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Single-valued features and the non-linear analysis of vowel harmony

1. Introduction

The phenomenon of harmony involves segments of a certain type necessarily having the same value for a phonological property (or properties) within a particular domain. The most common type of harmony is vowel harmony. In languages displaying vowel harmony, all vowels (or a subclass of vowels) must agree in properties such as rounding, height, frontness, tongue root position, and so on. But other kinds of harmony exist as well. We also find consonant harmony, and there are examples of cases where, within a particular domain, all the segments in a language - both vowels and consonants - must agree in properties such as nasality or pharyngealisation.

Within most theories of phonology (with the exception of *SPE*) harmony is considered to be a suprasegmental phenomenon. Saying that harmony is a suprasegmental phenomenon is one thing; to develop an explicit and concise notational system to analyse specific instances of harmony is rather more difficult.

In recent years at least one serious attempt has been made to do this. Clements (1980) offers a suprasegmental theory of vowel harmony which is based on the notational system of autosegmental phonology, first developed in Goldsmith (1976). The fundamental insight of autosegmental phonology - that tonal features can be represented on a distinct autosegmental tier - is transplanted to the harmony process, so that those features which are harmonic are also placed on a separate tier.

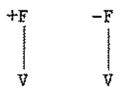
Until recently the autosegmental approach has assumed the binary feature notation deriving essentially from the Jakobsonian tradition. In this approach, no appeal is made to the distinction between Trubetzkoy's equipollent and privative oppositions - i.e. there is no attempt to distinguish binary and single-valued feature-types. *All* features, then, are of the same type - they can have the values + or -.

There is, however, a growing tendency within autosegmental phonology to propose the use of single-valued features: see, for example, Kaye & Vergnaud (1984) and Goldsmith (forthcoming). A not dissimilar suggestion is made by Kaye *et al.* (forthcoming), who propose a system of unary phonological elements. These, however, are made up of binary features of a rather traditional kind.

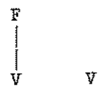
Outside autosegmental phonology, more drastic revisions of the notational framework have been proposed. In dependency phonology (Anderson & Jones 1974; Anderson & Ewen ms), for example, segmental structure is viewed entirely in terms of single-valued features, or components, while Schane (1984), within the framework of particle phonology, proposes an approach based on three particles defined as palatality, labiality, and aperture. (For some discussion of these approaches, see Anderson *et al.* forthcoming.)

The essential claim embodied in a single-valued feature system is that no segment is characterised by the explicit specification of the fact that it lacks a certain property. If it lacks a property, that property is simply absent in the representation of the segment. This is shown in (1) and (2), in terms of an autosegmental type of notation, where (1) is a binary feature and (2) a unary or single-valued feature:

(1)



(2)



An issue which is at least partially independent of the number of values which the features in a particular system have is the precise nature of the set of features employed. There are at least two radically different ways of characterising the vowel space, which Rennison (1984) calls bidirectional and tridirectional. In a bidirectional system vowels are classified along the dimensions front-back and high-low, while in a tridirectional system, the three points of the vowel triangle are taken as primitive (although notice that the interpretation of such tridirectional systems varies according to the nature of the constituent features: in systems incorporating a feature [round] (cf. (14) below), this feature is 'superimposed' on the triangle, rather than being part of it). As the issues of the number of values and the set of features show a considerable degree of independence, four systems of representation are possible, and there are explicit proposals for at least three, and perhaps all four, as indicated in (3):

(3)	Binary	Single-valued
Bidirectional	Chomsky & Halle (*SPE*)	Lass (1984:§11.2)
Tridirectional	Rennison (1984)	Anderson & Ewen (ms:§1.5)

In this paper we want to look at some evidence which suggests that a single-valued tridirectional approach offers a simpler analysis of a number of harmony processes than other approaches, and in addition we will suggest that a notation of this sort is to be preferred in that the relationship between underlying and surface representations is much less abstract. Van der Hulst & Smith (forthcoming) suggest that this is true for the analysis of harmony processes in various Australian languages; here we will be looking at evidence from other languages (cf. also Anderson forthcoming for Old English).

