final syllable. When this happens, the autosegment [+B] associated to the first vowel spreads:

(31) ágnes   ágnEs   ágnʌs   ágnes

+B -B (29) +B Ø (WFC) +B (24) +B -B

If the second vowel is specified as [+low] spreading of [+B] will turn it into *a*. The fronting rule cannot apply to the resulting form since in general *a*'s cannot all be turned into *e*'s; the vowel *a* belongs to the set of surface vowels. Hence the final vowel must be [-low] giving, after spreading, an abstract vowel /ʌ/ that is fronted by the neutralization rule. Since only one *e* appears on the surface Clements' analysis presupposes a second neutralization rule, which collapses the mid *e* and the low *e*.

The final aspect of Clements analysis involves roots with front unrounded vowels. As noted in the quote above, some of them are marked as an exception to the morpheme structure condition which requires front unrounded vowels to be associated to [-B]. The form in (32a) is regular and subject to the MSC and the form in (32b) is marked as exceptional. Clements represents these exceptional forms with an autosegment [+B], thus accounting for the fact that these roots take back suffixes:

(32) a. kék   b. hÍd

-B   +B

It is not clear whether it follows from anything that roots exempted from the morpheme structure condition have a [+B] autosegment, rather than no autosegment at all, unless Clements assumes yet another morpheme structure condition which requires that all roots have (at most) one floating autosegment.

2.2. *An alternative autosegmental analysis*

In this section I will propose an autosegmental analysis that differs from the one I have just summarized. I too will posit two sources for the surface root vowel *e*, one harmonic source and one neutral source. To account for the behaviour of neutral vowels, I propose that they will be associated to an autosegment [-B] at the *end* of the derivation, rather than at the *beginning*, on the assumption that predictable information is in general supplied as late as possible.

Before I proceed let me point out that the treatment of neutral vowels that was offered in Clements (1976b) is altered in Clements & Sezer (1982). They assume that an analysis of harmony involves assigning values to five parameters:

(33) a. The class of *P-segments* (melody units) which constitute the autosegmentally-represented harmony features;
b. The class of *P-bearing units* (melody-bearing units) defined as the class of units to which P-segments are associated under the universal Well-formedness Conditions;
c. The (possible null) class of *opaque segments*, defined as those which are underlyingly associated with a P-segment;
d. The (possibly null) class of *transparent segments* which must be formally excluded from the class of P-bearing units;
e. The *domain* within which the Well-formedness Conditions initially apply

("P" stand for "harmony" or "tone" etc.) Clements & Sezer are not explicit about the way in which *transparent* (= *neutral*) segments are to be represented formally, either underlyingly or at the surface. They merely say (p. 218):

> Transparent segments are a subset of the segments characterized under [33b] which are "neutral" to the system in the sense that they do not associate with P-segments under the Well-formedness Conditions, but receive their feature values by independent specification.

The proposal that I adopt here can be seen as the formal implementation of the suggestion that neutral vowels are "formally excluded" from the class of P-bearing units.

As the first step toward an alternative analysis let me be explicit about the set of underlying vowels. I assume five underlying vowel segments and one harmonic segment, being the P-bearing segments and the P-segment respectively:

(34)

	vowels segments (P-bearing segments)		harmonic segment (P-segment)
	[-round]	[+round]	
[+high]	I	U	[back]
[-high, -low]	E	O	
[+low]	A		

In addition the grammar contains a set of structure conditions, concerning segmental, autosegmental and sequential structure, capturing predictable value-assignments which are left unspecified in the lexical representations. Among segmental and autosegmental structure conditions are two conditions which are relevant for the phenomenon of VH: +O

(35) $$\begin{bmatrix}\text{-round}\\ \text{-low}\end{bmatrix} \rightarrow \begin{array}{c}\text{[-B]}\\ |\\ \text{---}\end{array}$$

Stx. $\begin{bmatrix}\text{-ro}\\ \text{-hi}\\ \text{ø lo}\end{bmatrix}$

(36) $$\begin{bmatrix}\text{-round}\\ \text{-high}\end{bmatrix} \rightarrow \left\{\begin{array}{l}\text{[-low]} \quad / \quad \begin{array}{c}\text{[-B]}\\ |\\ \overline{\;\;\;}\\ \text{X}\;\;\text{X}\end{array}\\ \\ \text{[+low]}\end{array}\right\}$$ [7]

+lo

Condition (35) accounts for the fact that Hungarian does not have back unrounded, nonlow vowels. Condition (36) says that an unrounded nonhigh vowel is mid if long (→ *é*) but low otherwise (→ *e, a, á*).

I will now assume that a condition like (35) *blocks* the universal association conventions from linking [+B] to vowels that are [-round, -low], blocking following from the universal principle of proper inclusion precedence. (36) does not block association, since its structural change is not in conflict with that of the association conventions. However, (36) *adjusts* the result of association. In particular it turns (37a) into (37b) thus capturing the fact that *a* alternates with *e* (a low vowel) but *á* with *é* (a mid vowel):

Why not
feature filling?

(37) a. [-B] b. [-B]

$$\begin{array}{cc} \text{a.}\ [-\mathrm{B}] & \text{b.}\ [-\mathrm{B}] \\ | & | \\ \begin{bmatrix} -\text{high} \\ -\textit{low} \\ -\text{round} \end{bmatrix} & \begin{bmatrix} -\text{high} \\ +\textit{low} \\ -\text{round} \end{bmatrix} \\ /\mathrm{E}/ & /\mathrm{A}/ \end{array}$$

The idea that predictable information is added at the latest possible stage (found for example in the theory of natural generative phonology, e.g. Hooper 1976) has received a new stimulus from the work of Kiparsky (1982, 1983) and Pulleyblank (1982) who combined this with the idea that values which are supplied at the end of the lexical derivation are considered to result from *default* rules. The other suggestion, i.e. to block association in the case of neutral vowels, derives in essential respects from ideas that have been expressed by Paul Kiparsky.[8] Finally, to let structure conditions adjust the output at each stage of the derivation is nothing but resuscitating the device of *linking*, proposed by Chomsky and Halle (1968).

After this sketch of what I think is the most promising variant of a "standard" autosegmental theory of VH, we can turn to the question how roots and suffixes are now represented.

