

Abstract – English

The aim of this dissertation is describing and explaining several phenomena of vowel harmony, in Italian dialects and in Turkish alike; the issues discussed include interactions between vowel harmony and consonants, the role of metrical structure and syllables in vowel harmony, the phonological features to use to account for the phenomena described, and underspecification. The phonological features adopted are also used to put forth a new representation of metaphony and of pretonic harmonies in Italian dialects .

The varieties under discussion are the dialect of Piverone (TO) (a variety of Piedmontese where vowel height in word final vowels depends the height of the stressed vowel); several varieties of central Italy, especially those spoken in Umbertide (PG), Servigliano (AP) and in Garfagnana. In such areas, in proparoxytones the post-tonic vowels are a copy of the word final vowel. In some areas harmony occurs only if there is an intervening liquid consonant between the last and penultimate vowel. Also consonant harmony in Standard Turkish is discussed: some consonants are palatalized or velarized depending on the features of their tautosyllabic vowel, sometimes also harmonizing suffix vowels. As for metaphony, several dialects are examined. Pretonic harmonies are in Friulano and in Servigliano.

The use of privative phonological features and the possibility of head-dependent among the features of a segment offer an explanation of the asymmetric behaviour of Piveronese harmony. In proparoxytones the reason for the transparency of the penultimate vowel is attributed to the metrically weak status of that context (as reduction, syncope and vowel duration show). An analogous metrical representation is adopted for post-tonic harmony in the dialects of central Italy.

Metaphony is interpreted as a vowel neutralization, still thanks to the use of privative features.

Turkish consonant harmony is explained assuming the syllable as its domain; consonants which apparently trigger harmony in suffixes are assigned to a syllable with an empty nucleus, (motivated by epenthesis and vowel shortening), which determines the feature of the consonant.

Abstract – Italiano

L'obiettivo di questa tesi è la descrizione e l'analisi di diversi fenomeni di armonizzazione vocalica in alcuni dialetti italiani e in turco; sono discussi l'interazione armonia vocalica e consonanti, il ruolo della struttura metrica e sillabica nell'armonia vocalica, e i tratti fonologici più appropriati per rendere conto dei fenomeni esaminati (argomento collegato anche al ruolo della contrastività e della sottospecificazione). I tratti fonologici adottati sono inoltre utilizzati per una nuova proposta di spiegazione della metafonìa nei dialetti italiani, applicabile anche a fenomeni di armonia nelle vocali pretoniche.

Le varietà analizzate sono: il dialetto di Piverone (TO) (una varietà di piemontese in cui il grado di apertura delle vocali finali di parola dipende dall'apertura della vocale tonica); diverse varietà dell'Italia centrale, con particolare riguardo per le località di Umbertide (PG), Servigliano (AP) e la Garfagnana. In queste zone, nei proparossitoni le vocali postoniche sono una copia della vocale finale. In alcune località l'armonia ha luogo solo se tra la vocale finale e la penultima è presente una consonante liquida /l/ o /r/. È esaminato anche il turco standard, in cui alcune consonanti partecipano all'armonia vocalica, essendo palatalizzate o velarizzate a seconda dei tratti delle vocali tautosillabiche, e talvolta imponendo il loro tratto alle vocali dei suffissi. Per quanto riguarda la metafonìa, sono discussi diversi dialetti italiani. Casi di armonie in pretonia si trovano p. es. in friulano e a Servigliano.

L'uso di tratti fonologici privativi e la possibilità di relazioni testa-dipendente tra i tratti all'interno di un segmento permettono di dare una spiegazione del comportamento asimmetrico dell'armonia piveronese. Nei proparossitoni la trasparenza della penultima vocale è giustificata dallo status metricamente debole di tale contesto (motivato da fenomeni di riduzione, sincope e dalla durata vocalica). La stessa rappresentazione metrica è utilizzata per i dialetti del centro Italia.

La metafonìa viene interpretata come un fenomeno di neutralizzazione vocalica, sempre con l'uso di tratti privativi.

In turco l'armonizzazione delle consonanti è spiegata assumendo la sillaba come dominio dell'armonia; le consonanti che apparentemente causano armonia dei suffissi vengono attribuite a una sillaba con nucleo vuoto (motivato da fenomeni di epentesi e accorciamento vocalico), che determina l'armonia nella consonante.

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Obviously, I am the only one to be blamed for all the inconsistencies, errors and obscurities which still remain.

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CHAPTER 1

INTRODUCTION

1. Definitions and concepts

A general definition of vowel harmony, being able to encompass all and only the phenomena which traditionally have received this label, is yet to come, and several linguists would be sceptical about the very possibility of such a definition (see for example Anderson (1980), Archangeli & Pulleyblank (2007)). For the time being, we will be content with adopting a definition John proposed some years ago:

a vowel harmony system is one in which the vowels of a language are divided into two (or more) (possibly overlapping) subsets, with the condition that all vowels in a given word (or *domain*, more generally) must come from a single such subset. ... [I]n most cases of vowel harmony the restriction is relatively transparent or natural from a phonological point of view. In such cases, we find that all the vowels in the domain share a particular phonological feature that is distinctive for vowels, such as [back], [tense] or [round]. (Goldsmith 1990: 304)

A few concepts which will be useful in the following chapters are introduced here. In several vowel harmony systems some vowels so not take part in harmony, in that they do not have the same feature of the other vowels of the word (or rather, more generally, of the harmony domain). In some cases this non-harmonic vowel stops

vowel harmony: when such a vowel occurs, the following vowels are not subject to harmony (or the preceding vowels, if harmony is leftward). Such vowels are labelled opaque. On the other hand, when a vowel is not harmonic, but has no effect on the other vowels, is called ‘transparent’.

2. Feature theory

Vowel harmony has frequently been the testing ground for theories of phonological features: since it is not individual vowels, but whole sets of vowels that are in opposition, harmony is a privileged phenomenon to identify and/or motivate features, since they are the property defining the set. Just to mention one example, vowel harmony in Akan led Stewart (1967) to propose the feature [ATR], since traditional features representing height or front/back dimension were unable to account for the alternation between the vowels /i u e o/ and /ɪ ʊ ɛ ɔ/ found in this language.

Some of the varieties under discussion here have interesting properties with regard to feature theory. I argue that properties of Piveronese harmony are best accounted if a set of unary features is adopted.

An issue related to feature theory is underspecification: in chapter 3 it is used to explain transparency phenomena.

A number of harmonies are related to stress in various ways. Their dependence from metrical structure will be discussed in several chapters. Another kind of suprasegmental structure, the syllable, will enter in the discussion of Turkish vowel harmony.

More generally, this dissertation is about phonological representations. In a period focussed on Optimality Theory, a formal discussion of representations is often neglected, but I believe that several solutions to puzzles posed by vowel harmony depend on solid answers to fundamental representational problems, like “what are syllables?”, “is [ATR] a motivated feature for Romance languages?” “in which sense is a process local?”, and so on.

CHAPTER 2

METRICALLY CONDITIONED VOWEL HARMONY IN PIVERONESE

1. Introduction

The dialect of Piverone, a small town (approximately 1200 inhabitants) located approximately 40 km north-east of Turin, is a variety of Piedmontese, more precisely a transitional variety between western and eastern Piedmontese¹. A peculiar feature of this variety was pointed out more than a century ago by the Italian dialectologist Giovanni Flechia (1811-1892) (who was born in Piverone, and was a speaker of its dialect) in an unfinished manuscript, which was posthumously published as Flechia (1898)²; years later also an unfinished small vocabulary of Piveronese was published as Flechia (1914).

In that article Flechia observed that the height of the word-final vowel depended on that of the stressed vowel, a phenomenon unattested in the other Piedmontese varieties. This case of vowel harmony, which to my knowledge has passed hitherto unnoticed in the phonological literature, save for a few pages in Savoia (2005), poses several interesting problems, which will be dealt with in the following paragraphs. They include the choice of distinctive features which best represent this harmony, the role of metrical structure in the domain of harmony – especially in the seeming non-local behaviour of harmony in proparoxytones.

1 For a sketch of the phonology of the Piedmontese dialects, cf. the relevant sections in Berruto (1974) and Parry (1997); Soffietti (1949) offers a phonological description of only one variety – Turinese – within the framework of American structural linguistics.

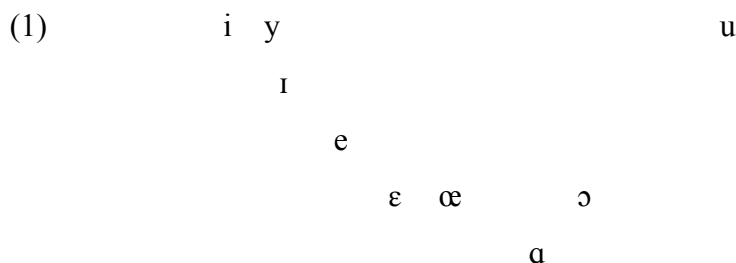
2 I would like to thank Lori Repetti for pointing me the existence of this article.

2. A sketch of the Piveronese vowel system

Notwithstanding the restricted area of its diffusion, the influence of Italian and of other varieties of Piedmontese, and the progressive reduction in the use of the dialect, Piveronese still preserves its vowel harmony, at least among older speakers. I therefore collected new data, including recordings for spectrographic analysis. The phonetic transcription used here is fairly broad, but it should be kept in mind that the sound represented by [ɛ] more accurately is a slightly lower [ɛ̃], unstressed [e] and [o] vary in their degree of aperture, mostly depending on their syllabic position, stressed vowels are longer than unstressed, especially in open syllables, etc.

It must be pointed out that at Flechia's time Piveronese harmony was highly regular, with hardly any exception and with productive application to Italian loanwords as well (in Flechia's dictionary (Flechia 1914) some words are exceptions to harmony, but sometimes the very same words are listed in Flechia (1898), and are always regular. Very likely this discrepancy is due to the unfinished status of the dictionary, which maybe included also words from the neighbouring villages, that do not have this harmony). Still today speakers apply it in a consistent and regular manner, albeit no more to the extent of adapting Italian words.

Piveronese preserves the same phonological system as described by Flechia, and more in detail the same vowel system. As in many varieties of Piedmontese, a few differences aside, nine vowels are contrastive in stressed position. Its vowel system (1) is typical of eastern varieties, whereas western ones have [ə] instead of [ɪ].



Moreover, five diphthongs must be added to the vowels in (1) : [aɪ̯ aʊ̯ ɛɪ̯ ɛʊ̯ ɔɪ̯].

Still analogously to what happens in most other varieties of Piedmontese, in

pretonic position several contrasts are neutralized, giving rise to the vowel inventory below³.

- (2)
- | | | |
|---|---|---|
| i | y | u |
| ɪ | | |
| e | | |
| a | | |

The alternations created by loss of contrasts in pretonic vowels are represented in (3), and examples are given in (4).

(3)	Stressed vowels	ɑ	ɛ e	ɪ	i	ɔ u	æ y
	Unstressed vowels	a	e	ɪ	i	u	y

- (4) [ɔ] / [u]:
 ['kɔla] 'glue' – [aŋku'la] 'to glue'
 ['mɔbil] 'piece of furniture' – [mu'bilja] 'furniture'
 [ɔ] / [y]:
 [am'brœi] 'cheat' – [ambry'ja] 'to cheat/cheated'
 ['dœrmi] 'to sleep' – [dyr'mia] 'sleep'

 [ɛ] / [e]:
 [bu'lɛ] 'mushroom' – [bule'tin] 'small mushroom'

³ Actually, as discussed in detail in § 6., vocalic reduction in unstressed vowel is more complex than what is shown in (2), and seems to be sensitive to subtler degrees of stress intensity than simply word stress vs. unstressed vowels.

[^ha] is not involved in neutralizations, but becomes [a] when destressed:

- (5) [ˈkrava] ‘goat’ – [kraˈvɔt] ‘kid’ (literally ‘small goat’)
 [ˈkasja] ‘box’ – [kasjɔt] ‘small box’

Unstressed vowels in post-tonic position show an even more radical reduction than in pretonic vowels. Usually in Piedmontese only four vowels are possible, as shown in (6).

- (6)
- | | |
|---|---|
| i | u |
| e | |
| a | |

But, rather unexpectedly for a Piedmontese dialect, in Piveronese also [o] is possible word-finally.

- (7)
- | | |
|---|---|
| i | u |
| e | o |
| a | |

Comparing (2) to (6), it is interesting to observe that such a difference between the pretonic and post-tonic vowel inventory is not an idiosyncrasy of Piedmontese. On the contrary, it happens, to various degrees, in many other dialects of Italy: the number of vocalic contrasts in post-tonic position is new greater – and usually smaller, as in Piedmontese – than the number of contrasts in pretonic position (*e.g.* Rohlfs (1966: 21-24), Maiden (1997: 10-11)).

Interestingly, in Piveronese unstressed [o] is possible word-finally (7), notwithstanding its impossibility pretonically, and the complete absence of unstressed [o], both pretonic and post-tonic, in many other Piedmontese varieties. It thus seems to violate both a strong empirical generalization valid for virtually all Italian dialects,

and a well attested phenomenon of vowel reduction of Piedmontese, which bans [o] in any unstressed syllable.

3. Piveronese harmony

Given this vowel system, Piveronese vowel harmony can be described, still rather informally, as the assimilation of the word-final vowel (if this is not /a/) to the degree of aperture of the stressed vowel.

More in detail, if the stressed vowel is one of the vowels [a ε e ɔ œ] or one of the diphthongs [aɪ aʊ εɪ eʊ ɔɪ]⁴, the word-final vowel can be only [a], [e] or [o]; [i] and [u] are excluded. On the other hand, if the stressed vowel belongs to the set [ɪ i u y]⁵, the word-final vowel is restricted to [a], [i] or [u]; [e] and [o] are impossible.

Feminine nouns and adjectives (8), as verbal inflection (9), clearly exemplify how harmony works: the plural form of feminine nouns and adjectives alternates [e] with [i] depending on the stressed vowel (while it is [e] in the western Piedmontese varieties and [i] in eastern varieties); analogously, whereas in Piedmontese the exponent of the first person singular indicative is [e] or [i] depending on the variety, in Piveronese the quality of this vowel depends on the stressed vowel. Likewise, the exponent of the third person plural present indicative (and first and third person plural present subjunctive) is [u] in Piedmontese, but in Piveronese [o] and [u] alternate (10).