2. Underspecification

In her recent dissertation, Archangeli (1984) formalises the notion of underspecification with respect to binary features. In this approach, only one value for any feature can be specified in the underlying representations: the other feature-value is added in the course of the derivation by a complement rule. The choice of which feature-value is underlying and which added by rule is largely a matter of language-specific economy, and, in addition, if there is evidence for claiming that a particular segment is the least marked in a language, that segment will have no underlying specification. Thus, the four underlying vowels of Yawelmani are given the representations in (4):

(4)	i	u	a	o
high			–	–
round		+		+

with the complement rules in (5):

(5) a. [ ] → [+high]

b. [ ] → [-round]

and a number of default rules, some of which are universal, supplying the appropriate values for the features [back] and [low]. Notice that /i/ is selected as the unmarked - and hence unspecified - vowel in Yawelmani because it is the epenthetic vowel in the language.

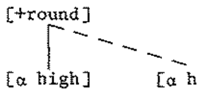
One of the advantages claimed for this approach is that the vowel harmony processes of Yawelmani can be given a natural interpretation. In these processes, underlying /i/ becomes [u] after /u/, and /a/ becomes [o] after /o/, as in (6):

(6) a. /i/ → [u] / /u/ C ______

b. /a/ → [o] / /o/ C ______

The harmony rule is formulated by Archangeli as (7):

(7)



The harmony rule operates between the two complement rules in (5), and thus precedes the complement rule which would otherwise assign [-round] to any vowel which is not lexically specified for [round], so that the derivations of the various vowels will be as in (8):

(8)		no harmony				harmony	
		i	u	a	o	i	a
underlying representation	[high]			–	–		–
	[round]		+		+		
(5a)	[high]	+	+	–	–	+	–
	[round]		+		+		
(7)	[high]	+	+	–	–	+	–
	[round]		+		+	+	+
(5b)	[high]	+	+	–	–	+	–
	[round]	–	+	–	+	+	+

(We ignore here the rules which assign values for the features [low] and [back].)

Consider now a single-valued approach in terms of the same set of assumptions concerning underspecification in the underlying representations. We will use the three vocalic components of dependency phonology, given in (9) with articulatory glosses (for a fuller discussion, see Anderson & Ewen ms:§6):

(9) |i| - frontness
|u| - roundness
|a| - lowness

These three components give the following <u>surface</u> representations of the four Yawelmani vowels in question:

(10) [i] [u] [a] [o]
|i| |u| |a| |u,a|

Here [o] is the vowel containing both the roundness and lowness components; while the other vowels contain one component and simply lack the rest. In terms of Archangeli's approach, the <u>underlying</u> representations will be:

(11) /i/ /u/ /a/ /o/
| | |u| |a| |u,a|

No complement rules as such are required, because single-valued features can have no complement values, nor do we need rules to fill in the values of absent features like [low] and [back] in Archangeli's framework - 'absent' features of this sort simply do not occur in a single-valued approach. A default rule *is* needed for the unspecified segment, and this is given as (12):

(12) V
| | → |i|

i.e. if a vowel remains empty, it is assigned the frontness component, and surfaces as [i]. Notice that the default rule is predictable in the same sense as Archangeli's complement rules, in that the component which it specifies must be the one which is *not* utilised in underlying representations, and notice too that the issue of whether we need this rule is quite independent of the notation. (12) will be ordered after the harmony rule, which simply states that a roundness component is added to a vowel following another round vowel. The derivations will be as in (13):

(13)		no harmony				harmony	
		i	u	a	o	i	a
	underlying representation	| |	|u|	|a|	|u,a|	| |	|a|
	(7)	| |	|u|	|a|	|u,a|	|u|	|u,a|
	(12)	|i|	|u|	|a|	|u,a|	|u|	|u,a|

(12) does not apply to the vowels which have undergone harmony, of course, because they are no longer empty.