Harmonic roots and *non-alternating suffixes* will be represented as in the previous autosegmental analysis:

(38) *Roots*

a. +B
VÁrOs

b. -B
OrOm

c. +B
hÁz

d. -B
fÓz

Suffixes (non-alternating)

e. +B
kOr

Alternating suffixes will be represented as "defective", i.e. as lacking a segment on the backness tier:

(39) nAk

The representation of alternating suffixes as defective is in conflict with the claim advanced in Vago (1976, 1980c) that at least for some suffixes it can be shown that they must be underlyingly specified for the feature [back] (Vago 1976: 245-6):

> The directional case morphemes normally function as alternating suffixes attached to nominal stems [...]. However, following a personal pronoun, the case morphemes function as stems to which a possessive suffix is attached that agrees with the personal pronoun in person and number; the personal pronoun may then be deleted, in *(én) nálam* (**énnél*) 'at me', *(én) tőlem* (**éntől*) 'from me', *én* is the first person singular pronoun, *nál–* and *től–* are the adessive and ablative case morphemes that function as stems, and *-am/-em* is the first person singular suffix.
>
> The fact that some stem forms, like *nál–*, have back vowels, but others, like *től–*, have front vowels is explained quite naturally if we assume that the stem forms reflect the harmonic shapes of the underlying suffix forms; otherwise, ad hoc statements are required to specify the harmonic shapes of the stem forms. In this analysis, the underlying adessive and ablative suffixes are /nál/ and /től/.
>
> It can further be shown that the conditional –na/–ne/–ná/–né has an underlying front vowel: /ne/. While this suffix alternates regularly (e.g. *hoznának* 'they would bring', *néznének* 'they would see'), in the first person singular indefinite forms only the alternate *-né* appears: e.g. *hoznék* 'I would bring', *néznék* 'I would see'. These facts suggest that the underlying form of the conditional suffix is /ne/, which is exempted from undergoing VH before the first person singular indefinite suffix /k/.

We might adopt two strategies to escape from Vago's position. Although Clements (1976b) does not address the issue explicitly, he mentions a "universal convention" which stipulates that alternating suffixes always lack an autosegment (p. 52). If we wanted to maintain that there is one underlying form for the case suffixes and the independent stems, the autosegment that forms part of that morpheme would be stripped by the universal convention if the morpheme appears as a suffix.[9] The second strategy would be to question the assumption that suffixes and stems must be derived from one underlying representation. It is a fairly common phenomenon that some suffixes bear a resemblance (both in form and meaning) to stems. The explanation for this is that many suffixes derive historically from stems. Without going into the matter in depth I claim that we are not forced to assign a single underlying representation to such historically related morphemes.

The second argument involving the conditional suffix can be countered as follows. Vago assumes a rule that assigns an exception feature to this suffix when it precedes the indefinite suffix /k/. The facts on which the second argument is based can be handled in the autosegmental model by assuming an allomorphy rule (in the sense of Aronoff 1976) which renders the suffix /nA/ *opaque* in the context of the suffix /k/:

$$(40) \quad \text{nA} \quad \rightarrow \quad \underset{\substack{| \\ -\text{B}}}{\text{ne}} \quad / \;\_\_\_ + \text{k}$$

I conclude that it is possible to maintain that *all* alternating suffixes are defective underlyingly.

Disharmonic roots will be represented as follows:

```
(41)  +B -B
       |  |
      soffőr
```

So far the analysis has been the same as the one presented in the previous section. Let us now turn our attention to *mixed roots*. The representation of *mixed A (neutral)* roots will be:

```
(42)  +B

      rAdÍr
```

It was argued at the beginning of this section that association of [+B] to the second vowel will be blocked by the presence of a language-specific structure condition. This implies that Í will be skipped when the autosegment is associated to the vowel(s) of alternating suffix(es):

```
(43)      +B                      +B -B +B
         /  \                      |  |  |
      radÍr  nak      by (35)     radírnak
```

Let us now turn to other mixed roots. There are two remaining categories, typically containing an *e* in the final syllable. In the present analysis the surface vowel *e* has two possible sources:

```
(44)  a. -B        b.                 -B          -B
          |                            |           |
          A               E  by (35)   E  by (36)  A
```

In the case of (44a) we are dealing with the harmonic vowel /A/ that is associated to the autosegment [–B] and in the case of (44b) we are dealing with the neutral vowel /E/ that is assigned an autosegment [–B] by rule (35), the result of which is adjusted by rule (36). The dual source of surface *e* is the key to the analysis of the categories *mixed B* (*vacillating*) and *mixed C* (*disharmonic*). The point is that a root with an *e* in the final syllable cannot be mapped onto a unique underlying representation. With this in mind it comes as no surprise that roots of this type typically vacillate:

(45) *mixed B (mixed vacillating)*

```
         ágnes
     ↓               ↓
+B -B               +B
 |   |
ágnes               ÁgnEs
   [+low]             [-low]
```

In the case of *József* native speakers have apparently decided to favor the disharmonic interpretation.

(46) *mixed C (mixed disharmonic)*

```
+B -B
 |  |
józsef
   [+low]
```

There are, as we have seen in section 1, no roots ending in *e* that take back suffixes only.[10] Zonneveld (1980: 34) points out that this gap cannot be explained in an analysis that posits two sources for *e*. If there are words that vacillate between the two sources for *e* (e.g. like *Ágnes*), and there are words having only the low-e (e.g. like *József*), why then are there no words that have been "fixed" on the non-low-e? Zonneveld furthermore claims that this gap is explained if we assume only low-*e*. The reason is this. The low-*e* cannot be included in the set of neutral vowels because it alternates with *a*. Hence roots containing this vowel (and a back vowel as well) must be marked as exceptions to vowel harmony: they are disharmonic. In Zonneveld's analysis such roots are furthermore either marked with [+D] (in the case of *Ágnes*) or not so marked (in the case of *József*) and this diacritic feature is referred to by an optional *dis*harmony rule. (This analysis will be discussed in more detail in the next section). It follows then that roots ending in *e* that take back suffixes cannot exist, just as there are no roots of the type *sofför* which take back suffixes.

Zonneveld's point is well-taken. Suppose we conclude from this that the autosegmental analysis must be modified. The way to do this would be as follows. We assume only one source for *e*, i.e. /A/ ([+low]), which belongs to the set of harmonic vowels. To account for the vacillation we then postulate an optional rule that inserts a floating autosegment [+B], after the autosegment that is associated to the /A/. Forms like *József* are marked as exceptions to this rule:

```
(47)   Ø → [+B] / [-B] ---
                   |
                  /A/
```

The one-source-for-*e* analysis starts out then from the assumption that (48) is excluded (cf. fn. 7):

```
(48)   *X
        |
       /E/
```

i.e. the melodic segment /E/ must be linked to two slots. A form like *Ágnes* is now represented with two /A/'s:[11]

```
(49)   +B -B                      +B -B +B
       |   |         -(47)→       |   |
       AgnAs         (opt.)       AgnAs
       |\                         |\
       xx                         xx
```

I am not convinced that we must accept this complication of the autosegmental analysis, however. Vago (1976) claims that roots taking only front suffixes develop from roots that vacillate. Apparently then there is a tendency to regard the *e* as harmonic only. Given this tendency and the fact that vacillation is the expected initial stage (given two sources for *e*) we also explain the gap.