(8a)	Feminine nouns and adjectives	
	[^l maska] / [^l maske]	‘witch/es’
	[^l mandula] / [^l mandule]	‘almond/s’
	[^l berta] / [^l berte]	‘magpie/s’
	[^l leŋgwa] / [^l leŋgwe]	‘tongue/s’
	[fy ^l mɛla] / [fy ^l mele]	‘female/s’

4 Henceforth we will informally – that is, without implying that they necessarily are all [+low] – label the vowels [a ε e ɔ œ aɪ aʊ εɪ eʊ ɔɪ] as the ‘low’ vowels of Piveronese.

5 Henceforth the ‘high’ vowels.

	[ˈpɛra] / [ˈpɛrɛ]	‘stone/s’
	[byˈrœra] / [byˈrœrɛ]	‘churn/s’
	[nɛiˈrœra] / [nɛiˈrœrɛ]	‘blackish-FEM.SING./PLUR.’
	[ˈpjɔta] / [ˈpjɔtɛ]	‘paw/s’
	[ɕilˈɔza] / [ɕilˈɔzɛ]	‘jealuos-FEM.SING./PLUR.’
(8b)	[baˈstmja] / [baˈstmji]	‘blasphemy/es’
	[ˈbir̥na] / [ˈbir̥ni]	‘plum/s’
	[kasˈtɪna] / [kasˈtɪni]	‘chestnut/s’
	[turˈtɪfula] / [turˈtɪfuli]	‘potato/es’
	[ˈsjula] / [ˈsjuli]	‘onion/s’
	[ˈturtura] / [ˈturturi]	‘turtledove/s’
	[ˈbryta] / [ˈbryti]	‘ugly-FEM.SING./PLUR.’
	[ˈlyva] / [ˈlyvi]	‘she-wolf/ves’
(9a)	2 nd person singular present indicative	
	[it ⁶ ˈkante]	‘you sing’
	[it ˈtɛnzɛ]	‘you dye’
	[it ˈlɛzɛ]	‘you read’
	[it ˈpɔrtɛ]	‘you carry’
	[it ˈfjœrɛ]	‘you stink’
(9b)	[it ˈzim:i]	‘you groan’
	[it ˈskrivi]	‘you write’
	[it ˈzuwi]	‘you play’
	[it ˈspysi]	‘you stink’

6 [it] is the obligatory subject clitic ‘you-SING.’.

- (10a) 3rd person plural present indicative
- | | |
|-------------------------|----------------|
| [a ⁷ 'kanto] | ‘they sing’ |
| [a 'krɛdo] | ‘they believe’ |
| [a 'perdo] | ‘they lose’ |
-
- (10b)
- | | |
|-------------|--------------|
| [a 'skrivu] | ‘they write’ |
| [a 'rumpu] | ‘they break’ |
| [a 'zim:u] | ‘they groan’ |

Inflection, both nominal and verbal, is the context where harmony is most evident, since the phonetic realization of the same inflectional morpheme alternates between [e] and [i], or [o] and [u], depending only on the quality of the stressed vowel.

But Piveronese harmony is not restricted to the selection of inflectional markers, and more generally seem to be independent of morphological categories or boundaries. This follows from the observation that harmony applies to words lacking inflectional markers as well. For example most masculine nouns are identical in their singular and plural forms (save for the rather small group of nouns ending in /-VI/, which becomes /Vi/ in the plural: *e.g.* [ka'val] ‘horse’, [ka'vɑi] ‘horses’), without an overt inflectional marker indicating number and gender. Their final vowel (if present) thus is part of the stem, without any inflectional meaning: such a vowel is nevertheless subject to harmony (11).

Other instances of harmony targeting a word-final non-inflectional vowel include adverbs (12), and also Italian town names, which at least at Flechia’s time were still adapted according to the rule of harmony (13).

7 [a] is the obligatory subject clitic ‘they’.

- (11a) Masculine nouns and adjectives
- | | |
|--------------------------|---|
| [¹ azo] | ‘donkey(s)’ |
| [¹ pento] | ‘comb(s)’ |
| [¹ seto] | town name (<i>Settimo</i> in Italian, [¹ setu] in the other Piedmontese varieties) |
| [¹ bɔrɲo] | ‘blind-MASC.SING.(PLUR.)’ |
| [¹ mæro] | ‘thin-MASC.SING.(PLUR.)’ |
| [ar ¹ mare] | ‘wardrobe(s)’ |
| [¹ babe] | ‘toad(s)’ |
| [nu ¹ vembre] | ‘November’ |
- (11b)
- | | |
|------------------------|--------------|
| [¹ visku] | ‘bishop(s)’ |
| [¹ pitu] | ‘turkey(s)’ |
| [¹ kuku] | ‘pup(s)’ |
| [¹ byru] | ‘butter(s)’ |
| [¹ sybi] | ‘whistle(s)’ |
| [u ¹ tubri] | ‘October’ |
- (12) Adverbs
- | | |
|----------------------|------------|
| [¹ wero] | ‘not much’ |
|----------------------|------------|
- (13) Adapted Italian words
- | | | | |
|------------------------------|---|--------------------------|-------------|
| <i>Trapani</i> | > | [¹ trapane] | ‘town name’ |
| <i>Girgenti</i> ⁸ | > | [ɕir ¹ ɕente] | ‘town name’ |

The domain of harmony thus appears to be bounded only by the right edge of the word. More precisely, its domain does not necessarily coincide with the inflected word, since also the vowels of enclitics undergo harmony. Again, this fact implies the

8 Nowadays *Agrigento*.

domain of harmony can be stated in purely phonological terms, being the phonological word: when a clitic is added to a word, becoming part of its domain, the clitic vowel is influenced by the stressed vowel, just as inflectional vowels are (examples are given in (14); incidentally, in Piedmontese the presence of an enclitic causes the loss of the word-final vowel of (non-oxytone) verbs).

(14)	[^l katlo]	‘buy it-CLIT.’	/kata=lu/
	[^l purtlu]	‘carry it-CLIT.’	/purta=lu/
	[^l dame]	‘give me-CLIT.’	/da=mi/
	[^l musmi]	‘show me-CLIT.’	/musta=mi/

3.1. Special cases of harmony

Proparoxytones form a special class of words with respect to harmony, given that in both cases the vocalic segment intervening between the stressed and the final vowels is transparent.

In paroxytones the stressed vowel influences the word-final one, independently of the aperture of the penultimate vowel; the latter can be disharmonic with the stressed and the final vowels, without preventing them from agreeing. For instance, sequences as /á...i...e/, /í...a...i/ are possible.

(15)	[^l mandule]	‘almonds’
	[^l makine]	‘cars’
	[^l kamule]	‘moths’
	[^l sigali]	‘cigars’
	[^l skatule]	‘boxes’

It must be pointed out that paroxytones are rather infrequent in Piedmontese, for two reasons: 1) Latin words in many cases lost their final vowel when it was not /a/, Latin paroxytones therefore becoming Piedmontese paroxytones, 2)

proparoxytones lost their penultimate vowel when its result would have been /e/ (e.g. Latin *FEMĪNA* > ['fumna] 'woman, wife', whereas the regular outcome of Latin short unstressed /i/ was [e] in other positions. Since /e/ was lost in this position, as a result in Piedmontese the penultimate vowel of a proparoxytone can be only [a], [i] or [u], thus allowing even less contrasts than in word-final position.

Only in a handful of words borrowed from Italian /e/ can be found: It. *termometro* 'thermometer' is ['termometro], *scheletro* 'skeleton' is ['skeletro]. However, interestingly also in such recent borrowings a certain amount of reduction can be found: the dialect atlas *ALI (Atlante Linguistico Italiano)* lists for the word 'skeleton' various realizations of the penultimate vowel in Piedmont, ranging from ['skeletru] in Turin to ['skel^ətru] (indicating a shorter and more centralized vowel in its transcription) in Ivrea, ['skelətru] in Saluzzo, and up to ['skeltru] in Lanzo Torinese.

4. Problems

The data presented in the preceding sections pose several intertwined problems to any phonological theory.

Firstly, which distinctive features can represent at the same time 1) the two sets of 'low' and 'high' stressed vowels, 2) the two sets ([a e o] and [a i u]) of unstressed word-final vowels selected by harmony (explaining why /a/ can follow any stressed vowels), and 3) the harmony process itself? Besides, it would be reasonable to expect that the features adopted to describe harmony properly represent other phonological processes of Piveronese as well.

Secondly, only stressed vowels trigger harmony; what is the relation between metrical structure and harmony in Piveronese?

A problem related to metrical structure is the transparency in words as in (15), since they all are proparoxytones: a type of stress position implies a non-contiguous assimilation. Skipping a vowel, harmony is apparently non-local in these cases: why does it fail to target the penultimate vowel, yet still targeting the final vowel?

Thirdly, Piveronese seems to contradict the empirical generalization about unstressed vowels in pretonic and post-tonic position in Italian dialects, allowing [o]

post-tonically but not pretonically. Can this exception be explained?

4.1. Phonological features

Adopting binary features, the representation of Piveronese vowel system would be as in (17).

(17) /i/ [–low, +high, +ATR] /y/ [–low, +high, +round] /u/ [–low, +high, +back]

/ɪ/ [–low, +high, –ATR]

/e/ [–low, –high, +ATR]

/ɛ/ [–low, –high, –ATR] /œ/ [–low, –high, +round] /ɔ/ [–low, –high, +back]

/ɑ/ [+low, –high, +back]

With regard to harmony, the features in (17) meet with some difficulties. Piveronese harmony intuitively is an assimilation which involves tongue height, thus the two obvious candidate features are either [±low] or [±high]. [±high] clearly is not the correct solution: /ɑ/ is the only [+low] vowel of the class of ‘low’ vowels, whereas all the other vowels, both ‘high’ and ‘low’, are [–low], entailing that the two sets of stressed vowels cannot be represented as natural classes by [±high].

[±high] appears to be a better choice at first sight: all the ‘low’ vowels are [–high], and all the ‘high’ vowels are [+high]. We would thus have them expressed as two natural classes.

But a problem arises in the representation of the process of assimilation. The choice of [±high] as the harmonic feature predicts that, when the stressed vowel is [–high], the word-final vowel should be [–high] too: this prediction is empirically confirmed, since [+high] /i/ and /u/ are not possible word-finally if the stressed vowel is ‘low’ (see 8a, 9a, 10a). However, if the stressed vowel is [+high] it can be followed

by [+high] /i/ and /u/, and not by [–high] /e/ and /o/, as expected; but /a/ too, which obviously is [–high] (indeed, it is the lowest possible vowel), can follow a [+high] vowel: [+high] stressed vowels are not necessarily followed only by [+high] vowels (see for example 8b).

An analysis based on incompatibility of features could be invoked: since the only troublesome case is [a] after a stressed high vowel, whereas the exclusion of [e] and [o] in favour of [i] and [u], is consistent with spreading of [+high], we could suppose that harmony applies to /a/ as well, but its raising would yield an impossible *[+high, +low] vowel (the tongue body cannot be high and low at the same time), and is therefore blocked; the absence of raising of /a/ would not be caused by an asymmetry between [–high] and [+high], but by a universal constraint against an impossible feature combination.

It can be objected that high vowels raise /a/ to a mid/low-mid vowel in several languages. They include also Piedmontese (if not Piveronese, at least close varieties): a case in point is metaphony, which caused raising of /a/ to [ɛ] triggered by word-final /i/ in several dialects of northern Italy, including varieties very similar to Piveronese. For example in Viverone, a town neighbouring Piverone, nowadays the word-final vowels triggering metaphony have been lost, making metaphony opaque, but the plural form of nouns still preserves metaphonic alternations in the root: for example [gat] ‘cat’ vs. [get] ‘cats’, [kar] ‘wagon’ vs. [kɛr] ‘wagons’ (Rohlf 1966: 43), which imply a previous stage /gato/⁹ [gato] vs. /gati/ [geti], /karo/ [karo] vs. /kari/ [keri]. Therefore raising of /a/ appears to be possible, yielding [ɛ] (or maybe [ɔ] in Piveronese, since its low vowel is also back).

If resort to the constraint *[+high, +low] is not a viable solution, another seemingly valid answer could be to assume that Piveronese harmony does not spread of the feature [±high], but only of the feature value [–high]. After all, it is what is standardly done to describe other assimilation processes, like metaphony:

9 Actually, we do not know whether raising of all unstressed [o] to [u] occurred after metaphony ceased to be a synchronic process or before, therefore the singular forms could have been [gatu] and [karu] as well. Yet this does not prevent us from assuming metaphony as the reason for the raising of /a/, since in several varieties [u] does not trigger metaphony (for examples, see Maiden 1991: 114-115).

only /i/ and /u/ trigger metaphony, raising the stressed vowel, whereas before [–high] word-final vowels any stressed vowel is free to occur, including [+high] vowels. Likewise, in Piveronese both [+high] and [–high] vowels can follow a [+high] stressed vowel.

Yet [+high] is not inert in Piveronese harmony: while in metaphony a word-final [–high] vowel is totally inactive, not posing any kind of restriction on the stressed vowel, in Piveronese harmony a stressed [+high] vowel can be followed by [–high] [a], but [–high] [e] and [o] are excluded. Therefore also high vowels impose some sort of restriction on the final vowels, allowing /i a u/ but banning /e o/: the quality of final vowel seems to be influenced by both classes of stressed vowels, not only by [–high].

If a [+high] stressed vowel can be followed by /i/ and /u/, and not by /e/ and /o/, but by /a/ as well, a further solution at disposal could be assuming that /a/ is an opaque vowel. Since it triggers harmony when stressed, but does not undergo harmony when unstressed, it matches the description of opacity in vowel harmony.

There are two objections to this proposal too: first of all, ‘opacity’ (and ‘transparency’) are descriptive labels, not explanations. Saying that a vowel is opaque is simply a more compact statement than saying that it does not undergo harmony, yet can start a harmonic span; but the label does not explain the reason for this behaviour. Stating that /a/ is opaque in Piveronese does not offer a deeper understanding of its vowel harmony, but simply translates the empirical data in a concise way. What we need is an account of /a/ which draws its opacity from general assumptions, or alternatively which does not consider it opaque at all.