In this kind of process, at any rate, the single-valued approach gives a rather simpler account. It does, indeed, seem to be a virtue of this approach that it lends itself to accounts, like Archangeli's, in which derivations do not include feature *changes*, but only *additions*. In particular, the underlying representations are not in themselves abstract, but are potentially phonetically interpretable (with the exception of any vowel which we decide to leave unspecified, rather than underspecified, like /i/ in Yawelmani).

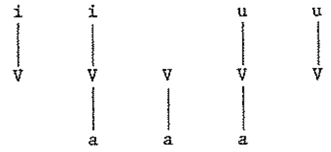
3. Binary-valued *and* single-valued features?

We turn now to the vowel harmony processes of Hungarian. As is familiar, vowel harmony in Hungarian involves the front-back dimension, so that all vowels in the root and in any suffixes must agree in value for backness, with the exception of the set of <u>neutral</u> vowels, which in a traditional bidirectional feature system can be characterised as [-low, -round]. (For a general survey of approaches to Hungarian vowel harmony, see van der Hulst forthcoming).

In a single-valued tridirectional system, mid vowels can be characterised as a 'combination' of the lowness feature with either or both of the other two features needed to characterise a simple three-vowel system. Thus (14) shows the representation of a three-vowel system, while (15) and (16) show two possible interpretations of a five-vowel system. In (15) the two features characterising the mid vowels are placed on separate tiers, while in (16) they are simply combined on a single tier:

(14)

(15)



(16)

In terms of this kind of notation, the vowel system of Hungarian can be represented as in (17) (we ignore considerations of length):

(17) i i,u u

i,a i,u,a u,a

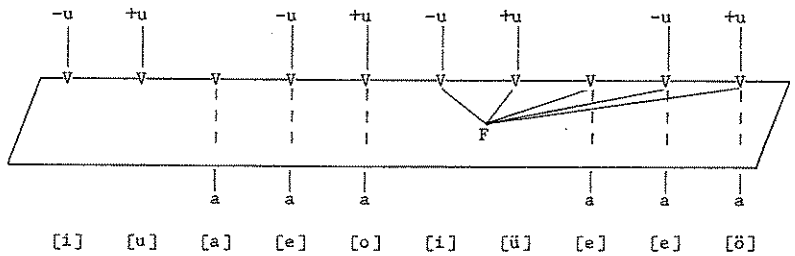
a

Given a single-valued tridirectional system whose components are frontness, roundness, and lowness, it is clear that frontness is the only component available for interpretation as the autosegmental element in a front-back harmony process. On the assumption that neutral vowels are unspecified (cf. van der Hulst forthcoming), a system such as that in (17) can be shown to be inadequate. The neutral vowels of Hungarian must contain the frontness component phonetically, and so must receive this component after the application of the harmony processes. It would not be possible to formulate a rule to do this, as there would be no way of distinguishing between /a/ and /e/, both of which would be represented as simply having the lowness component in underlying structure, as in (18):

(18) |a|

In an attempt to solve this problem, Goldsmith (forthcoming) makes various proposals, still within a tridirectional feature system, based on the use both of binary features and of single-valued features. In his account of Hungarian, the roundness feature is binary, i.e. it has the values [-u] and [+u], while lowness and frontness are single-valued. The three features occur on separate autosegmental tiers, to give (19):

(19)



Notice that the adoption of a 'mixed' feature-system allows several sources for phonetically identical vowels. Thus, in Hungarian, phonetic [e] can result from association of [-round] with [low], from association of [front] with [low], or from association of [-round], [front], and [low].

The system in (19) allows Goldsmith to characterise the neutral vowels as those containing the feature specification [-u], and to have the phonetic realisation rule in (20):

(20) Associate [Front] with any [-u] V-slot

(20) allows [i] and [e] to be specified as front, while leaving [a] unassociated. But this can only work because of the particular use which Goldsmith makes of his feature-system. Observe that the difference between [-round] and 'unspecified for round' is allowed to function distinctively, so that [i] and [e] can be specified as a class to the exclusion of the low back vowel. In other words, Goldsmith is here allowing a single feature to be both binary and single-valued in the same system, which clearly makes the notational system on the one hand suspiciously powerful, and on the other open to charges of phonetic irresponsibility - what is the phonetic difference between [-round] and 'unspecified for round'? Presumably, there is none, and so the notational distinction is no more than diacritic.