But there is a more compelling reason to reject the approach just outlined. As we know, *é* too may occur in the final syllable of a vacillating root (cf. 11). But unlike *e*, *é* may also be neutral (as in *tányér*; cf. 8). We now face the problem of how to represent these two types of roots. It seems to me that a proponent of the one-*e* analysis must be in favour of a one-*é* analysis:

```
(50)   a. Vacillating      b. Not vacillating
          +B -B               +B -B
          |   |               |   |
          AffAr               tAnyAr
              |\              /\  /\
              xx              xx  xx
```

affér undergoes the optional rule in (47), just like *Ágnes*, but observe now that we must say that *tányér* undergoes this same rule *obligatorily*. Apart from technicalities involving the optional/obligatorily distinction, it is rather strange to see that *é* triggers the insertion of a [+B] autosegment, if and only if a back vowel precedes. If a root contains only *é* (one of more) we find as a rule [–B] affixes (ignoring the two exceptional forms in 16a).

It seems to me then that instead of (50b) we must prefer (51):

(51) +B

tAnyEr

xx xx

If this reasoning is convincing I fail to see why anyone would be in favour of a double source for *é*, but against a double source for *e*. So I conclude that the analysis that I proposed in the first place can be maintained.

Let us proceed with a discussion of the treatment of the other root types. Vacillating roots that involve a final sequence of two front unrounded vowels (cf. 12 and 14) call for a separate rule:

(52) -B

$$\begin{bmatrix}-\text{round}\\-\text{low}\end{bmatrix}\begin{bmatrix}-\text{round}\\-\text{low}\end{bmatrix}$$

Obligatory if the final vowel is *e* or *é*
Optional in other cases

Roots like *federatív* that do not end in *e* or *é*, nor in a sequence of two front unrounded vowels, and yet are vacillating according to Vago (1978: 120) (cf. the examples in 15) can only be accounted for by assuming that in sporadic cases neutral vowels are optionally associated to [–B]:

(53) –B +B(–B)

federatív

Finally, consider the monosyllabic roots that contain a neutral vowel. Crucial to an account of those roots is the fact that harmony in Hungarian is root-controlled. We can express this fact by assuming a morpheme structure condition saying that each root must contain an autosegment, be it [+B] or [–B]. As it turns out we find both possibilities:

(54) a. –B b. +B

víz híd

The autosegment in (54a) will be associated to the root, but this is not possible in example (54b). In both cases, however, the autosegment will be associated to a following alternating suffix.

```
(55)  a.   -B               b.      +B     ( -B  +B )
          /  \                       |     (  |   | )
        víz  nek              hÍd  nak     ( hídnak )
```

To complete the analysis I must still provide an account of the truncated forms in pet names (cf. 18). Recall that Clements (1976b) provides two arguments in favour of representing neutral vowels with [–B] underlyingly. The first argument involves the diminutive of *Tibor* (*Tibinek*/**Tibinak*) and the second regular neutral vowel roots. In both cases we find front suffixes, and the question is how we can explain this. As for neutral vowel roots, we have just seen how the analysis works here: each root, including neutral vowel roots, must have an autosegment. As for the diminutive forms, let us simply see what will happen if we add nothing to the analysis:

```
(56)  TIb + I + nAk    -(35)→    Tib + i + nAk  -?→ ...
                                  |     |
                                 -B    -B
```

It seems to me that the most likely thing to happen after assignment of default values is application of the WFC, leading to front suffixes.

The present analysis makes crucial use of the dual source of *e*. Let us now return to the three properties of *e* that we mentioned above. It appears that we can interpret these properties as follows (cf. 17). The /E/ source does not occur in affixes, nor in monosyllabic words that take back suffixes. In all other morphemes, however, we may find a free variation between /A/ and /E/ as the source for *e*.

The fact that the [–low]-*e* does not occur in suffixes or monosyllabic roots that take back suffixes remains an accidental fact, but, as was pointed out, other neutral vowels too are somewhat defective in their distribution. *i* does not occur in neutral suffixes and there are only two monosyllabic roots with *é* that take back suffixes.

2.3. *A different approach to neutral vowels*

Booij (1984) offers an analysis of Hungarian vowel harmony that is different from the two preceding analyses with respect to the treatment of neutral vowels, ignoring for the moment other differences that are of minor importance. Booij recapitulates an argument provided by Anderson

(1980) against Clements' (1976b) treatment of neutral vowels, pointing out that the same argument can be used against the proposal of Clements & Sezer (1982). Booij claims that both approaches are based on the assumption that the presence of a neutral segment A, being either [+F] or [–F], implies the absence of a segment that differs from A in the specification for [F] only.

Recall the first proposal, i.e. that found in Clements (1976b). Neutral /I/ is turned into an abstract vowel *ɨ* which is turned into a front vowel *i* by an absolute neutralization rule. Such an approach would be impossible if Hungarian has surface *ɨ*'s. In the second proposal (as found in Clements & Sezer 1982) the set of neutral vowels must be identified (parameter 33d). Booij says (p. 4) that if the backness value of neutral vowels is specified after the application of the backness rule:

> ... parameter *d* cannot 'see' the difference between a front vowel and its back counterpart. This is no problem in the case of Hungarian, because of the absence of the [+back] counterpart of the three neutral vowels /i, í, é/. However, it would be a problem for a language in which a front vowel is neutral with respect to backness harmony, but its [+back] counterpart is not. An analogical reasoning holds for other kinds of harmony.

Anderson (1980) gives two examples where the implication on which both approaches to neutral vowels are based, is not satisfied. Firstly, in Khalkha Mongolian /i/ is neutral with respect to rounding harmony. Yet the language has a "rounded /i/", i.e. ü. Secondly, in Finnish we find backness harmony, as in Hungarian. Apart from *i* and *e* that are neutral (and have no back counterpart) it appears to be the case that occasionally *u* and even *o* are neutral. Yet the vowels *ü* and *ö* occur as well. Booij then continues (p. 4):

> Although Anderson's insight that neutral vowels must be skipped is correct, this does not necessarily lead to a rejection of the autosegmental analysis of vowel harmony. The autosegmental framework as developed in [Clements & Sezer 1982] solves the problem of neutral vowels, provided that the neutral vowels are specified for the relevant feature at the underlying level.