Moreover, usually a property of opaque (and transparent) vowels is the lack of their harmonic counterparts: while all the other vowels in a language displaying harmony can be either [+F] or [–F], the opaque (or transparent) vowel is [–F] or [+F] only. Instead in Piveronese /a/ is identical to /o/ (if it is specified as [+back]), or to /ε/ (if it is specified as [–back]), save for the fact that the former is [+low] and the latter are [–low].

If a [+high] stressed vowel can be followed by [a i u], but not by [e o], harmony

could still be represented by the features in (17) relying on the fact that, word-finally, unstressed vowels [e o] never contrast with [i u]: [i u] could be assumed as the default realizations – when [+high] is present in the stressed vowel and harmony is not active – while [e o] would be the result of [–high] harmony on such default values. This explanation would require several assumptions:

(18)

- i. of the two values of [±high], only the negative one spreads
- ii. /a i u/ is the underlying inventory of word-final unstressed vowels
- iii. there is no contrast between mid and high vowels word-finally, but such non-low vowels must be underlyingly specified as [+high]; otherwise they could not emerge as [i] and [u] when the stressed vowel is [high], since they do not share this feature value with the stressed vowel, according to the assumption in 18.i.
- iv. an alternative solution to 18.iii could be leaving the non-low vowels unspecified for [±high], and assuming a default rule filling [+high] when the word-final vowel is [–low] and has not received [–high] from the stressed vowel; this would make Piveronese harmony a process that adds a feature rather than changes a feature value

From 18.i-iii follows that in words with a stressed ‘high’ vowel, vowel harmony does not take place and the final vowel is [a], [i] or [u] (19a); if the stressed vowel is ‘low’, instead, its [–high] feature value spreads to the final vowel and delinks [+high] (19b).

(19a)

/s k r i v - u/	
[+high]	[+high]
[ˈskrivu]	

(19b)

/k a n t - u/	
[–high]	[+high]
[ˈkanto]	

Taken together, the assumptions in 18.i-iv can provide a representation of Piveronese

harmony. However, while they work descriptively, they are precisely what they have been defined, that is assumptions: they correctly reflect the empirical data but are not derived from a general theory of features (18.i predicts the actual results, but the inertness of [+high] is merely observed), or require postulating underlying feature specifications which are not justified by contrasts (ii. assumes only three underlying vowels word-finally, because the alternations between [e] and [i], and [o] and [u], can be predicted depending on the stressed vowel, but iii. is not consistent with that fact: without a contrast between mid and high vowels, there are simply /a/, a front unrounded vowel and a back rounded vowel; the choice of [+high] for the latter two is arbitrary. Alternatively, adopting 18.iv, the presence of [+high] depends on an *ad hoc* rule). Also the inventory in ii. is a coincidence: is there a reason why /a e o/, or anything else, is not the underlying system in unstressed final vowels?

We can conclude that binary features offer a description of Piveronese harmony which is descriptively correct, since they can represent harmony as spreading of [–high], if either opacity of /a/ or [+high] specification of word-final high vowels is assumed. But both solutions demand several assumptions, and several facts remain unrelated. Moreover, it must be pointed out that changes of detail in an analysis based on binary features would not yield radically different (and better) results: for example the use of the (nowadays outdated) feature [mid] does not offer a better alternative.

On the contrary, a different system of features is available which predicts that i.) only lowering can occur, ii.) the set /a i u/ has a special and motivated status, and iii.) no non-contrastive features or redundancy rules are required to represent the non-low word-final vowels in Piveronese.

4.2. Unary features and dependency relations

To circumvent the problem posed by binary features we will pursue another line of reasoning, based on a different theory of distinctive features. More in detail, we will adopt two basic tenets of Dependency Phonology, that is monovalency of features and intra-segmental dependency relations among the features themselves (cf. for example Anderson & Jones (1974), Anderson & Ewen (1987), Durand (1990,

especially chapter 8), Ewen (1995), Anderson (2002)).

4.2.1. *Unary features **a i u***

Unlike binary features, which have a positive and a negative value, the features we intend to adopt have just one value: they can be either present or totally absent, implying that the negative value of a feature is not a phonological entity. It should not be necessary to describe vowel systems or phonological processes; spreading or deletion of a feature should never make reference to something like [–F].

Unary (or monovalent, or privative, or one-valued) features have been gaining currency in the last decades in several phonological theories other than Dependency Phonology (which incidentally was the first theory to develop a detailed system of features based on unarism). Nevertheless, theories using unary features vary in several respects, mainly in the specific inventory of features adopted, and in the possibility of allowing some features to be binary, universally or language-specifically: in fact, most recent feature-geometric theories (*e.g.* Clements & Hume (1995), Halle, Vaux & Wolfe (2000)) argue that at least some features are unary, but maintain that binary features are still necessary to represent certain properties, as vowel height¹⁰. On the other hand, Dependency Phonology makes quite radical assumptions, since its features are all and always unary, and, with regard to vowel place, are just three¹¹: **i**, **u** and **a**. Their phonetic interpretations are palatality, labiality/roundness, and openness respectively (or, in acoustic terms, respectively predominance of energy in the higher part of the spectrum – acuteness –, predominance of energy in the lower part of the spectrum – gravity and flatness –, and concentration of energy in the central part of the spectrum – compactness, sonority).

When alone, the three features are realized as the extremes of the vocalic triangle, [i], [u] and [a]. Their combinations give rise to all the other vowels: thus in a vowel

10 For example the difficulty Dependency Phonology meets in the representation of metaphony (see chapter 4) “raise the broader question whether DP has not generalized too far. Just because some features are monovalent, it does not follow that all are [...]. An alternative hypothesis worth exploring is that monovalency is restricted to a certain subset of features” (Kenstowicz 1990: 83).

11 Henceforth represented by bold characters, while segments will be represented by curly brackets.

system /a e i o u/, /o/ is {**a,u**}, /e/ is {**a,i**}. In a vowel system including also /y/ and /ø/, /y/ is {**i,u**} , /ø/ is {**a,i,u**} (where the order of features in the notation is not relevant: {**u,a**} and {**u,i**} would still represent /o/ and /y/ respectively, since the two features in each segment all contribute to the same degree). The underlying idea is that all vowels other than /a i u/ are composed of the fusion of the properties of such vowels. For example, /o/ is seen as the result of both roundness and aperture mixed together; it is neither purely rounded nor purely open, but a fusion of the two dimensions. Likewise, /y/ is the sum of rounding and palatality¹².

This inventory of features is empirically motivated by several widely attested cross-linguistic phenomena: for example these features represent the fact that from a typological point of view /a i u/ are the most common vowels and form the most basic vowel system¹³; even in more complex vocalic systems, nevertheless /a i u/ frequently are the only vowels admitted in unstressed position rather than, let us say, /y œ ʊ/ (for example Sicilian allows /a e i o u/ in stressed vowels, but the unstressed vowels neutralize contrasts between high and mid vowels, reducing the inventory to /i u a/; and, obviously, they are the only word-final unstressed vowels in Piveronese. For a discussion of vocalic neutralizations adopting such features, see Harris (2005)).

This representation predicts that vowels composed of two or more features imply the presence of the vowels corresponding to the features they are literally made of: actually, almost any language having /y/ or /e/ has /u/ and /i/, or /a/ and /i/, as well, but the reverse situation is not necessarily true.

Neutralizations and reductions, which intuitively can be seen as simplification processes, are captured in this model as the elimination of one or more features, rather than as feature-changing processes like with binary features. Generally, the complexity/markedness of a segment is directly reflected in the notation.

12 Eventually, the inventory of feature could also include **ə**, to represent a ‘neutral’ vowel, and **atr**, in languages where the position of the tongue root is a dimension independent of height. These features have no bearing on the present discussion, save possibly for the representation of /ɪ/, which could be represented as {**i,ə**} (also because other varieties of Piedmontese have [ə] in words having [ɪ] in Piveronese). Anyway, this choice would not yield radically different results from those proposed below.

13 Apart from a few languages having only two vowels, usually /a/ and a higher vowel.

Besides vowel inventories, also the possible processes predicted by this theory are empirically motivated. Many non-occurring or very rare processes, that could be expressed by binary features, are ruled out by this notation. For instance [–round] entails that unrounded vowels could trigger derounding of adjacent vowels; such a process, which seems to be unattested (although see *e.g.* Hyman (2002: 6-10) for a possible case of [–round] harmony in Ineseño), is impossible to represent if only rounding, that is **u**, exists (and can spread). Analogously, fronting of back rounded vowels triggered by a front vowel ($u > y / _C_0i$) is a common process (*e.g.* Germanic umlaut), whereas derounding of a back rounded vowel triggered by a front unrounded vowel ($u > \text{ɯ} / _C_0i$) is barely if ever attested. Both processes are equally possible adopting binary features, since /i/ is both [–back] and [–round]; but using unary features, /i/ is simply {**i**}, therefore only palatality can spread to /u/. Likewise, in many languages front vowels palatalize consonants, but back vowels rarely if ever velarize them. More generally, unary features straightforwardly account for the asymmetric behaviour of several processes (incidentally, from a formal point of view this means that phonological processes are represented as addition or deletion of features, rather than as a change in their values).

Moreover, from an acoustic point of view [a i u] have a discrete, ‘quantal’ nature (Stevens 1989): their acoustic properties remain fairly constant even in case of comparatively wide variations in their articulation, implying that the degree of articulatory precision they require is less than for all the other vowels.

It must be pointed out that, while also in other frameworks there is a fairly general consensus on the privative status of features like [round], it is much more debated whether other properties can be represented only by privative features. In the case of vowel height, which is the relevant dimension in Piveronese harmony, Dependency Phonology assumes not only that it can be represented by unary features, but also that just one feature, **a**, is sufficient to account for it. It also entails that only lowering, not raising, can universally be the ‘real’ process affecting vowel height.

In the case of Piveronese, it correctly predicts that ‘low’ vowels lower the word-final vowel, but ‘high’ vowels do not raise it, while with binary [\pm high] this fact is

accidental. But obviously raising should be impossible in any language for this theory to be confirmed. Even some linguists who accept feature privativity claim that at least two features, [low] and [high], are anyway necessary to represent vowel height; [high] needs to be an active feature, if we want to represent raising phenomena. Metaphony is a typical case put forward as a counterexample to the feature system of Dependency Phonology: high word-final vowels trigger raising of the stressed vowel. The burden of the proof for this feature theory is demonstrating that all the processes previously analysed as raising, that is spreading of [high], can be reinterpreted in an alternative manner, without recourse to [high].

4.2.2. Head-dependent relations among features

While (some version of) unary features, as pointed out above, have been adopted – to different degrees – also in other frameworks (for instance feature geometric approaches), another assumption (logically independent of monovalency) is more peculiar to Dependency Phonology and theories most closely related to it. It is the idea that also below the segment there exist asymmetric head-dependent relations among elements.

As in a foot the stressed syllable is more prominent than, and is implied by the presence of, the unstressed one, and in a syllable the nucleus is implied by an onset or a coda, and is more prominent than them, likewise within a segment a feature can be in a more prominent role (the head) than the other(s) (the dependent(s)). It is true that in the two former cases, we have a relation among chronologically distinct elements – syllables within a foot, segments within a syllable – while subsegmental dependencies take place among simultaneous features; but on a more abstract level, all have a head element more prominent than the other elements. Significantly, the simultaneous relation within a segment can be ‘linearized’, or two chronologically distinct elements can merge but still preserve the asymmetry of their relation, as in the case of monophthongization of diphthongs and diphthongization of simple vowels. These phenomena suggest that the dependency relation among their elements is fundamentally the same, and is maintained in both cases: for example Middle English

diphthongs /a_i/ and /a_u/ became /ɛ/ and /ɔ/, not /e/ and /o/, preserving their dependency relation (Anderson & Ewen 1987: 129): in diphthongs the first half, represented by the feature **a**, was more prominent (since it was stressed) than the second half represented by **i** or **u**, and in the simple vowels **a** was more prominent than **i** or **u**.

In fact, different degrees of prominence are formally necessary if we want to represent all possible contrasts; mere co-occurrence of features, without asymmetric relations among them, can represent only some of them.

For example it can represent three levels of height at most: /a/ {**a**}, /e/ {**a**,**i**}, /i/ {**i**}. But if a language displays a contrast between low-mid and high-mid vowel, as /ɛ/ vs. /e/, such a contrast cannot be represented by means of the presence of a feature in one of the segments which is absent in the other, since the only features we have at disposal for both vowels are **i** and **a**. But if dependency relations among features are available in our formal apparatus, since /ɛ/ is more open than /e/, we can say that **a** dominates over **i** in the former vowel, and the reverse relation takes place in the latter (notationally, if in a segment a feature **x** is dominant over **y** it will be represented either as {**x**→**y**} or {**x**:**y**}). Finally, the most complex available option is mutual dependency, {**x**↔**y**} (or {**x**:**y**}), which involves both **x**→**y** and **y**→**x**.

4.2.3. *Unary features, dependency relations and Piveronese vowel harmony*

Piveronese vowel harmony has already been briefly described by Savoia (2005: 228-230) within the framework of Government Phonology, hence with a theory of features very close the one adopted here; apart from some problems of detail (he seems to be unaware of the presence of /i/ in Piveronese vowel system, treats diphthongs as disyllabic sequences, maintains that all stressless vowels can have only one feature), he explains harmony as licensing of **a** by the stressed vowel to the word-final one. This is not very distant from what we suggest below, but it is unclear how his formulation (“[t]he presence of [A] [analogous to our feature **a**] in the head nucleus licenses the presence of [A] in the weak nuclei of its domain [i.e. the foot in

Savoia's opinion]"¹⁴) would account for words having word-final [a], but a stressed 'high' vowel (e.g. the last four singular forms (8a) and all the singular forms in (8b)), since they have **a** word-finally but no (dominant) **a** in the stressed vowel. An analysis based on licensing (in a few words, a feature – **a**, in this case – can be present in a weak position only if it is present in a strong position as well, which licenses the weak one) seems to be problematic; we suggest instead that **a** spreads.