We suggest, then, that a mixed system of this sort should be abandoned in favour of an alternative analysis, and we will now go on to consider vowel harmony in terms of a purely single-valued notational system.

4. A single-valued approach to Hungarian vowel harmony

Up to now we have been proceeding on the assumption that neutral vowels are not specified for frontness. Suppose we drop this assumption, and allow neutral vowels to be lexically specified by association with an autosegment at a lower level than the word. Similar approaches have been proposed elsewhere, but not within the context of this kind of feature-system (cf. Hart 1981; Booij forthcoming; Vago ms; van der Hulst & Smith 1982).

We assume, then, that in normal harmony cases, vowels are P-bearing units with respect to a word-level prosody or autosegment, and that neutral vowels are lexically associated with a syllable-level prosody.

Notice that this approach, in combination with a single-valued feature-system, means that the notion of unspecified underlying representations again plays a role. The P-bearing units of Hungarian turn out to be the same as those of Yawelmani:

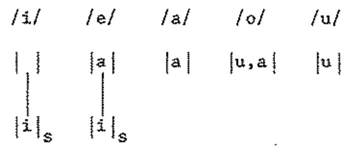
(21) | | |a| |u,a| |u|

(We again ignore length here.) However, (21) does not of course represent the lexical system of Hungarian as such, because, as we have seen, the neutral vowels are associated with the syllable-level prosody. The prosody in Hungarian, i.e. the harmonising element, is the frontness component, as in (22):

(22) |i|

so that the lexical system is:

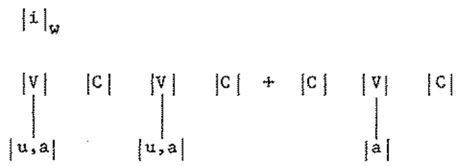
(23)



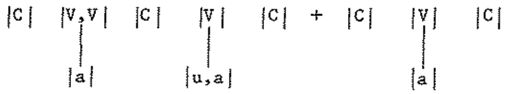
where the subscript *s* characterises the claim that |i| here is a syllable-level prosody.

The treatment of the regular harmony cases is straightforward. Each front vowel root is associated with the word-level frontness prosody, and each back vowel root is simply unassociated, as in (24) and (25):

(24) örömnek 'joy', dat.



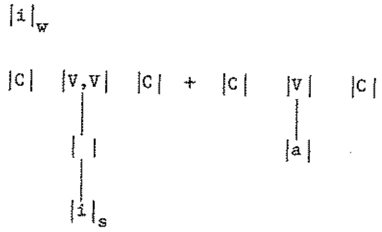
(25) városnak 'city', dat.



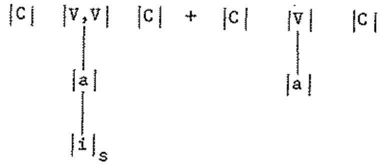
In (24), the frontness prosody is associated in the course of the derivation with all V elements, to give the appropriate surface representation as in (17). In (25), the underlying representations will also be the surface representations.

Neutral vowel roots fall into two categories - the normal type, which take front vowels in the suffix, and the exceptional type, with back vowel suffixes. These two types are illustrated in (26) and (27):

(26) színnek 'colour', dat.

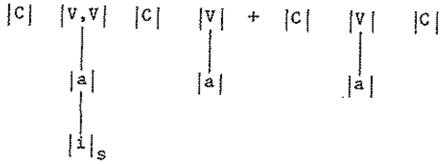


(27) célnak 'aim', dat.