The specification of neutral vowels at the underlying level is interpreted as being at the *segmental level*.[12]

I will first consider the two arguments that Anderson puts forward, because I think that they do not, contrary to what Booij believes, carry over to the Clements-Sezer approach (nor to the approach that I have adopted). If I am correct then it follows that Booij's suggestion is *unnecessary*. Secondly, I will argue that Booij's suggestion, though seemingly possible, is at odds with the spirit of autosegmental phonology.

In both the Clements–Sezer approach toward neutral vowels and the more explicit (and compatible) approach that I have adopted some care is taken to prevent the WFC from associating an autosegment to some P-bearing vowels, i.e. the neutral ones. Yet this does not exclude the possibility of associating P-bearing units having the same featural make-up *lexically* to this autosegment. The point is, however, that such P-bearing units will be *opaque*. In other words a vowel *i* may be neutral with respect to backness harmony, although the language in question has *ɨ*. The prediction is that in that case *ɨ* will always function as an opaque vowel.

We predict then that rounded front vowels are opaque in Khalka Mongolian. The analysis offered in Chinchor (1979) shows that rounded high vowels are indeed special in the sense that they do not participate in the harmonic process as "normal" harmonic vowels do. The high rounded vowels block the spreading of an autosegment [+R], so in that sense they behave as opaque. It seems to me this is sufficient reason to cast doubt on the conclusion drawn by Booij, although I admit that the process of rounding harmony in Mongolian needs further study.

With respect to the Finnish case, Campbell (1980) states that "back and front harmony are both possible in most cases with neutral *y*" and "back harmony is considered more prestigious, more learned, while front harmony is more colloquial" (p. 250-251). I claim that in colloquial styles we find the things that are phonologically natural. The prestigious style may just as well contain a non-phonological rule inserting the autosegment [+B] in the case of loans that typically belong to the learned vocabulary.

Let me now point out why Booij's proposal is at odds with the fundamental claim of autosegmental phonology. I will first quote his "summary" of the autosegmental theory (p.2):

> In an autosegmental analysis of this [i.e. Hungarian; HvdH] harmony the roots can be lexically specified with an autosegment [-B(ack)] or [+B(ack)], which is associated with the vowels of the root by means of the Association Convention. This implies that the vowels in the segmental core are archisegments, i.e. they are underspecified since they do not contain a specification for the feature [back]. The same holds for the alternating suffixes like *nek/nak*.

The crucial term here is *archisegment*. In recent literature this term is used to refer to P-bearing units, but we must realize that in the theory as conceived by Clements (1976a) P-bearing units are not strictly speaking archisegments. Segments in the "segmental core" are not "underspecified" in the sense that they contain a blank for the feature [Back]. The essence of the autosegmental approach toward backness harmony is that the feature [Back] is not present in the segmental core, but is present on a different tier. On a more intuitive level, representing one and the same feature on separate tiers strikes me as artificial in the light of the phonetic interpretation of the model, but I will not pursue that point here, since little is known in this area.[13]

It seems to me that the modification of the autosegmental framework that Booij proposes is a very fundamental one. Implicitly Booij casts serious doubt on Clements' original claim that the same model that is used to represent tonal phenomena can be extended to the phenomenon of vowel harmony. Now it may eventually turn out that tone and harmony call for different approaches. It is pointed out in Van der Hulst (1984: chapter 1), that there are a number of differences between tone and harmony that appear somewhat mysterious if both are represented in the same fashion. I claim, however, that the treatment of neutral vowels does not force one into a revision of the framework proposed by Clements in various articles.

Moreover, Booij's approach to neutral vowels faces the problem that there are two pieces of evidence showing that neutral vowels are associated to autosegments. This evidence was mentioned in the summary of Clements' analysis. Neutral vowel roots as well as the diminutive of a proper name like *Tibor* take front suffixes. To explain this Booij must assume a default rule that introduces the value [-Back] for suffixes that remain unassociated to an autosegment. Observe that in Booij's analysis it remains an accidental fact that the default rule introduces [-Back] rather than [+Back]. The analysis that I have proposed in the preceding section makes the appearence of front suffixes after neutral vowel roots non-accidental: suffixes are front because neutral vowels are front.

2.4. *Conclusion*

I claim that the analysis offered in section 2.2. qualifies as "the best autosegmental analysis" and that there is no need to give up a basic claim of the autosegmental model about the structure of phonological representations.[14] In the next section I will discuss segmental analyses of the same Hungarian data.

3. SEGMENTAL ANALYSES

3.1. *The alternatives*

During the past few years a number of segmental analyses have been proposed. Vago developed the first extensive analysis within a generative model (Vago 1975, 1976, 1980c). His 1976 article triggered three reactions (Jensen 1978, Phelps 1978 and Ringen 1978). A large portion of Vago's reply (Vago 1978) is devoted to the issue of dealing with exceptions to vowel harmony. Zonneveld (1980) takes up this central issue, presenting an analysis that differs from the accounts that had already been proposed. In reaction to Zonneveld, Ringen (1982) defends her analysis and Battistella (1982) contributes to the discussion by offering yet another analysis.

In this section I will not spell out in detail all the proposed analyses. In particular I will not consider here the analyses proposed by Phelps (1978) and Battistella (1982), since these authors make use of powerful exception devices that are non-standard and, it seems, unnecessary within a segmental approach.[15] Since these authors offer no compensation by eliminating other devices or by covering more data their analyses can not qualify as "better" than analyses that make use of a more restrictive theory of exception devices, without covering less data.

Furthermore I will concentrate on points where the segmental analyses seem to differ in essential respects. I will discuss the differences by showing how the various types of roots have been handled, discussing them in the same order as in section 1:

(57) a. harmonic roots
b. disharmonic roots
c. mixed roots
mixed A (mixed neutral)
mixed B (mixed vacillating)
mixed C (mixed harmonic/vacillating)
mixed D (vacillating disharmonic)
d. neutral vowel roots

(a) *harmonic roots*
The controversy surrounding this class is the following. The type of agreement that exists between vowels inside a root and across a suffix boundary is undoubtedly the same. Yet it has been proposed to deal with VH inside roots in terms of a separate statement. Within this view root vowels are fully specified and VH is accounted for in terms of a *morpheme structure condition* (MSC). Suffix vowels may be fully specified or archisegmental (depending on the evidence for underlying specification) and a *phonological rule* either changes or fills in their value in accordance with the value of the final root vowel.