According the assumptions in §4.2.1 and §4.2.2, Piveronese vowel system is represented in (20).

$$\begin{array}{llll}
 (20) & /i/ \{ \mathbf{i} \} & /y/ \{ \mathbf{i}, \mathbf{u} \} & /u/ \{ \mathbf{u} \} \\
 & /ɪ/ \{ \mathbf{i} \rightarrow \mathbf{a} \} & & \\
 & & & \\
 & /e/ \{ \mathbf{a} \leftrightarrow \mathbf{i} \} & /œ/ \{ \mathbf{a}, \mathbf{u}, \mathbf{i} \} & /ɔ/ \{ \mathbf{a}, \mathbf{u} \} \\
 & & & \\
 & /ɛ/ \{ \mathbf{a} \rightarrow \mathbf{i} \} & & \\
 & & & \\
 & /a/ \{ \mathbf{a} \} & &
 \end{array}$$

An implication of this representation must be pointed out: since segments can contrast not only for the presence vs. absence of a feature, but also for its relative prominence, consequently also natural classes can. Thus the set of vowels having F_1 as the dominant feature is a possible class, which includes segments $\{F_1\}$, $\{F_1, F_2\}$, $\{F_1; F_2\}$, $\{F_1: F_2\}$, but not $\{F_2\}$ and $\{F_2; F_1\}$ (if a feature occurs alone, by definition is in head position).

As a consequence 'low' and 'high' vowels can still be represented as natural classes: the former are all the vowels having **a** in head position ($/a/ \{ \mathbf{a} \}$, $/ɛ/ \{ \mathbf{a} \rightarrow \mathbf{i} \}$, $/œ/ \{ \mathbf{a}, \mathbf{u}, \mathbf{i} \}$, $/ɔ/ \{ \mathbf{a}, \mathbf{u} \}$, $/e/ \{ \mathbf{a} \leftrightarrow \mathbf{i} \}$), the latter are the vowels without a dominant **a** ($/i/ \{ \mathbf{i} \}$, $/u/ \{ \mathbf{u} \}$, $/y/ \{ \mathbf{i}, \mathbf{u} \}$ simply lack any **a**, $/ɪ/ \{ \mathbf{i} \rightarrow \mathbf{a} \}$ has it but only as a dependent feature).

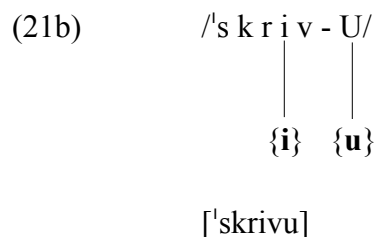
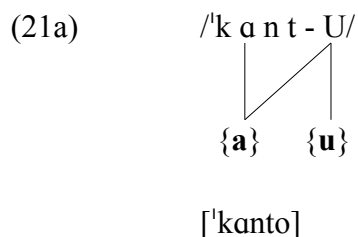
14 "La presenza di [A] sul nucleo testa autorizza la presenza di [A] sui nuclei deboli del suo dominio" (Savoia 2005: 229)

Since the presence vs. absence of dominant **a** separates the two classes of stressed vowels, it is natural to suppose that this is also the harmonic feature: **a** should spread when it is the dominant feature.

As already observed above (8-10), the word-final vowels mechanically alternate between [e] or [i], and [o] or [u], depending on the stressed vowel. In fact there are only three contrastive vowels word-finally: /a/ (a low unrounded back vowel), a non-low front unrounded and a non-low back unrounded vowel, since minimal pairs /e/ vs. /i/ and /o/ vs. /u/ are not possible in this position. This is well in accordance with the assumptions above, which predicts a tendency toward a simple triangular system in weak positions. The only feature necessary to represent the low vowel is **a**; the front vowel only requires **i** (because it is front and non-low), and the rounded vowel **u** (because it is rounded and non-low). No arbitrary [+high] feature is necessary for the latter two.

The alternation created by vowel harmony is between segments with and without **a**, which spreads from the stressed vowel, whereas the segmental features **i** and **u** remain constant. At the segmental level the word-final vowels are restricted to /a i u/ (that is, {**a**}, {**i**} and {**u**}), to which a feature **a** is suprasegmentally added when the stressed vowel is ‘low’.

Now the main problem raised by the binary feature [±high], that is the possibility of [–high] /a/ followed by a stressed high vowel, can be reinterpreted. If the word-final vowels are composed of just **a**, **i** or **u**, and the spreading feature of the stressed vowel is **a**, when word-final **i** and **u** receive an **a** element from a stressed ‘low’ vowel they become [e] and [o] (21a); on the other hand /a/ remains unaffected, since the spread feature is already present in the target vowel. If the stressed vowel is ‘high’, that is one of the vowels /i u y ɪ/, harmony simply does not take place, because they lack **a**, or have it only as a dependent feature (in the case of /ɪ/). This is the reason why word-final **a** can follow a stressed ‘high’ vowel: in fact in this case there is no harmony at all (21b). Not receiving any feature from the stressed vowel, the word-final segments do not have to agree with it, and are realized according to their segmental content alone – which is just one of the triangular vowels.



Moreover, this explanation accounts for the possibility of word-final unstressed [o] in Piveronese. As discussed in §2, this fact seemed to be an exception to two well-established empirical generalizations. But, albeit five vowels (including [o]) are possible word-finally, the contrasts are only three, and specifically there is no contrasting /o/. There is no increase in the number of contrasts: [o] is only the phonetic result of licensing suprasegmental /a/ from the stressed vowel to the final vowel, which is just **u** at the segmental level. With respect to the other Piedmontese dialects, the outcome of Piveronese harmony is not the creation of a new contrast allowing unstressed /o/, but the elimination of contrastive /e/ in word-final position, since [e] becomes the realization of /i/ when the stressed vowel is ‘low’ (thus eliminating the asymmetry between front and back vowels in the inventory in (6)).

4.3. Preliminary conclusion

If in (22) we compare the explanation proposed in the preceding paragraph to the analysis based on binary features in (18), we see that what were assumptions or stipulations there now are necessary properties of our analysis, derived from general principles. Indeed, given the feature theory adopted here, it predicts only one possible way to represent Piveronese harmony: the theory ‘forces’ this solution, since it leaves no alternatives in the choice of the harmonic feature, in the representation of stressed vowel and of word-final unstressed vowels.

(22)

- i. since **a**, which represent openness, is the only feature representing vowel height, a raising harmony cannot exist, because it would spread closeness
- ii. in a weak position (as are word-final unstressed vowels) the inventory /a i

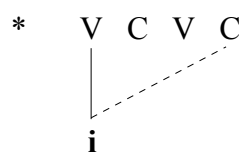
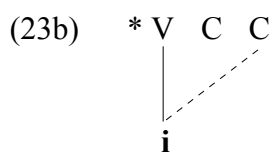
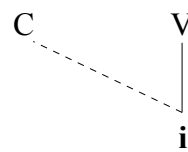
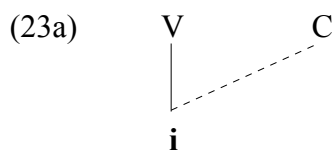
u/ is expected

- iii. word-final unstressed vowels other than /a/ have to be specified as only {i} and {u}, not requiring any other feature
- iv. no *ad hoc* feature-filling rules are required

5. Locality

As discussed in § 3.1 and 4., harmony in proparoxytones is (superficially, at least) non-local. It is widely assumed that phonological (and not only phonological, for that matter) processes, constraints, restrictions, should take place only among adjacent elements. Given a sequence of elements¹⁵ *xyz*, there should not be unaffected intervening elements between two of them involved in a phonological process. Only processes affecting *xy*, *yz*, or *xyz* should be possible phonological phenomena, with the exclusion of *xz*.

Locality is an easily observable constraint in many segment-to-segment processes: to make a simple example, palatalization of consonants triggered by front vowels goes from the vowel to an adjacent consonant to its left or to its right (23a; incidentally, the first case is more frequent) in many unrelated languages, but to my knowledge cases of palatalization which skips intervening segments (be they non-palatal vowels or consonants) are not attested (23b).



¹⁵ Here 'element' broadly and informally covers any phonological unit: segments, syllables, feet and so on.

As for other phonological phenomena, locality is *prima facie* less evident. With regard to the problems discussed here, vowel harmony and stress are two typical areas where locality, if valid, cannot in any case be interpreted as a relation among strictly adjacent segments. Vowel harmony, by definition, is assimilation among vowels, while the intervening consonants are (almost) always irrelevant.

This leaves open the question of whether harmony is subject to locality, or it must be considered an exception to this principle. At least since the advent of Autosegmental Phonology, a richer and more complex theory of phonological representation has originated a large amount of discussion and proposals concerning the nature of locality in vowel harmony.

Theories which try to explain consonantal transparency have been developed in several feature-geometric approaches, in which vowels and consonants are on different planes, thus making vowel-to-vowel processes local (Clements & Hume 1995, Morén 2003). Also representations adopting (some form of) underspecification have been proposed to explain transparency, since consonants (or transparent vowels) usually need not be specified for the harmonic feature(s) (see Calabrese (1995, 2005) and Dresher (2003) for two different recent theories of underspecification – Visibility Theory and Modified Contrastive Underspecification respectively – which are applied also to vowel harmony).

One recent view offers an articulatorily-based explanation of locality, claiming that no segment can be skipped and true transparency, strictly speaking, does not exist at all in phonology (hence the label ‘Strict Locality’; see, among others, Gafos (1999), Baković (2000), Ní Chiosáin & Padgett (2001) – ultimately this theory is built on certain insights of Articulatory Phonology: Browman & Goldstein (1986, 1992)).

From the point of view of articulatory organs, this theory sees harmony as a single uninterrupted articulatory gesture over a span of several segments. Thus in vowel harmony vowels always influence also the intervening consonants and (supposed) transparent vowels, albeit sometimes only as allophones, and very slightly (to the extent that, for the proponents of Strict Locality, it is not relevant whether this articulatory assimilation can be perceived or not: “[i]t is important to bear in mind

that there is no requirement that the distinctions we are considering be auditorily robust or even audible, since they need not have contrast potential. The criterion here is that there be a systematic articulatory difference” (Ní Chiosáin & Padgett 2001: 125)). If a phenomenon is clearly non-local in articulatory terms, it is usually argued that it is morphological rather than phonological (*e.g.* Gafos (1999: ch. 3) with respect to consonantal spreading over vowels non-concatenative languages as Arabic, reinterpreted as reduplicative affixation).

A more abstract hypothesis to save locality in vowel harmony assumes that harmony is a syllable-to-syllable process (see chapter 5). It is linked theoretically to Dependency Phonology and its emphasis on head-dependent relations: since nuclei are syllable heads, it is their features which can spread to other syllables, while a consonant cannot spread its features to the nuclei of other syllables; on the contrary, it is limited to strictly local processes involving the preceding or following segment, but cannot reach higher nodes in the structure (van der Hulst & van de Weijer 1995).

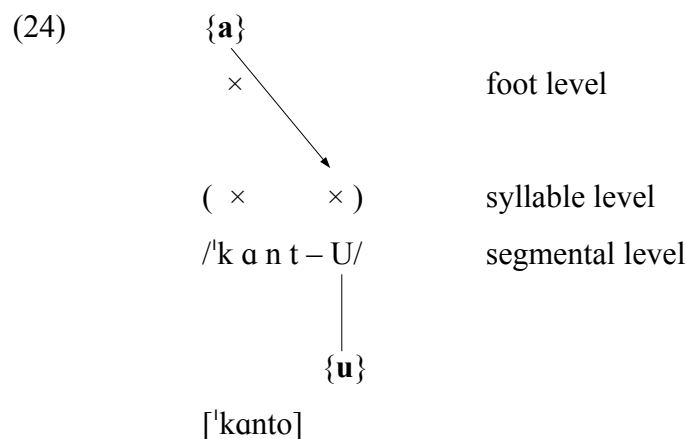
With respect to the relation between harmony and stress, frequently stressed vowels are triggers, and unstressed vowels are targets. This fact has led several authors (*e.g.* Halle & Vergnaud (1981) for numerous languages, Anderson (1987) for Khalkha Mongolian, Hualde (1989) for several Spanish dialects, Mascaró (2007) for Andalusian Spanish and Central Catalan) to adopt metrical structure as the representation of vowel harmony mechanism: the feature of a vowel (usually the stressed one) percolates through the metrical tree. Since the terminal nodes of metrical trees are vowels, skipping of consonants is gained, so to say, for free. Moreover, this solution has also other advantages:

1. it accounts for domains that assuming autosegmental spreading have to be stipulated: if harmony is triggered by a stressed vowel, its compass often corresponds to a metrical domain, like the foot, or is blocked by vowels which are at the edge of a metrical domain
2. it can predict directions of assimilation that under autosegmental spreading have to be stipulated: if in a given language the triggering vowel is the

stressed one and feet are trochaic, a harmony process having as its domain the foot can only be rightward

3. it does not require new assumptions, since metrical structure is independently and strongly motivated by the need to represent stress

As we will argue in the next section, the seemingly non-local behaviour of Piveronese vowel harmony in proparoxytones can be explained recurring to metrical representation. For the time being, we will adopt this solution only for paroxytones. (21a) is thus more properly represented as (24), as a rightward spreading having as its domain the dependents of the vowel carrying word stress: when the **a** feature is a property of the metrical head of the word, it percolates to the lower syllable nodes to the right which are part of the same constituent of the head (in the case of paroxytones, the stressed vowel is the head of a trochaic foot, and dominates the word-final syllable).



6. Piveronese proparoxytones

Any theory which assumes (some form of) locality has to explain the behaviour of proparoxytones in Piveronese. In such words the penultimate vowel is transparent, apparently making harmony a long-distance process.

(25=15)	[^l mandule]	‘almonds’
	[^l makine]	‘cars’
	[^l kamule]	‘moths’
	[^l sigali]	‘cigars’
	[^l skatule]	‘boxes’

Interestingly, this type of transparency is both unusual on a world-wide typological scale, and fairly common in Romance languages. Usually transparent vowels are a subset of the vowel system of a language displaying harmony, almost always lack their harmonic counterpart, and can occur in any position in the word, but cannot block harmony neither start a new harmonic span (definition in chapter 1). A prototypical example are /e/ and /i/ in Finnish: Finnish displays palatal harmony (26a), but these two vowels do not have a [+back] counterpart (or, according to the features adopted here, there are not two vowels identical save for the absence of *i*), that is */ɤ/ and */u/ do not exist in Finnish. They can precede and follow back vowels, and the vowels of a suffix added to a stem ending in /e/ or /i/ agree with the vowel preceding the latter (26b).

(26a)	[tyhmæ]	‘stupid’	[tyhmæ-stæ]	‘stupid (ill.)’
	[tuhma]	‘naughty’	[tuhma-sta]	‘naughty (ill.)’