Because the domain of the prosody in (27) is the syllable, it cannot spread to the vowel of the suffix. Mixed roots, i.e. roots containing both a neutral vowel and a back vowel, which have back vowel suffixes, will be given a similar treatment:

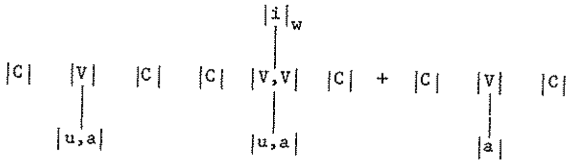
(28) békanak 'frog', dat.



Again, the fact that there is no word-level prosody determines the back realisation of the vowel suffix.

The final category consists of the disharmonic roots, which contain both back and front non-neutral vowels. In such cases, the suffix vowel takes its value from the last vowel of the root:

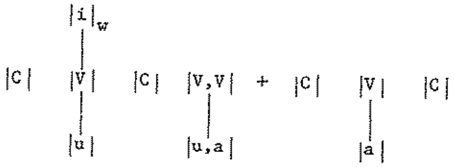
(29) zsonglőrnek 'juggler', dat.



Note that the prosodic element does not spread back to the first root vowel, because of the strict cyclicity condition (cf. Levergood 1983; Goldsmith forthcoming), which prevents application of an operation in a non-derived environment.

A similar approach can be used for the reverse case, in which we have a disharmonic root in which the final vowel is back, as in (30):

(30) bürónak 'bureau', dat.



Again, the prosody is prevented from spreading to the second root vowel by the strict cyclicity condition. Furthermore, it cannot spread to the suffix vowel, on the assumption that non-neutral vowels cannot be skipped.

We have shown that a single-valued tridirectional feature-system is capable of accounting in a straightforward way for the harmony processes considered here, provided that we incorporate prosodies which are indexed for domain, and that it is to be preferred over other approaches on grounds of simplicity and because of the fact that the relationship between underlying and surface representations is more direct.

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Small clauses 'A tout prix'?

1. Introduction*

The verb croire is a member of the class of French verbs which can appear in two constructions that seem related in some way. Ruwet (1982) calls them Construction à l'attribut du sujet ("CAO") and Construction à datif épistémique ("CDE"). In both the CAO (1) and the CDE (2) croire predicates something about someone :

(1) Je crois Jean heureux
I believe Jean happy
(2) Je lui crois beaucoup de charme
I (to) him believe much charm

The CAO has been studied quite frequently in French and in other languages. Recently, most linguists have adopted the so-called small-clause analysis for this construction. The CDE, on the other hand, exists only in French and has had far less attention in the literature. However, Guéron (1984) proposes to analyse this construction along the same lines as the CAO, i.e. involving a small-clause structure. In this article I will try to show that, however tempting this may be, the two constructions should not be analysed in the same way : more specifically, the small-clause analysis proposed by Guéron for the CDE will be rejected in favour of an analysis along the lines of possessive dative constructions.

2. The CAO : croire NP $\overline{X}$

In the CAO verbs like croire, trouver, imaginer etc. are followed by an NP and a predicative constituent, which can be a nominal, as in (3), an adjectival, as in (4) or a prepositional expression, as in (5)

(3) Je croyais Hérodote l'auteur favori de Platon
I believed H. the author favorite of P.
(4) Je croyais Jean fidèle à Marie
I believed Jean faithful to Marie
(5) Il croit ce pays à la veille de la guerre
he believes this country at the eve of the war

We find the CAO in many other languages as well : in Dutch, as illustrated in (6), in English, as in (7), in Spanish, as shown by (8) and in Italian, as in (9)

(6) Ik vind Jan intelligent
(7) I consider John intelligent
(8) Considero inteligente a Juan
(9) Ritengo Giovanni intelligente

In the literature the CAO in Dutch and English is generally analysed as having a small-clause structure. This analysis naturally extends to French, which means that (3)-(5) would have the following underlying structure :

(10) NP croire $_{SC}[\text{NP } \overline{X}]$

In general, the motivation of a small-clause analysis is mainly based upon