Several arguments have been advanced in favor of this type of approach (cf. Ringen 1980).[16] Firstly, Kiparsky (1968) argues that the two VH-rules (i.e. the MSC and the P-rule) have different classes of exceptions:

> [...] it is impossible to derive both root harmony and affix harmony by a single rule, because they have different classes of exceptions, and are therefore different processes. Finnish (as well as Turkish and Hungarian) contains harmonically incompatible vowels, e.g. *afaari* 'affair', *olympiasaiset* 'olympic games'. Obviously these words are exceptions to the stem harmony morpheme structure condition. Yet that all strictly observe the vowel harmony rule; their affixes undergo exactly the same rule as do those of native words [...] (p. 29)

However, Ringen (1980) correctly points out that we have a non-sequitur here. Disharmonic roots may be marked as [-vowel harmony rule], implying that each segment of such roots is thus marked. Hence no segment of such roots will *undergo* VH. According to SPE conventions it is not the case that segments that are marked as [-VH] cannot function as the environment of the rule. Hence there is no reason why suffix vowels could not agree with the final vowel of a disharmonic root. Apparently Kiparsky had a different theory of exception features in mind, as will also become apparent below (cf. footnote 21).

A second argument in favour of using a morpheme structure condition relates to the use of "blanks" in phonological representations. An obvious way of dealing with VH inside roots and across suffix boundaries using only a P-rule involves setting up roots in which all vowels except one are unspecified for the harmonic feature.[17] The specified vowel is usually considered to be the vowel in the first syllable. Stanley (1968) claimed that it is possible to (mis)use blanks as a third value and that lexical representations must therefore contain fully specified feature bundles, thus ruling out the one-rule approach to VH just mentioned. Regularities holding at the morpheme level cannot be expressed in terms of P-rules that fill in or change underlying values. All regularities at this level must be expressed in terms of a separate category of morpheme structure conditions.

Again Ringen points out that the argument is not compelling (cf. also Ringen 1977). It is possible to modify other aspects of the theory in order to prevent the misuse of blanks, while allowing P-rules to apply morpheme-internally to underspecified segments. The change that Ringen proposes also affects the third argument in favour of the MSC-approach, which I will now discuss.

This argument is based on proposals advanced in Kiparsky (1973), where he argues in favour of a principle which requires that non-automatic neutralization rules must be prevented from applying in *non-derived* environments. In this way Kiparsky blocks the possibility of setting up abstract underlying representations that violate his earlier *alternation condition* (cf. Kiparsky (1968, 1973)). Since VH rules (at least in Hungarian and all other cases I know of) neutralize underlying contrasts and are non-automatic in the sense that they have exceptions, we may infer that VH inside roots cannot be effected by a rule.

Ringen (1977, 1980) posits a single rule of VH. She is able to capture the spirit of Kiparsky's principle by reformulating it so that it forbids a rule from *changing* feature values when applied in a *non-derived environment*. The requirement, thus formulated, prevents both the misuse of blanks that Stanley rightly condenms and the type of abstractness that Kiparsky judges so harmful for the generative theory. By this ingenious move Ringen has managed to eliminate two arguments in favour of the two-rule approach.[18]

Only in Vago's analysis of Hungarian VH do we find an explicit defence of the position that VH inside roots is accounted for by a morpheme structure condition. Vago (1976, 1980), however, does not rely on the three arguments that have just been discussed. His line of argumentation is the following:

(58) i. Neutral vowel roots (regularly) take front suffixes;
ii. Since neutral vowels are front we explain i. if we assume that neutral vowels trigger VH;
iii. Mixed vowel roots like *Tibor* have an underlying front vowel in the first syllable; cf. *Tibinek*;
iv. By extension the same holds true for *bika*, although there is no diminutive evidence
v. *bika* does not become *bike*;

$\vdash$ VH does not apply root internally

Vago argues that roots need not be marked as [-VH], if Kiparsky's principle is accepted.

In all other segmental approaches the use of a separate MSC is explicitly or implicitly rejected. Ringen (1980) uses, as said, one harmony rule. In roots the first non-neutral vowel is fully specified and all other vowels are unspecified for the feature [back]. Suffixes (at least those for which there is evidence) are fully specified. The harmony rule only fills in values when it applies root internally and changes values when applied to suffixes. Neutral vowels are not affected by the rule:[19]

(59) $$\begin{bmatrix}+\text{syll}\\+\text{low}\\+\text{round}\end{bmatrix} \rightarrow [\alpha\text{back}] \;/\; \begin{bmatrix}+\text{syll}\\\alpha\text{back}\end{bmatrix}\left(C_0\begin{bmatrix}+\text{syll}\\-\text{low}\\-\text{round}\end{bmatrix}\right)_0 C_0 \text{---}$$

A neutral vowel may trigger the rule (i.e. is not skipped) if it is the only vowel that can function as the triggering environment after the VH rule has applied the value for [back] in neutral vowels is filled in by a rule (cf. Ringen's footnote 13, p. 152), that I formulate here as follows:[20]

(60) $\begin{bmatrix} \text{+syll} \\ \text{-low} \\ \text{-round} \end{bmatrix} \rightarrow$ [-back]

In the analysis given by Jensen (1978) and Zonneveld (1980) there is also one rule:

(61) [+syll] $\rightarrow$ [αback] / $\begin{bmatrix} \text{+syll} \\ \alpha\text{back} \end{bmatrix} C_0$ --- (left-to-right iterative)

Neither author is explicit with respect to the representation of roots and affixes; i.e. it is not clear whether in roots only one vowel is specified and whether affixes are unspecified or not. In any case Jensen and Zonneveld make no use of Kiparsky's principle, since they specify disharmonic roots (like *soffőr*) as [-VH]. They also specify mixed roots like *beka* as [-VH]. Hence they eliminate premiss five in Vago's argument, which means that the conclusion no longer follows.

(b) *disharmonic roots* & (c) *mixed roots*
An analysis like that of Jensen, using only one rule and an exception feature [-VH], faces a serious problem, as Vago (1978) points out. Let us see how such an analysis would work. As noted above, disharmonic roots are marked as [-VH], as well as mixed roots like *bika* and *József*. Mixed roots like *radír*, however, are not so marked and therefore subject to the rule. Consider the following derivation:

(62) radír+nek → radɨ́r+nek → radɨ́r+nak

The back unrounded vowel ɨ is subsequently fronted by a rule of absolute neutralization:[21]

(63) $\begin{bmatrix} \text{+syll} \\ \text{-round} \\ \text{-low} \end{bmatrix} \rightarrow$ [-back]

The vacillating behaviour of roots like *Ágnes* is accounted for (by Jensen) by supplying them *optionally* with the rule feature [-VH].