(26b) [tuoli-lla] ‘on the chair’

(from van der Hulst & vand de Weijer 1995: 499-500)

On the other hand, in Piveronese all the vowels in proparoxytones (/i/, /a/ and /u/) are transparent, and transparency is limited to this specific position. Transparency in the usual sense involves one specific vowel (in some languages more than one, but always a subset of the vowel inventory), without any restriction on its (their) metrical position; on the contrary, in Piveronese transparency involves a specific metrical position, regardless of which vowel is present there.

Moreover, such a transparency, typologically uncommon as it is, has a strong

similarity to other transparency phenomena in the Romance family. In several dialects displaying metaphony, both in Italy and Spain, in proparoxytones the word-final vowel raises the stressed vowel, but leaves the penultimate one unaffected (although this is not the only solution for proparoxytones at all. In other dialects metaphony does not take place in proparoxytones, and in still others the stressed vowel assimilates to the penultimate vowel, if the latter is high, and not to the final one; for some examples of this last case, cf. Savoia & Maiden (1997: 22-23)). Also in some Spanish dialects metaphony skips the penultimate vowel of proparoxytones (Hualde 1989, 1998 and references therein).

For example the dialect of Ascrea (Fanti 1938) raises stressed /e/ and /o/ to [i] and [u], and /ɛ/ and /ɔ/ to [e] and [o] respectively (it is an instance of the so-called ‘Sabine’ metaphony widespread in Central Italy), also in proparoxytones, while the penultimate vowel always remains [e] or [o].

- (27) [ˈtoɾewa] ‘cloudy-FEM.SING.’ [ˈturewu] ‘cloudy-MASC.SING.’
 [doˈmineku] ‘Dominic’ (cf. Italian *Domenico*)

(Fanti 1938)

Hualde (1989, 1998) describes dialects of north-western Spain, in Cantabria and Asturias. In (28) some examples from the dialect of the Nalón Valley (where /a/ is raised to [ɔ] by word-final high stressed vowels) are reported.

- (28) [ˈmɔtolu] ‘I kill him’ [ˈmato] ‘I kill’
 [ˈmɔtalɔ] ‘s/he kills him’ [ˈmata] ‘s/he kills’
 [ˈpɔʃaru] ‘bird’ [ˈpaʃaros] ‘birds’

(Hualde 1998: 104)

This state of affairs seems to imply that this type of transparency must be closely

related to specific properties of the metrical structure of (some) Romance languages, in particular with regard to the status of proparoxytones in these languages.

The solutions proposed so far for cases of transparency comparable to that of Piveronese are to my knowledge Hualde (1989) and (1998) for Spanish metaphony, Walker (2004, 2006) for Spanish and Italian metaphony respectively, and Savoia (2005) for Piveronese itself. I will briefly sum up their proposals, and argue that they make either wrong empirical predictions when applied to Piveronese, or are based more on undemonstrated assumptions than on firm evidence. Then I will propose an alternative solution, based on some properties of the metrical structure of Piveronese.

6.1. Previous explanations of long-distance harmony in proparoxytones

As for Spanish dialects displaying transparency phenomena in proparoxytones, Hualde (1989) represents their metrical structure building a left-headed foot from the right edge of the word; this solution is sufficient to represent the metrical structure of paroxytones, while in proparoxytones the final syllable is lexically marked as extrametrical, and is then adjoined to the preceding foot (in practice giving rise to a ternary foot, although this is not stated explicitly by Hualde). In both cases, the feature of the word-final vowel percolates through these metrical structures.

Also leaving aside some problems this metrical representation raises (proparoxytones require a fairly complex mechanism, which in any case relies on an ultimately circular diacritic mark – extrametricality of the final syllable, which ‘predicts’ antepenultimate stress position in proparoxytones precisely if it is previously limited just to words that will be proparoxytones – and creates ternary feet, which have an uncertain status in metrical theory), the problem for locality remains untouched: whatever the other merits of this representation of proparoxytones, it does not explain why percolation skips one vowel in the metaphonic systems he discusses. Likewise, Piveronese harmony would remain a non-local process if this representation of proparoxytones were adopted.

Indeed, Hualde (1998) is less categorical and only tentative, not offering a formal account of proparoxytones and suggesting as possible explanations either an

analogical extension from paroxytones, or a slight and hitherto unnoticed amount of assimilation:

It seems reasonable to assume that all assimilatory processes initially result from the influence between adjacent gestures. The fact that [...] [in proparoxytones] assimilation appears to be a “long-distance” process which skips a vowel between trigger and target is a puzzle for our understanding of vowel assimilation, regardless of whether or not a formal account is feasible (see Hualde 1989). Two possible explanations seem to me available. An explanation for this situation would be that in proparoxytones there has been analogical extension of metaphony from paroxytones. The other possibility is that, in fact, the unstressed penultimate vowel is also affected by metaphony in some slight way and researchers have simply failed to perceive its retracted/raised quality. (Hualde 1998: 104)

Both ideas are rather speculative: as for both Italian and Spanish metaphony, to my knowledge its late extension to proparoxytones, only after it began in paroxytones, has never been documented. As for Piveronese, we do not have access to written texts of the past, thus positive (or negative, for that matter) evidence cannot be found. In any case, analogy usually works within morphological paradigms: it is true that metaphony is often intertwined to the morphological exponence of inflectional categories, and an analogical effect, albeit not observable in the available data, at least is a plausible hypothesis (even if Italian dialects in which metaphony in proparoxytones was triggered by the penultimate vowel, which is within of the root, contradict it). But Piveronese harmony is purely phonological, as argued in § 3.: if the final vowel of uninflected nouns, adverbs, toponyms and borrowings behaves like all the other Piveronese final vowels, morphological categories are irrelevant, making the hypothesis of a morphological nature of Piveronese harmony inconsistent. It is unlikely that analogy can be at work there; adaptations like [ˈtrapane] in (13) show that at Flechia’s time harmony was fully automatic and affected proparoxytones also in loanwords lacking suffix vowels.

The second of Hualde's proposal is essentially the solution proposed by Strict Locality to explain many transparency phenomena in vowel harmony: its proponents observe, usually on the basis of minute phonetic data, that also 'transparent' vowels are slightly affected when surrounded by vowels bearing the opposite feature. The conclusion frequently is that 'real' cases of transparency do not exist (*e.g.* Gick *et al.* (2006) with regard to transparency of low vowels to [ATR] vowel harmony in Kinande).

It is true that in at least some of the Spanish dialects Hualde analyses metaphony is an allophonic process, which raises vowels but without merging them with higher vowels. For example in the dialect of the Nalón Valley illustrated in (28) – which contrasts /a/ and /o/ – when the word-final vowel is high /a/ is raised to [ɔ], a clearly higher vowel than [a] but still distinct from [o]. Since this harmony does not neutralize contrasts, also the penultimate vowel of proparoxytones could be affected, but with a less clearly perceptible result.

But Piveronese harmony is categorical: word-final [e] and [i], [o] and [u] are the realizations of distinct phonemes in other contexts. So why should [i] not be lowered to [e] in penultimate position, if [e] is the output of harmony in word-final vowels? The cases of transparency discussed by proponents of Strict Locality usually regard segments that do not contrast for the harmonic feature (*e.g.* low vowels in Kinande [ATR] harmony (Gick *et al.* 2006), or consonants in Turkish palatal and rounding harmony (Chiosáin & Padgett 2001)). One of their core assumptions is that also supposed 'transparent' segments in fact bear the relevant feature: but even accepting the idea that in segments which do not contrast for the harmonic feature the constraint against skipping segments is realized by means of (possibly not perceptible) coarticulation, transparent segments in Piveronese (and in metaphony) are different. In other positions they contrast for the harmonic feature, and since **a** (or [–high]) is the harmonic feature in Piveronese, Strict Locality predicts that its spreading to /i/ and /u/ should result in the outputs [e] and [o] in any post-tonic vowel.

This problem is acknowledged by Walker (2006: 4) with regard to Ascrea's metaphony; her solution for long-distance metaphony in proparoxytones rests on the

assumption that two different mechanisms are at work, one for metaphony in paroxytones (the [+high] feature of a final vowel has to be licensed by a [+high] feature of the stressed vowel) and a second one for proparoxytones (identity licensing, that is the value of [high] in the last vowel has to be identical to the value of [high] in the stressed vowel). Apart from formal considerations (it is unclear whether the two mechanisms represent something more than merely two notational conventions for the same idea, since both boil down to saying that both the stressed and the final vowel have to be [+high]), the very idea that what is basically the same phenomenon should be explained by two sharply distinct mechanisms is rather suspicious. On the contrary, there seem to be no empirical reasons to separate metaphony (and Piveronese harmony) in paroxytones from metaphony (and harmony) in proparoxytones.

Savoia (2005) notices the non-local nature of Piveronese harmony in proparoxytones¹⁶ and tries to give an explanation to this fact. In his opinion, Piveronese harmony consists in the selection of inflectional suffixes, while the penultimate vowel in proparoxytones is not modified insofar as part of the lexical stem:

the presence of an intermediate [...] nucleus does not affect harmony, which depends entirely on the stressed nucleus. [...] we have to conclude that harmony consists in the selection between two series of affixes, whereas the phonological content of the stressless nuclei within the lexical stem [...] is lexically fixed.
(Savoia 2005: 230)¹⁷

Yet, this idea still leaves open the problem of locality. If we assume that certain

16 Actually, he does not discuss ‘real’ examples of proparoxytones, since the only example he gives is [l'eure] ‘hares’, which in his opinion is a proparoxytone. But there are some arguments – sequences like [eu] cannot be followed by a tautosyllabic consonant; when a clitic is attached to a verb, the latter loses its last vowel (see 14), but in sequences like [eu], [u] is not deleted – which suggest that they form diphthongs rather than disyllabic sequences of two vowels, and consequently that a word like [l'eure] is a paroxytone.

17 “[L]a presenza di un nucleo [...] intermedio non influisce sull’armonia, che dipende interamente dal nucleo tonico. [...] dovremo pensare quindi che l’armonia consiste nella selezione fra due serie di suffissi, mentre il contenuto fonologico dei nuclei atoni interni alla base lessicale [...] è lessicalmente fissato.”

vowels cannot be modified because they are part of the stem, we should expect blocking of harmony rather than transparency, if locality holds: if there is an unmodifiable vowel between the stressed and the final vowel, spreading should be interrupted (unless, as Savoia's words seem to implicitly suggest, we consider Piveronese harmony more a morpho(phono)logical than a phonological phenomenon; being the phonologically conditioned selection of the proper allomorph of an inflectional morpheme rather than a phonological process, it would not be subject to strictly phonological constraints. In this case, the same objection to Hualde's first proposal can be raised against Savoia's as well: the nature of Piveronese harmony is not morphological, since word-final vowels are subject to harmony even when they are not inflectional.).

6.2. Metrical properties of Piveronese proparoxytones

Generally, all the proposals discussed so far seem to face the same paradox: since they are unable to offer a unified account of long-distance harmonies valid for both paroxytones and proparoxytones, they have to resort to something else (analogy, morphology, in any case a mechanism different from the one(s) used for the more prototypical assimilation in paroxytones). None of them seems to be fully convincing, both for empirical and theoretical reasons.

Moreover, they all start from the assumption that harmony in proparoxytones is non-local, or suppose it has a slight degree of articulatory locality still to be demonstrated. The latter proposal cannot work for Piveronese harmony, for the reasons stated above. It follows that in proparoxytones harmony is not strictly local, in articulatory terms. But if Strict Locality is not a viable solution, this state of affairs does not imply that locality must be completely abandoned, and that a unified account for both paroxytones and proparoxytones is unavailable. Rather than giving up a well-established and important principle, it would be preferable to look for a more abstract version of locality, which can accommodate also non strictly local phenomena. Put in other words, this implies looking for a level of linguistic structure where the stressed and the final vowel of a proparoxytone are adjacent. But what could this level be?

First of all, since proparoxytones are the problematic data, a closer look at their properties promises to be fruitful. Generally, in Italian dialects they show peculiar properties when compared to the more numerous paroxytones: several diachronic processes occurred only in proparoxytones, or had exceptions just in them (cf. for instance Rohlfs (1966: 21-24, 318-319)).

From the point of view of their prosodic representation, proparoxytones are problematic for any analysis of the metrical structure of Italian dialects. In Piedmontese (as in virtually all Italian dialects) word stress is limited to one of the last three syllables (leaving aside enclitics). Paroxytones are easily analysable recurring to a syllabic trochee; but this foot cannot represent oxytones, which nevertheless are fairly frequent in Piedmontese. In this regard, it must be pointed out that stressed monosyllables are licit words in Piedmontese (and in most Italian dialects). A short list of Piveronese examples from Flechia (1914) is given in (29).

- (29)
- | | |
|-------|------------------|
| [vel] | ‘calf, veal’ |
| [sej] | ‘thirst’ |
| [ze] | ‘game’ |
| [ɔm] | ‘man’ |
| [bry] | ‘heather, broom’ |
| [mek] | ‘only’ |
| [fɛ] | ‘you do’ |

A simple way to represent the metrical structure of monosyllables is assuming degenerate feet (see *e.g.* Hayes 1995: 86-105): since there is no requirement that words be at least disyllabic, the minimal foot can be made of just one syllable, provided that this bears a stress (on the contrary, there is no reason to assume monosyllabic weak feet in the universal foot inventory: see Hayes (1995: 87)). Once degenerate feet are accepted, they can be useful not only of monosyllables, but also for all oxytones in general: for example a trisyllabic oxytone word is represented as in (30) (the metrical representation adopted here is a bracketed grid – as proposed in

Halle & Vergnaud (1987), Hayes (1995) –, which aims at incorporating both the rhythmic nature of stress encoded in metrical grids (Prince 1983), and the hierarchy and constituency represented by metrical trees (Lieberman & Prince 1977)).