(64)

$$\text{Ágnes + nek} \xrightarrow{a} \text{Ágnʌs + nak} \xrightarrow{b} \text{Ágnesnak} \xrightarrow{c} \text{Ágnesnak}$$

(the second *e* of *Ágnes* is [-low, -back], the *e* of the suffix is [+low, -back])

$$\underset{[-\text{VH}]}{\text{Ágnes + nek}} \rightarrow \underset{[-\text{low}]}{\text{Ágnes + nek}} \xrightarrow{c} \underset{[+\text{low}]}{\text{Ágnesnek}}$$

where; a = VH, b = absolute neutralization rule, c = a rule converting /e/ to [ɛ]

Vago (1978) correctly points out that Jensen's use of the feature [-VH] is problematical. Consider the trisyllabic roots given in (15). These roots are disharmonic and must in Jensen's account be marked as obligatorily [-VH], but they are also vacillating and therefore at the same time optionally [-VH].

The problem under discussion does not exist if we claim, as was first done in Ringen's work, that the vacillating character of roots like *Ágnes* is due to a separate *Disharmony rule*, which is triggered by a diacritic feature [D]:

(65)
$$\begin{bmatrix} +\text{syll} \\ +\text{low} \\ +\text{round} \end{bmatrix} \rightarrow [-\alpha\text{back}] \;/\; \begin{bmatrix} +\text{syll} \\ \alpha\text{back} \\ \text{D} \end{bmatrix} \left(C_0 \begin{bmatrix} +\text{syll} \\ -\text{low} \\ -\text{round} \end{bmatrix}\right)_0 C_0 \text{---}$$

Condition: obligatory when root contains only neutral vowels, optional otherwise

This disharmony rule can be collapsed with the harmony rule given in (59) above:

(66)
$$\begin{bmatrix} +\text{syll} \\ +\text{low} \\ +\text{round} \end{bmatrix} \rightarrow [\alpha\text{back}] \;/\; \begin{bmatrix} +\text{syll} \\ \left\{ \begin{matrix} [\alpha\text{back}] \\ \begin{bmatrix} -\alpha\text{back} \\ \text{D} \end{bmatrix} \end{matrix} \right\} \end{bmatrix} \left(C_0 \begin{bmatrix} +\text{syll} \\ -\text{low} \\ -\text{round} \end{bmatrix}\right)_0 C_0 \text{---}$$

Zonneveld (1980) also proposes a disharmony rule:

(67)
$$[+\text{syll}] \rightarrow [\alpha\text{back}] \;/\; \begin{bmatrix} +\text{syll} \\ \alpha\text{back} \\ +\text{D} \end{bmatrix} C_0 \text{---}$$

The disharmony rule and the harmony rule given in (61) above can also be collapsed into one rule by means of braces:

(68)
$$[+\text{syll}] \rightarrow [\alpha\text{back}] \;/\; \begin{bmatrix} +\text{syll} \\ \left\{ \begin{matrix} [\alpha\text{back}] \\ \begin{bmatrix} -\alpha\text{back} \\ +\text{D} \end{bmatrix} \end{matrix} \right\} \end{bmatrix} C_0 \text{---}$$

Despite the similarities in the rules there are a number of important differences between Ringen's and Zonneveld's analysis.

A first difference is that disharmonic roots are marked with an exception feature in Zonneveld's analysis, while Ringen does not need this device. In her approach to disharmonic roots the vowels are specified for the feature back. This alone takes care of the fact that the VH rule is not applicable here: it cannot change values in non-derived environments.

A second difference involves the use of the diacritic feature which triggers the disharmony rule. A minor point is that Ringen assumes that diacritics are simplex in order to prevent reference to the complement class of the exceptional class (Ringen 1982, 195). The more important difference between the two analyses become apparent when we consider neutral vowel roots.

(d) *Neutral vowel roots*

We have seen that in the regular case such roots take front suffixes and that only about 60 roots select a back suffix.

The regular case is handled by both analyses without problems, since both rule (65) and rule (67) derive front suffixes in this case. With respect to the irregular class two approaches are possible. One, advocated by Vago and supported by Jensen (1978), Phelps (1978) and Zonneveld (1980), involves the postulation of underlying abstract segments. It is claimed that *hid* has in its lexical representation a back unrounded vowel *ɨ*. As such this root causes suffixes to surface with a [+back] vowel. The rule of absolute neutralisation, ordered after VH, turns *ɨ* into *i* to generate the surface form.

This treatment of "neutral vowels" is not chosen by Ringen, who adheres to a *concrete* theory of phonology. In this theory it is impossible to posit segments in the underlying representation of a morpheme that never reach the surface. The possibility of positing such abstract segments represents an undesirable richness of the theory, as was first argued by Kiparsky (1968). The impossibility of using such segments follows in Ringen's theory from the fact that the rule which must turn the abstract segment into some surface vowel (or zero) would be applying in a feature changing manner in a non-derived environment. In her theory, then, Ringen accounts for backing after forms like *hid* in terms of the *disharmony* part of the proposed rule. Hence a form like *hid* is stored with its surface vowel, but marked as [D].

Ringen's approach faces the problem that the disharmony rule, which applies optionally in the case of polysyllabic roots that are marked [D], must apply obligatorily to monosyllabic roots like *híd*. Zonneveld's analysis circumvents this complication.

With respect to neutral vowels in their other occurences (where they do not behave exceptionally as in *híd*) Ringen and Zonneveld also have different views. They agree on the point that roots containing the low vowel *e* as well as a back vowel are to be treated as disharmonic. So Zonneveld marks them as [-VH], whereas Ringen uses full specification. However, in Zonneveld's analysis the other unrounded front vowels are subject to the rule of VH, i.e. *i, í* and *é* when occurring in roots like *radír* are converted into back unrounded vowels by the rule of VH. The rule of absolute neutralization given above in (59) converts these vowels into front unrounded vowels after the rule of VH has applied. One might say that in Zonneveld's analysis (as in that of Jensen) "neutrality" is a surface phenomenon only.

Apparently Ringen assumes that abstract segments are not only impossible underlyingly, but also at intermediate stages of the derivation. Hence her rule only applies to vowels that are either [+low] or [+round] and skips front unrounded (i.e. neutral) vowels if possible. In this way Ringen avoids the appearance of a vowel like *ɨ* in forms such as /radɨ́r/. Let us now observe, however, that if Ringen adopted a rule that does not skip neutral vowels, she could allow the neutralization rule (which she has to adopt in any case, cf. fn. 21) to change *í* to *i, ɨ* tot *í* and ʌ̀ to *é*. The crucial point is that such an application of the neutralization rule would not be prevented by the constraint on rule application, since the abstract vowel in *radɨr* constitutes a derived environment. So it is not at all clear why Ringen should adopt a VH rule that is different from the rule that Jensen and Zonneveld use.

Before evaluating the foregoing discussion, let us consider the segmental analysis proposed by Vago (cf. footnote 1). Vago argues that two rules must be postulated in addition to an MSR. His argument rests on the presence of mixed roots, and in particular on the presence of mixed harmonic roots like *Jószef* and mixed vacillating roots like *Ágnes*.