(30)

$$\begin{array}{c}
 \times \\
 (\times \quad \times) \\
 (\times \times) (\times) \\
 [{}_1\text{barba}^1\text{r}^0\text{t}] \quad \text{‘chin’}
 \end{array}$$

The representation of proparoxytones is the most complex. They have been represented adopting ternary feet (*e.g.* Nespor 1993 for Italian), or extrametricality of the final syllable (*e.g.* Den Os & Kager 1986, still for Italian). Both approaches are not entirely convincing: several metrical theories (*e.g.* Hayes 1995) do not allow feet made of more than two elements (syllables or moras), and even theories which adopt ternary feet (*e.g.* Halle & Vergnaud 1987) use them to represent stress placement in only a handful of languages, and no one of such languages has metrical structures resembling those of Italian or Italian dialects. As for extrametricality, it has already been argued above for Spanish dialects that its limitation to proparoxytones is ultimately a diacritic; since the situation of Italian dialects is very similar, at least with regard to the most general properties of their stress systems, this critique can be extended to them as well.

Moreover, no one of these representations is able to account for the weakness of the penultimate vowel of proparoxytones: in Piedmontese (as in other dialects of northern Italy) diachronically proparoxytones frequently lost their penultimate vowel/syllable.

(29)	Latin		Piedmontese	
	ASĪNUS	>	[azo]	‘donkey’
	FEMĪNA	>	[^l fumna]	‘woman, wife’
	*MANĪCU	>	[^l maŋne] ¹⁸	‘handle’
	EPĪSCŌPUS	>	[^l visku]	‘bishop’

Langobardic

FODERA	>	[^l fɔdra]	‘pillow case’
--------	---	-----------------------	---------------

(Piveronese examples Flechia 1914)

More in detail, syncope has been systematic when the resulting vowel would have been [e]. A consequence of this process is that in the penultimate vowel of proparoxytones even less contrasts are possible than in other unstressed vowels: just /a i u/ are allowed. Moreover, some alternations suggest that the impossibility of [e] in this position is still a synchronically active constraint (30).

(30)	[^l puver] ‘poor-MASC.SING.’	[^l puvra] ‘poor-FEM.SING.’	*[^l puvera]
		(/ ^l puver/ + /a/)	
	[^l singer] ‘gipsy’	[^l singra] ‘gipsy-FEM.SING.’	*[^l singera]
		(/ ^l singer/+a/)	

6.2.1. Other cases of syncope

Also an analogous phenomenon, syncope¹⁹ of [e] in immediately pretonic position, is detectable both in ‘frozen’ words (31a) and in productive alternations within the word (31b) or word-initially (31c) (unless when it would yield a consonant sequence

18 In Piveronese a nasal followed by [a] is geminated, and its first half is velarized (Flechia 1898: 118).

19 Nowadays no more fully regular.

violating Piedmontese phonotactics, (31d)).

- (31a) [kat^llina] ‘Catherine’ (cf. Italian *Caterina*)
 [py^lvr̥un] ‘Piverone’
 [mlun] ‘melon’
- (31b) [ka^lpel] ‘hat’ [kap^llin] ‘small hat’
 (/ka^lpel/ + /^lin/)
- [ras^ltel] ‘rake’ [rast^lla] ‘to rake’
 (/ras^ltel/ + /^la/)
- [bi^lnel] ‘twin’ [bin^lla] ‘to give birth to twins’
 (/bi^lnel/ + /^la/)
- [mar^ltel] ‘hammer’ [mart^lla] ‘to hammer’
 (/mar^ltel/ + /^la/)
- (31c) [^lstera] ‘s/he buries’ [stra] ‘to bury’
 (/^lster/ + /^la/)
- [^lstre̞ʁ] ‘grave-digger’ (lit.
 ‘burier’)
 (/^lster/ + /^lε̞ʁ/)
- [fɛn] ‘hay’ [fna] ‘to make hay’
 (/^lfɛn/ + /^la/)
- [^lfne̞ʁ] ‘hay-maker’
 /^lfɛn/ + /^lε̞ʁ/

- (31d) [arle^lva] ‘to relieve’ *[arl^lva]

(from Flechia 1914)

Syncope, both in pretonic and post-tonic position, suggests that these contexts are prosodically weaker than the rest of unstressed vowels. Usually, vowel reduction (neutralization or deletion) is associated with weak metrical positions: if a vowel carries word stress, frequently more contrasts are possible than in unstressed vowels. A reduction to zero limited to a specific vowel quality, and sensitive to stress position, suggests a hierarchy also among unstressed vowels, with various degrees of prominence corresponding to various degrees of reduction.

Indeed, the two contexts of pretonic syncope clearly are metrically weak positions. The first is the intertonic vowel (between a secondary stress and word stress): suffixation in (31b) would create a stress clash and generally, when two underlyingly stressed vowels are adjacent, the weakest (the one on the left in Piedmontese) loses its stress, which shifts to the preceding syllable (as in numerous other languages). Any vowel other than [e] occurring between a secondary stress and word stress is realized, be it underlyingly unstressed (32a) or stressed (32b, c).

- | | | | | |
|-------|---|---------------|--------------------------------------|----------------|
| (32a) | [_l skara ¹ vel] | ‘rung’ | | |
| | [_l viru ¹ lin] | ‘splindle’ | | |
| (32b) | [am ¹ bɔs] | ‘turned down’ | [_l ambu ¹ sa] | ‘to turn down’ |
| (32c) | × | | × | |
| | (×) (×) | | (× ×) | |
| | × (×) (×) | | (× ×) (×) | |
| | /am ¹ bɔs/ + / ¹ a/ | > | [_l ambu ¹ sa] | |

On the contrary, when the resulting intertonic vowel would be [e], it is deleted (33).

- (33)
- | | | |
|--------------------|-----------|---------------------------|
| × | × | × |
| (× ×) | × | (× ×) |
| × (×) (×) | × (×) | (× ×)(×) |
| /ras'tel/ + /'a/ > | [rastl'a] | *[_l rastel'a] |

The second context for pretonic syncope of [e] (31c, 34) is an unparsed syllable: an unstressed [e] is deleted if it is not parsed in a foot.

- (34)
- | | |
|--------------------|---------------------------|
| × | × |
| (×) (×) | (×) × (×) |
| (/'ster/ + /'a/) > | [l'stra] *[ste'l'ra] |

Thus the reason for syncope of front mid vowels seems to be their weak metrical position: they can occur in stressed syllables, and also in syllables bearing a secondary stress, but not in a syllable which is not a foot head (that is, the weak syllable of a binary foot or an unparsed syllable).

Obviously a question arises: why does only /e/ undergo syncope (except in case of violation of phonotactic constraints, (31d)), while other vowels are preserved? /e/, made of the features {**a**, **i**}, is a 'complex' vowel (*i.e.* a vowel composed of more than one feature), thus should be the first to be lost in a weak position.

6.2.2. *An alternative representation of proparoxytones*

Coming back to proparoxytones, the availability of degenerate feet offers a representation which is consistent with the reduction of the penultimate vowel of proparoxytones, gives a unified account of post-tonic and pretonic syncope, and allows to dispense with extrametricality and ternary feet (and saves locality of vowel harmony as well, as argued in the next paragraph).

The problem with proparoxytones is basically the final syllable: if it is part of the foot including the syllable which carries word stress, it forms a trisyllabic foot; if is not part of the same foot of word stress, it remains unparsed. But if the degenerate

foot is licit in Piedmontese, it is useful to explore whether the final syllable of proparoxytones could be represented in this way. It must be recalled that a necessary condition for degenerate feet is to be strong: its only syllable must carry a stress (a secondary stress, at least).

With regard to syncope in the penultimate vowel of proparoxytones, it is very similar to syncope in pretonic vowels: in both cases the same vowel – /e/ – is targeted, and when this vowel is the weak syllable of a trochaic foot. But in pretonic position syncope requires an intertonic vowel: also a preceding secondary stress is needed. If syncope in the penultimate vowel of proparoxytones is parallel to pretonic syncope, this means that the final vowel should be followed by a secondary stress.

Put in other words, more radical reduction phenomena suggest that the final vowel of a proparoxytone is more prominent than the penultimate; and since the penultimate vowel is reasonably a weak syllable of a trochee, the final syllable should occupy a stronger metrical position to formally represent this asymmetry.

The reduced status of the penultimate vowel is confirmed by phonetic data as well: measurements²⁰ of the duration of the last two vowels of proparoxytones show that the penultimate is shorter than the final, the average duration of the former being of 75 ms, and the duration of the latter being 92 ms.

If degenerate feet are possible, the only representation of proparoxytones which can accommodate all these data is a binary trochaic foot headed by the stressed syllable, together with a degenerate foot for the final syllable. A trisyllabic proparoxytone word like [ˈmandule] is represented as in (35).

- (35) ×
 (× ×)
 (× ×) (×)
 [ˈmandu₁le]

20 Sampled at 44100 Hz, and analysed with *Praat* (Boersma & Weenenink 2007).

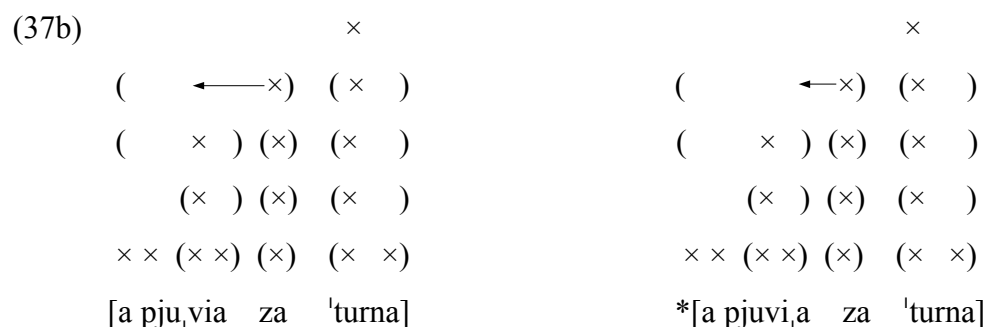
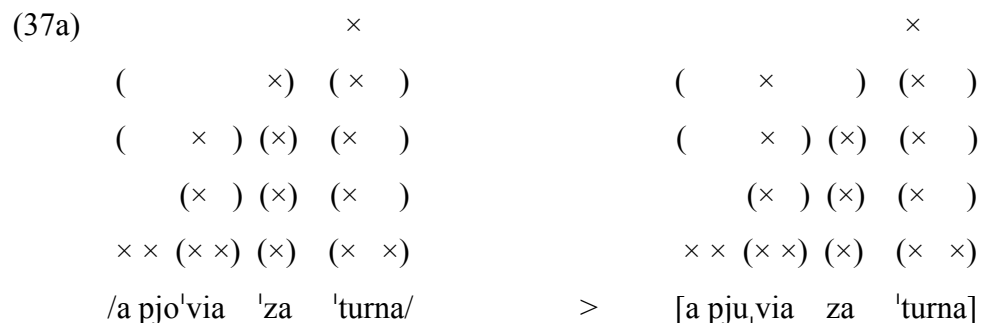
6.3. Long-distance harmony and metrical representation

The hierarchical structure of metrical representation is able to account for seemingly non-local phenomena, since only higher layers are relevant to stress rules (*e.g.* Hayes 1995: 33-34). A prototypical case is the landing site of stress shift, which is not necessarily a syllable adjacent to the syllable affected: for example, when phrasal stress is assigned and less prominent stresses are shifted to avoid stress clash, they can be moved several syllables away (in the case of Piedmontese, to the left). But the new position of the secondary stress still depends on locality conditions: albeit it is not always the vowel immediately adjacent to the original stress position, it is adjacent adjacent node.

For instance phrasal stress in Piedmontese is always carried by the word stress of the rightmost word of the phrase; if two syllables carrying word stress are adjacent, the weaker (that is, that on the left) is retracted. Thus when three words as [a], [va] and [nin] are grouped together in a sentence (and in a phonological phrase), the stress of the second word undergoes retraction, being shifted to the preceding syllable: [a va 'nin] 's/he/it does not go' (lit. 's/he/it goes not').

$$\begin{array}{rcccl}
 (36) & & \times & & \times \\
 & (& \times & \times) & (\times & \times) \\
 & (\times) (\times) (\times) & > & (\times) (\times) (\times) \\
 & /a \text{ 'va} \text{ 'nin}/ & & [a \text{ va} \text{ 'nin}]
 \end{array}$$

But this does not imply that the resolution of stress clash can be expressed simply as a rule shifting the weaker stress to the preceding syllable. In a phrase like /a pjo'via 'za 'turna/ 'it already rained again' the stress of /'za/, which would clash with that of /'turna/, is not moved to the last syllable of /pjo'via/, but to the penultimate: [a pju.via za 'turna]. Given the representation in (37), it means that the weaker stress is shifted to the syllable to its left which already bears the strongest pre-existing stress.

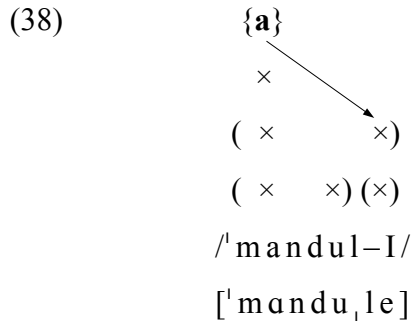


Apparently this is a non-local process, because it skips one syllable. But the relevant fact is that stress moves along the same level where the clash occurs: weaker syllables are not visible because they are at lower levels, whereas movement takes place only between positions adjacent at the level in question.

This property of metrical structure can be relevant for the problem of harmony in proparoxytones: as stress moves to an adjacent node on its same layer, skipping vowels on lower layers, thus a feature which percolates through the metrical structure is predicted to behave in the same way. In the paroxytone in (24) harmony was represented as percolation of **a** from the stressed vowel to the vowel to its right, which is the weaker part of the foot headed by the stressed vowel; harmony goes from word stress to the lower metrical node to its right.

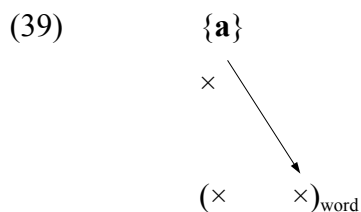
This representation of vowel harmony allows us to equate its behaviour in paroxytones with that in proparoxytones: also in the latter case, given a representation as in (35) for proparoxytones, **a** percolates from the stressed vowel to the lower metrical node to its right. Since a word like [¹mandule] is made of two feet, the node to the right of word stress is the head of the rightmost foot (which is the final vowel),

and not the penultimate vowel.