Vago starts out by assuming a simple harmony rule, essentially the one given in (61) above repeated here for convience:

$$(69) \quad [+\text{syll}] \rightarrow [\alpha\text{back}] \;/\; \begin{bmatrix} +\text{syll} \\ \alpha\text{back} \end{bmatrix} C_0 \text{ ---}$$

Given this rule and given a root like *radír*, which selects back suffixes, one might argue that the lexical representation of this root is /radɨr/, with a back unrounded vowel. But what about *Ágnes*, which may select both [-back] and [+back] suffixes?

Vago plainly rejects the possibility of having two underlying representations. Hence the lexical representation must be /ágnes/. Vago extends then this conclusion to *radír*, whose lexical representation is assumed to be /radír/. However, *radír* selects a back suffix and it must therefore follow that there is a second harmony rule (called *marked vowel harmony*) that *skips* unrounded front vowels. Forms like *Ágnes* are optionally exempted from conditioning this second harmony rule:

(70) $$[+\text{syll}] \rightarrow [+\text{back}] \; / \begin{bmatrix} +\text{syll} \\ +\text{back} \end{bmatrix} C_o \left(\begin{bmatrix} +\text{syll} \\ -\text{back} \\ -\text{round} \end{bmatrix} C_o \right)_1$$

Forms like *József* are obligatorily [-marked VH]. Rule (29) and rule (70) cannot be collapsed according to Vago since forms may be (obligatorily or optionally) exempted from undergoing rule (70), while they must undergo rule (69). As Vago says (1976: 255):

> The validity of the above argument rests on the assumption that lexical features may refer to an abbreviated rule schema, but not to its subrules. All things being equal, a theory that accepts this premise is more restrictive, hence stronger, than a theory that rejects it.

Granting this, let us see what the essential difference is between the two-rule analysis proposed by Vago and the two-rule analyses proposed by Ringen and Zonneveld.

At first sight it appears that the crucial difference is that the latter two analyses invoke a rule of *disharmony*, whereas Vago has two *harmony* rules. The difference is only apparent, however. This is observed by Zonneveld (1980: 36):

> [...], notice that the label "marked" VH is little more than a mnemonic disguise for what appears to be called, with equal reasonableness, a rule of vowel *disharmony*. Because of the subscript 1 in [(66)] there will obligatorily appear a front vowel immediately to the left of the back-vowel focus, a situation which is not avoided by suggestive nomenclature.

I think Zonneveld's objection to the marked harmony rule is convincing.

Having discussed the major segmental "variants", let us now ask the question which segmental analysis qualifies as the optimal one.

3.2. *Abstract or concrete*

The first conclusion that we may draw is that a segmental account necessarily involves two P-rules: a harmony rule and a disharmony rule. Two-rule analyses of this type are proposed by Ringen and Zonneveld (and implicitly as we just saw by Vago as well). The second conclusion is that it is not necessary to assume that there is a separate morpheme structure condition to account for VH inside roots. This leaves us with the analysis proposed by Ringen and Zonneveld. Let us therefore focus again on the major differences between these two analyses.

Ringen attributes the behaviour of both vacillating and neutral vowel roots that take back suffixes to the presence of diacritic [D], thus claiming that both types of roots belong to the same category. Zonneveld, on the other hand, attributes both types of roots to different categories. Vacillating roots trigger the optional disharmony rule with a diacritic feature, whereas the neutral vowel roots are represented underlyingly with an abstract vowel, thus triggering the obligatory rule of VH.

A point in favour of Zonneveld's position is that the two types of roots indeed behave differently. The neutral vowel roots at issue do not vacillate. This follows from Zonneveld's analysis, but it must be stipulated by Ringen (cf. the condition on the rule cited under (65)).

One might argue that Zonneveld pays a price for his abstract vowel analysis, viz. the rule of absolute neutralization. This rule, however, expresses a true generalization about the segment inventory of Hungarian, which implies that any analysis of Hungarian must contain such a rule. We observed above that Ringen assumes the same rule in her analysis (cf. (60) and footnote 21).

The two analyses also differ, as we have seen, in their treatment of disharmonic roots: Zonneveld uses an exception feature and for Ringen it is sufficient to say that the vowels of such roots are fully specified. There can be little doubt that Ringen's approach is superior here. This difference is not independent from the abstractness issue, since the principle that allows Ringen to use full specification as a means to encode exceptionality also forbids her to posit abstract vowels.

With respect to the treatment of neutral vowels, I have shown that by skipping them Ringen makes her rule (and theory) more complicated than necessary and for this reason I will prefer Zonneveld's approach: neutral vowels participate in the harmony process and a neutralization rule takes care of the fact that only the front couterparts appear at the surface.

In terms of overall economy I think the best segmental analysis should adopt from Ringen the use of full specification as a means to encode exceptionality (we don't need the exception feature), and from Zonneveld the treatment of neutral vowels (the rule becomes simpler, there is no "danger" of misusing the derived abstract segments and forbidding them requires extra principles).

I do not find it possible, however, to argue in favour of Zonneveld's abstract segment in forms like *hid*, although as we saw above Ringen's approach toward these roots is not satisfactory either. The question then as to whether or not abstract segments may be present in lexical entries, raised 16 years ago by Kiparsky, cannot receive a definite answer. I would like to claim that the issue is undecidable in principle, at least within the context of a segmental theory. Either one adopts a theory in which abstract segments are banned from the lexicon, as Ringen does, or one adopts a different theory in which such segments are legitimate entities. The former theory allows a rather harmless use of abstract segments (e.g. as here), but also the kind of use that Kiparsky objected to in the first place. The second theory disallows any kind of abstractness and leads in general to more complex analyses. It is not clear to me how the issue is ever going to be settled.

4. THE COMPARISON

An obvious difference between the autosegmental analysis and the (two) "best" segmental analyses is the fact that in the former there is no harmony rule to begin with. There is only a universal wellformedness condition.

A segmentalist might adopt the point of view, however, that the harmony rule used for Hungarian could also be looked upon as a universal rule. It is compatible with the analysis of both Ringen and Zonneveld to say that in harmonic roots only the first vowel is specified for the feature [back], and also that all suffixes have underspecified vowels. Underlying representations with underspecified vowels, our segmentalist might argue, entail the presence of a harmony rule by universal convention. In this sense an autosegmental and a segmental analysis would be equally simple.