6.4. Conclusion

In this way harmony in paroxytones and proparoxytones conforms to the identical principle: {a} percolates from a stressed vowel to the lower node to its right (39). This explains why in proparoxytones the penultimate vowel is skipped by harmony: such intervening vowel is too low in the metrical hierarchy to be ‘seen’ by percolation. Hence harmony is local also in proparoxytones: only adjacent nodes are affected, once the metrical nature of Piveronese harmony is recognized.



7. Appendix: pretonic reduction in Friulan

This kind of analysis based on the adoption of the unary features **a i u** can be extended to other Italian dialects as well. A case in point are some varieties of Friulan. Friulan has a five-vowel system /a e i o u/ both in stressed and unstressed vowels, but in some varieties the height of the pretonic vowels is influenced by that of the stressed one. If the stressed vowel is /a/, /e/ or /o/ (all the vowels including the feature **a**, in our system), only [a], [e] and [o] can occur in pretonic position. But if the stressed vowel is /i/ or /u/ (the vowels lacking **a**), only [a], [i] and [u] can occur,

since the mid vowels are raised (40a) (although /a/ can lower the pretonic vowels on its left also when it is not stressed (40b)).

(40a)	[¹ bestje] ‘animal’	[bis ¹ tjute] ‘animal-dim.’	[beste ¹ an] ‘livestock’
	[¹ femine] ‘woman’	[fimi ¹ nute] ‘woman-dim.’	[feme ¹ nate] ‘woman-pej.’
	[mo ¹ ros] ‘lover’	[muru ¹ sut] ‘lover-dim.’	[moro ¹ sez] ‘to make love’
	[ga ¹ roful] ‘rose’	[garufu ¹ lut] ‘rose-dim.’	[garofo ¹ lon] ‘rose-aug.’
	[¹ zbrendul] ‘rag’	[zbrindu ¹ lut] ‘rag-dim.’	[zbrendo ¹ lon] ‘rag-aug.’

(40b)	[bo ¹ ton] ‘button’	[botona ¹ dure] ‘buttoning up’
	[kre ¹ va] ‘to split’	[kreva ¹ dure] ‘split’

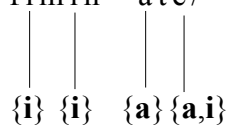
(varieties of Porpetto and S. Giorgio di Nogaro; Franco Finco, p.c.)

Also in Friulan the contrast between mid and high vowels is suppressed when the vowels are unstressed: the superficial occurrence of five vowels [a, e, i, o, u] is not due to the possibility of having five contrastive vowels, but to the alternations automatically produced by harmony between [i] and [e], and [u] and [o]. To represent the reduction of contrasts in pretonic vowels, the most straightforward way is assuming that all the underlying mid vowels (as /e/ in 41a), which are the most complex vowels, lose their feature **a**, producing a simple triangular system vowels composed of only /a, i, u/ (41b).

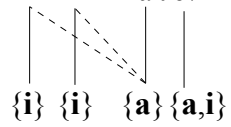
Then the **a** feature of the stressed vowel spreads to all the pretonic vowels, creating mid vowels in pretonic position (41c).

(41a)	/ ¹ f e m i n e /	
	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <div style="margin-bottom: 5px;"> </div> <div style="margin-bottom: 5px;"> </div> <div style="margin-bottom: 5px;"> </div> <div>{a,i}</div> </div> <div style="text-align: center;"> <div style="margin-bottom: 5px;"> </div> <div style="margin-bottom: 5px;"> </div> <div style="margin-bottom: 5px;"> </div> <div>{i}</div> </div> <div style="text-align: center;"> <div style="margin-bottom: 5px;"> </div> <div style="margin-bottom: 5px;"> </div> <div style="margin-bottom: 5px;"> </div> <div>{a,i}</div> </div> </div>	[¹ femine]

- (41b) / f i m i n - ' a t e / neutralization of complex vowels
in pretonic position



- (41c) / f i m i n - ' a t e / harmony



[feme'nate]

CHAPTER 3

POST-TONIC VOWEL HARMONY IN SOME DIALECTS OF CENTRAL
ITALY: THE ROLE OF PROSODIC STRUCTURE, CONTRAST AND
CONSONANTS

1. Introduction

Among the fairly numerous types of vowel harmony processes that can be observed in the dialects of Italy, several varieties of central Italy display a regressive post-tonic harmony which raises several problems, in particular with respect to the role of prosodic structure and consonants.

This harmony is attested – without a uniform distribution – within an area including south-eastern Tuscany, northern Lazio, Umbria and Marche, plus a small isolated zone in north-western Tuscany (similar phenomena can be found also in some localities of southern Italy, in Salento, Calabria and eastern Sicily, but they will not be discussed here).

Synthetic general descriptions of all these dialect areas can be found in several chapters of Maiden & Parry (1997), especially Vignuzzi (1997); the data presented here come from Maiden (1988, 1991, 1995) (covering most of the varieties examined here), Camilli (1929) (an account of the dialect of Servigliano, Marche), Elwert (1958) (on the dialect of San Oreste, northern Lazio) Venturelli (1979) (on varieties spoken in Garfagnana, a region of north-western Tuscany). Moreover, two atlases of

Italian dialects, *AIS* (Jaberg & Jud 1928-1940) and *ALI*, include many relevant examples.

This vowel harmony copies all the features of the last vowel on the preceding unstressed vowels. On the basis of several phonetic and phonological arguments it will be argued that the penultimate vowel of proparoxytones, the most common target of this harmony, is a prosodically weak context, given the metrical structure of these dialects, which makes it a good target for assimilation. In some dialects harmony is active only if a liquid consonant intervenes between the trigger and target vowels: since liquids do not contrast for place, underspecification can explain this asymmetry. Since place specification of non-liquid consonants is requested in varieties which nevertheless display harmony unaffected by consonants, following Clements (2001) it will be argued that in this case some nodes of feature geometry are not active.

2. Data

Like Italian, all these dialects have a vowel system /i e ε a ɔ o u/ in stressed position. In unstressed vowels the contrast between low-mid /ε ɔ/ and high-mid /e o/ segments is neutralized: all mid vowels are realized as [e o], giving rise to alternations like [ˈvɛŋgo] ‘I come’ [veˈnete] ‘you (PL) come’, [ˈmɔro] ‘I die’ [moˈrete] ‘you (PL) die’ (examples from the dialect of Servigliano, Camilli 1929).

The harmony process analysed here consists in a regressive complete assimilation of all the post-tonic vowels: in other words, all the post-tonic vowels are a copy of the word-final vowel, thus creating post-tonic sequences of identical vowels.

(1a)	[ˈprɛdoko]		‘I preach’
	[ˈprediki] ¹		‘you preach’
	[ˈprɛdaka]		‘s/he preaches’
	[doˈmen:aka]	[doˈmen:eke]	‘Sunday/s’
	[ˈstɔm:uku]	[ˈstom:iki]	‘stomach/s’

1 The height alternations in some of the stressed vowels in (1a, b) are due to metaphony: roots like /met:/, /predik/ etc. are realized as [mit:], [predik] when the word-final vowel is /i u/.

	[^l frate]	[^l fratutu]	‘brother/brother-your’
(1b)	verb /met:i/ ‘put!’ plus clitics /lu/, /li/, /la/, /le/, /tʃi/)		
	[^l mit:ulu]		‘put it-MASC.’
	[^l mit:ili]		‘put them-MASC.’
	[^l met:ala]		‘put it-FEM.’
	[^l met:ele]		‘put them-FEM.’
	[^l mit:uʃulu]		‘put it-MASC. there’
	[^l met:atʃala]		‘put it-FEM. there’

(data from Servigliano, Camilli 1929)

The pattern exemplified in (1) is the most widespread. Yet, there are two important parameters of variation.

- 1 In dialects like Servigliano’s the word-final vowel features spread freely across any intervening consonant, but in a fairly high number of dialects the final vowel is copied on another vowel only if the intervocalic consonant is [l] or [r].
- 2 In a few dialects (in the Garfagnana area (Venturelli 1979) and in Southern Italy (Maiden 1988: 133)) there is no complete copy, but only assimilation of height: if the word-final vowel is [i] or [u] (sometimes only [i]), preceding post-tonic /e/ and /o/ raise to [i] and [u] respectively.

The two parameters can intersect: for example in some localities of Garfagnana mid vowels are raised by word-final /i u/ only if the intervening vowel is a liquid (2).

(2)	[^l kavolo]	[^l kavuli]	‘cabbage/s’
	[^l angelo]	[^l angili]	‘angel/s’
	[^l albero]	[^l albiri]	‘tree/s’

(Venturelli 1979: 104)

Moreover, even when (in some dialects) harmony is blocked when the consonant preceding the word-final vowel is not a liquid, the quality of the post-tonic vowels not subject to harmony is not free. They are not dependent on the final vowel, yet they cannot be any of the vowels which can occur in pretonic or word-final position ([i e a o u]): on the contrary, they are limited to [i] or [e], depending on the variety. The dialect of Umbertide is one of the most regular examples of this type of harmony: in (3a) post-tonic vowels harmonize, but in (3b) only [i] is found.

(3a)	[ko'kom:oro]	[ko'kom:iri]	‘watermelon/s’
	[^l sigoro]	[^l sigiri]	‘cigar/s’
	[^l skatala]	[^l skatele]	‘box/es’
	[^l fragwala]	[^l fragwele]	‘strawberry/es’
	[^l mit:u-lu]		‘put it-MASC.’
	[^l mit:i-li]		‘put them-MASC.’

(intervening liquid consonant)

(3b)	[^l sabito]	‘Saturday’
	[do'men:ika]	‘Sunday’
	[^l stəmbiko]	‘stomach’
	[^l kalitʃe]	‘goblet’
	[^l monika]	‘nun’

(intervening non-liquid consonant; cf. Italian [^lsabato], [^lstəmakɔ], [^lmonaka])

The identical restriction is found in other varieties as well: in San Oreste (Lazio) (Elwert 1958) the penultimate vowel of proparoxytones is always [i] (4a), except when the following consonant is a liquid, which allows total harmony (4b).

(4a)	[^l sab:itu]	It. [^l sabato]	‘Saturday’
	[^l skom:ida]	It. [^l skomoda]	‘uncomfortable-FEM.’
	[^l stom:iku]	It. [^l stomako]	‘stomach’
	[^l trapinu]	It. [^l trapano]	‘drill’

(intervening non-liquid consonant)

(4b)	[^l arbulu]	[^l arbili]	‘tree/s’
	[^l ɖɛnuru]	[^l ɖɛniri]	‘son-in-law/sons-in-law’
	[^l dukulu]		‘educate him’
	[^l dukala]		‘educate her’
	[^l dukele]		‘educate them-FEM.’
	[^l dukili]		‘educate them-MASC.’

(intervening liquid consonant)

As for the domain of harmony, in these dialects – as in most Romance languages – stress is restricted to a three-syllable window at the right edge of the word. But – again as in other Romance languages – enclitic particles attached to a word can violate this constraint, giving rise to a phonological word stressed on a syllable on the left of the antepenultimate: thus stress on the fourth – as the last two examples in (1b) – and even fifth syllable from last is attested. Since harmony assimilates all the post-tonic vowels to the last one, restrictions on stress position imply that up to three vowels can undergo assimilation, if there are clitics (although most examples are proparoxytones, in which only one vowel, the penultimate, is assimilated).

It must be pointed out that the regularity of this harmony shows a large degree of variation from variety to variety; while in several localities it is fully or nearly regular, in other areas there are several exceptions, and in still other areas it seems to be a relic of a past synchronic state, with only a few traces left. In general, influence of Italian seems to reduce this phenomenon. Besides, in varieties in which harmony is influenced by consonants, there can be sporadic traces of consonants other than liquids allowing assimilation.

3. Theoretical problems

These harmony processes raise various problems, which are summed up below:

1. cross-linguistically vowel harmony much more frequently goes from the root to the affixes rather than the other way round (see Hyman (2002) for a general discussion on directionality in vowel harmony); here the triggering vowel is in most cases an inflectional ending
2. the trigger of harmony usually is a ‘strong’ vowel: even if it is not within the root, it usually is a stressed vowel. On the contrary, here the triggering vowel is unstressed
3. a relation with prosodic structure seems to exist: harmony is limited to post-tonic vowels, thus its domain depends on word stress position. But what is the exact nature of this relation?
4. also the target of vowel harmony requires justification: as the trigger is usually ‘strong’, so the target is usually ‘weak’ (unstressed, in an affix, and so on). Why should the penultimate vowel of proparoxytones be weaker (up to undergoing total assimilation) than the final vowel, rather than the opposite? Put in other words, why does harmony go from right to left, rather than from left to right?
5. why in some varieties is harmony blocked by the intervocalic consonant, and why do only [r] and [l] never block harmony?

In the next paragraphs it will be argued that the reason for this harmony, its direction and domain, lie in the particular metrical status of proparoxytones in many Italian dialects, and that the penultimate vowel of proparoxytones is the prosodically weakest vowel in the word. Vowel copy undergone by this vowel is due to its reduction up to complete neutralization, as closely related varieties without vowel harmony show. These dialects thus provide an interesting example of metrically-dependent case of vowel harmony: they differ from the most usual instances in which the vowel carrying word stress is the trigger of harmony, but still require reference to metrical structure to be explained. A side effect of this proposal is motivating an account of

the metrical structure of (many) Italian dialects which differs in some respects from standard assumptions.

In the varieties which display harmony only if a liquid consonant intervenes, the transparency of liquids will be explained as an effect of absence of contrastive place features.

3.1. Previous analyses

While the phenomena under discussion are relatively well known, to our knowledge up to now few explicit explanations have been put forth for them. They have nonetheless been used as the empirical basis to support several theories.

Maiden (1991, 1995), on the basis of several processes of assimilation in pretonic and post-tonic vowels, including those discussed here, argues for a model of suprasegmental structure in Italian dialects: as the syllable is divided into a prenuclear, nuclear and postnuclear domain (onset, nucleus and coda respectively), so the word would be analysable into a pretonic, tonic and post-tonic constituent, each of them being a potential domain of phonological processes.

Clements & Hume (1995) cite data from the post-tonic harmony of Servigliano to support their model of feature geometry. To justify the assumption of a vocalic node grouping all vowel features, they write:

By grouping all place and aperture features of vocoids under the vocalic node, we predict that all these features should be able to spread freely across intervening consonants, even if they are specified for place features of their own. This is because consonants (at least those with no secondary articulations [...]) have no vocalic node that would block them.