What about the rule of disharmony, however? Recall that both Ringen and Zonneveld make use of such a rule to account for the behaviour of vacillating roots. Our autosegmental analysis accounted for these roots by postulating different underlying representations. This difference appears to be independent of the framework we choose. The view that vacillating roots have two possible underlying representations is also possible in a segmental approach (cf. the analysis of Jensen 1978). We also saw that an autosegmental analysis with one source for *e* is in principle possible. In that case we have to postulate an autosegmental counterpart of the segmental disharmony rule (cf. (47)).

Let us turn therefore to the "heart of the matter", i.e. to the neutral vowel roots that take back suffixes. Here Ringen uses the diacritic [D], while Zonneveld uses abstract vowels. I would now like to claim that the autosegmental analysis strikes a perfect balance between these two approaches:[22]

(71)	a. /híd/	b. /hɨ́d/	c. /híd/
	[D]	[+B]	
			[+B]

By postulating a floating feature we have not committed ourselves to the claim that abstract vowels are possible. The autosegmental representation is of course abstract in that it allows a floating feature that need not appear on the surface, but this is only possible, I would like to argue, because we make use of an autosegmental tier, for which the language offers abundant evidence. This makes the autosegmental type of abstractness more constrained than the type of abstractness that is allowed by Zonneveld, Jensen and many other generative phonologists.

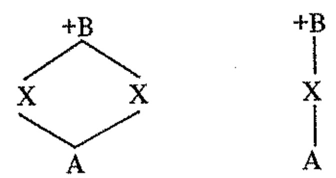
The autosegmental representation has the advantage over Ringen's diacritic and shares with Zonneveld's abstract vowels that it does not trigger a separate rule. In Ringen's analysis it is essentially a coincidence that the diacritic [D] triggers a rule that refers to the feature [back], rather than to a rule that refers to [nasal]. Given that a separate disharmony rule is formulated, such a state of affairs would nearly be as easy to describe. This is not the case in the autosegmental analysis if the constraint on the use of floating features just suggested is adopted, because there is no independent motivation for placing the feature [nasal] on a separate tier in Hungarian.

I claim that the advantage of adopting the autosegmental analysis lies in the fact that this framework offers a principled answer to the "abstractness controversy" as it is manifested in the analyses of vowel harmony. It allows us to be concrete and disallows many of the abstract analyses that are possible in an SPE-type of approach. Yet we are not forced into a diacritic approach in cases of the type we have discussed here. This is a welcome result, since it does not seem likely that "ghost segments" will ever stop haunting the proponent of a purely segmental framework.

NOTES

1. In very recent work Vago has offered an autosegmental analysis of VH in Hungarian. The autosegmental theory that Vago proposes deviates in several ways from the standard theory. Vago's autosegmental analysis reached me too late to be included in this study.
2. Miklós Kontra and Catherine Ringen have been working on the treatment of loanwords with respect to Hungarian. Their work, known to me from an oral presentation, reached me too late to be discussed here.
3. This was pointed out to me by C. Ringen and A. Kornai.
4. C. Ringen (p.c.).

5. I refer to Clements' article for some discussion on the technical details associated with the application of this rule.
6. A harmless ambiguity is that *kosztüm* could also be represented with one of the association lines missing. In Vago (forthc.) it is argued that the first autosegment must be unassociated, but nothing that I say here hinges on a decision, so I will ignore this point.
7. The difference between short and long vowels is due to their being associated to one and two "slots". In full the phonetic interpretation of vowels refers to more complex structures:



8. During the 2nd Salzburg Summer Institute (1982) Paul Kiparsky showed me some unpublished work of his dealing with vowel harmony. The present proposal concerning the treatment of neutral vowels is inspired by that work.
9. This convention forces us to represent suffixes like /kor/ (cf. 38) with a bound autosegment and should refer to floating autosegments as being impossible in suffixes.
10. Recall our discussion of the form *maszek* in the section 1.
11. In examples (49), (50) and (51) I deviate, for the sake of clarity, from the convention of using small letters for P-bearing units that are bound to an autosegment. I also indicate length in terms of slots instead of with a diacritic.
12. In Van der Hulst and Smith (1982b) it is also argued that neutral segments can be handled in terms of segmental specification.
13. Ringen (1984) makes the same point when she discusses Halle and Vergnaud's proposal to specify all vowels at the segmental level with the "unmarked value" (cf. Halle and Vergnaud (1980). This proposal can easily be replaced by another proposal in which the unmarked value, where necessary, is assigned by a "default" rule that inserts an autosegment. This is the proposal suggested in Pulleyblank (1982), taken over in the analysis that was presented in section 2.2.
14. In some "underground" variants of the autosegmental model it is proposed to use single-valued features as autosegments, i.e. in this case [B] or nothing. In considering this possibility during an oral presentation of his paper, Booij pointed out that in this alternative it follows that neutral segments must be specified non-autosegmentally. It seems to me that this is a very interesting approach, but it faces the problem of dealing with opaqueness. For example, in Akan the low vowel is opaque, yet it is [-ATR], whereas the spreading autosegment is [+ATR]; Clements (1981).
15. These exception devices involve segment-sized exception features, exception features that differentiate between "environment and "focus", and others. I refer to Zonneveld (1980) and Ringen (1982) for some discussion of the proposals of Phelps and Battistella.
16. Kiparsky (1968) gives some other arguments based on markedness theory and morpheme structure conditions. In the light of subsequent developments these arguments are no longer relevant.
17. I refer to Kiparsky (1968) for some discussion of some of the early proposals that involve this approach.

18. In the theory of "lexical phonology" (cf. Kiparsky 1982, 1983 and Mohanan 1981) Ringen's proposals have been incorporated.
19. In giving this rule and others I have made some harmless changes such as the replacement of "V" by [+syll].
20. A problem in Ringen's approach is that neutral vowel roots have underspecified vowels only, i.e. Ringen (1980, 147) gives /hI:d/ for *híd*. This is probably an oversight, since if only neutral vowels are present one of them must be fully specified in order to function as the determinant in the harmony rule.
21. In her footnote 14 (p. 152) Ringen (1980) claims that her analysis does not contain the absolute neutralization rule, but this is not really true, since in footnote 13 she introduces a rule (given in (63) in this paper), that is identical to the rule of absolute neutralization that Jensen proposes. In fact no analysis of Hungarian can do without such a rule, since it expresses a true generalization about the segment inventory of Hungarian.
22. Kiparsky (1968) proposes a third way of dealing with the irregular abstract vowel roots. He marks them as [-VH]. This exception feature is of the type [-environment VH] as opposed to the feature [-context VH] that Kiparsky (1968) will also have to use for disharmonic roots. Hence the analysis proposed by Kiparsky (1968) is subject to the same criticism that we levelled against Phelps (1978) and Batistella (1982) in that it presupposes a theory of exceptions that is extremely powerful.

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