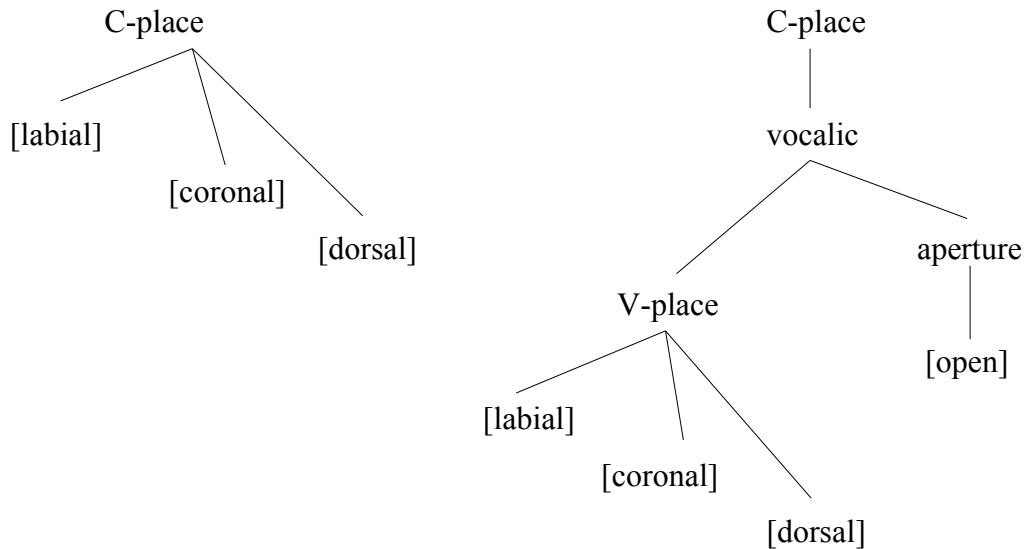
There is considerable evidence that this prediction is correct. An example can be cited from the Servigliano dialect of Italian.

[...] Crucial to the point at issue, [in the Servigliano dialect] all consonants are transparent, whatever their places and manners of articulation. (Clements & Hume 1995: 283-4)

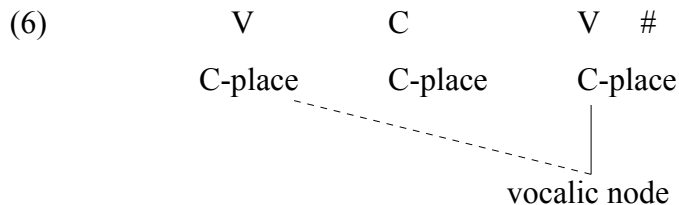
They represent vowel and consonant place features as below (all higher and some lower nodes omitted):

(5) Consonants

Vowels



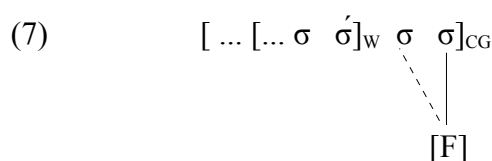
Servigliano vowel harmony according to Clements & Hume (1995) is represented in (6). Since consonants do not have a vocalic node, it is expected that they are transparent to harmony:



Obviously, this model is valid not only for Servigliano, but it is assumed to be universal: consonants *always* lack a vocalic node, so the prediction is that they can in no language block total harmony, which is just spreading of the vocalic node in that model.

Vogel (1997) adduces examples as in (1b) as evidence for the existence of the

Clitic Group in the phonological hierarchy (that is, a phonological constituent above the phonological word and below the phonological phrase, Nespor & Vogel 1986). Since the harmony trigger is the vowel of a clitic, and harmony targets the vowels of all clitics affixed to the phonological word, reference to the clitic group would be necessary at least to state the right border of harmony.



Nibert (1998) is interested mainly in Servigliano metaphony (see (1) and note 1), but she also provides a formal rule for vowel copying (Nibert 1998: 77).

3.1.1. Critical discussion of the previous proposals

A detailed discussion of all these proposals would lead us too far, since most base their arguments on other varieties as well, not discussed here, and their goals differ from ours. But since they try to give an explanation also to some of the questions raised in the preceding section, some remarks can be made.

As for Vogel (1997), reference to the Clitic Group appears to be unnecessary. Examples in (1a) show that whether zero, one or more clitics are present is immaterial to this harmony: it is active in proparoxytones like [stom:i:ki], where the domain of harmony includes no clitics, as in cliticised forms like ['mitulu] (domain formed by an inflectional vowel and a clitic) or ['dam:ulu] (domain formed by two clitics). Indeed the only relevant domain, from a descriptive point of view, are the post-tonic vowels, with no need to make reference to their being part of a clitic or not: whatever the syntactic status of the vowels found after the stressed vowel, they are identical. The syntactic status of the vowel need not be visible to harmony.

As for Clements & Hume (1995), harmonies in which consonants interact are a problem to feature geometry, or at least to models of feature geometry assuming that all vowel features are dominated by a vocalic node, which is absent in consonants.

They predict that consonant features should never interfere with processes spreading the vocalic node (that is, processes creating total vowel harmony, since they spread all vowel features), because this node is not possessed by consonants. This happens in dialects like that of Servigliano, which Clements & Hume (1995) mention, but dialects as Umbertide (3) or San Oreste (4) – which are otherwise similar to Servigliano – are a problem in this respect: all consonants but liquids block harmony, contrary to what predicted by that model of feature geometry. Given that model, no consonantal feature or node could intervene between two vocalic nodes.

Maiden (1991, 1995)'s proposal is interesting, but his definition pretonic and post-tonic vowels as prosodic domains leaves unanswered their relation with other well established prosodic constituents. For example the first syllable of a foot can carry word stress, hence would be in Maiden's nuclear domain, while the second syllable would be part of the post-tonic domain. A foot would be split into two prosodic domains, contrary to the 'Strict Layer Hypothesis' (Nespor & Vogel 1986) he assumes: constituents are exhaustively dominated by the immediately superordinate constituent, and constituents dominate only whole subordinate constituents.

Moreover, at least the post-tonic prosodic domain would not be able to represent cases of long distance harmonies in Italian dialects. In several varieties the penultimate vowel of proparoxytones is skipped by metaphony (e.g. in Ascrea, Lazio (Fanti 1938): the final vowel raises the tonic one, but leaves the intermediate unaffected, making reference to post-tonic vowels as the domain of metaphony problematic).

4. Metrical structure

More generally, all these analyses leave one question unanswered: why is the penultimate vowel of proparoxytones such a favourite target for assimilation, to the extent that all its content is a copy of another vowel?

Maiden (1988) suggests that several vowel harmonies in Italian dialects could be due to different levels of stress intensity, reflected in different degrees of neutralization (although in Maiden 1991 he partially rejects this idea). We want to

argue that in many Italian dialects the penultimate vowel of proparoxytones has a prosodically weak status, which has caused an extreme degree of reduction and neutralization, making this context extremely sensitive to the influence of adjacent vowels.

Processes of reduction in the penultimate vowel of proparoxytones had to be at work already in Vulgar Latin, causing syncope of this vowel; compare for example Classical Latin *vīrīdis* ‘green’ with *verde* in Spanish, Portuguese, Italian, etc. In the so-called *Appendix Probi* (a 3rd or 4th century A. D. prescriptive text containing a list of ‘erroneous’ forms, actually in most cases those undergoing diachronic change) we find *calda* listed as the ‘incorrect’ pronunciation of *cālīda* ‘hot-FEM.’, *veclus* for *vētūlus* ‘old’, etc.

In the dialects of Italy there are cases of syncope and reduction other than those common to many other Romance languages. It has already been pointed out (chapter 2) that in the dialects of north-western Italy syncope is very widespread, giving rise to consonant sequences otherwise unattested in Romance: e.g. Lat. *fēmīna* > [fumna] ‘woman’ in Piedmontese, *cūbītus* > [gumde] ‘elbow’ in Emiliano (Rohlf 1966: 171-173). In central and southern dialects the degree syncope is similar to that of Italian, Spanish, etc., but interestingly at least some of the dialects under discussion here reduction sporadically reached more words: e.g. [skɛltro] ‘skeleton’ (cf. It. [ˈskɛlɛtro]) in Umbertide.

Moreover, even if syncope was not a regular and pervasive process in north-eastern, central and southern Italy, in many varieties a similar phenomenon took place, that is neutralization of all vowel contrasts (fairly obviously, neutralization and syncope can be seen as two stages of the same reduction process, since syncope is simply the most radical form of reduction of a weak vowel).

In Friulan /a/ and /e/ were merged with /i/: *orphānu* > [ˈwarfɪn] ‘orphan’, **sabbāta* > [ˈsabide] ‘Saturday’, *stomāchu* > [ˈstomi] ‘stomach’, *iuvēne* > [ˈdʒovɪn] (Vanelli 2007: 54-55).

In Veroli (southern Lazio) only [ə] is possible in this position: [ˈmaɲːəte] ‘eat yourself!’ vs. [maɲːaˈtelːu] ‘eat it yourself!’ (Vignoli 1925: 18, 23). Also several

words of Tuscan, which show a non-etymological vowel [a] in proparoxytones (Lat. *iūvenis* ‘young’, *indīcus* ‘indigo dye’, but Tuscan (and Italian) [ˈdʒovane], [ˈindako], etc.), suggest a stage in its history when all post-tonic vowels of proparoxytones were reduced to this vowel (cf. (Tuttle 1974) for this proposal; vowels other than [a] would have been re-introduced later for various reasons). In a fairly high number of dialects in central Italy, only one vowel can be found in this position still today, but it is either [i] or [e] (in some dialects only one of the two vowels is always found, whereas in others both can be found in proparoxytones). Significantly, it happens in varieties without vowel harmony, but near those under discussion here: for example in Cortona, only a few kilometres from Umbertide, we find [ˈsabeto], [ˈskatela] (Italian [ˈsabato], [ˈskatola]). It is also significant that this neutralization is very frequent in varieties in which harmony interacts with consonants: only [i] or [e] are the vowels found in all the proparoxytones without a liquid as their last consonant (cf. (3b) and (4a) above, where the vowel is always [i]).

What is relevant here is the motivation for reduction in the penultimate vowel of proparoxytones.

It is uncontroversial that more prominent metrical positions allow a wider array of contrasts than less prominent ones; in numberless languages, contrasts possible in stressed vowels are neutralized in unstressed vowels.

As for the dialects of Italy, as reported in the first section, most of them contrast /e/, /o/ and /ɛ/, /ɔ/ in stressed vowels, but only [e o] are possible in unstressed position. If weaker metrical positions allow fewer contrasts, the extreme degree of neutralization in the penultimate vowel of proparoxytones should follow from a weak position in the metrical grid. But whether all unstressed vowels are equal, or there exist different degrees of stress and metrical prominence among the vowels which do not carry word stress is a controversial issue in the analysis of Italian dialects. Put in other words, does a difference between vowels bearing secondary stress and unstressed vowel exist? Is there a hierarchy of strength, other than stressed vowel > unstressed vowels?

Phonetically, even when all contrasts possible in the other unstressed vowels are

preserved, there seem to be a certain degree of phonetic reduction in the penultimate vowel of proparoxytones; data in Bertinetto (1981) and Farnetani & Kori (1990) indicate that in Italian this vowel is shorter than the final one (an average of 68.9 vs 92.6 ms in Bertinetto (1981: 254)). Only isolated words were tested, so the final vowel could be longer due a general tendency to phonetic word- and phrase-final lengthening, widespread among the world's languages (see *e.g.* Hayes 1995: 100). Anyway, two observations can be made: i.) the penultimate of proparoxytones is shorter than pretonic vowels too, and ii.) while word-final vowel lengthening is a cross-linguistically widespread tendency, it is notorious (among others D'Imperio & Rosenthal 1999: 6-7) that in Italian word-final stressed vowels are *shorter* than non final stressed vowels. It seems unlikely that unstressed vowels would behave differently.

If we look at the diachrony of Italian dialects, Tuscan for instance, we can observe cases of syncope also pretonically. The vowel immediately preceding word stress frequently underwent syncope (8), especially if it was not [a].

(8a)	<i>*longitanu</i>	> Tusc.	<i>lontano</i>	'far away'
	<i>computāre</i>	>	<i>contare</i>	'to count'
	<i>ululāre</i>	>	<i>urlare</i> ²	'to scream'
	<i>septimāna</i>	> Old Tus.	<i>settimana</i>	'week'

(examples from Rohlfs 1966: 178, Tuttle 1974: 452-453)

An unstressed vowel was lost or reduced to [a] in intertonic position, between a secondary stress and the word stress. In terms of metrical structure (see also chapter 2), a weak syllable between the word stress and a secondary stress was deleted or neutralized (9): the weak becomes weaker, a typologically common pattern (in some cases, so weak that it disappears).

2 The presence of [r] is due to an intermediate stage **urulare*, with consonant dissimilation: *urulare* 'to scream' is attested in Sardinian (Tuttle 1974: 453).

(9)

	×				×					
(×	×)		(×)				
(×	×)	(×	×)	>	×	(×	×)
lon	gi	ta	nu		lon	ta	no			

It is tempting to relate pretonic syncope and reduction to the post-tonic syncope and reduction in the penultimate vowel of proparoxytones: as the former process deleted a weak vowel immediately before word stress, the latter deleted a vowel immediately after word stress (or neutralized contrasts). Actually, in several dialects the latter appears to be a more regular and widespread process than the former. But since syncope took place in pretonic position when a secondary stress was present, for syncope in proparoxytones to be a mirror image of the other process, there should be a secondary stress on their last syllable.

Given a tendency towards trochaic strong/weak alternation of prominence in syllables in the dialects under discussion here (and in Italian), a secondary stress two syllables after the word stress is indeed what we would expect in proparoxytones. This is what Camilli (1965) and Lepschy & Lepschy (1981) report for Italian, while other authors are sceptical on the very existence of secondary stress.

As seen in Piedmontese, the possibility of monosyllabic words requires the adoption of degenerate feet. Since also the dialects analysed in this chapter allow stressed monosyllabic words, and their basic foot is the syllabic trochee, the metrical representation assigned to them is analogous to that proposed for Piedmontese. Syncope, neutralizations and vowel duration all suggest a representation of proparoxytones as below.

(10)

	×		
	(×		×)
...	(×	×	×)
...	σ́	σ	σ̀

If this representation is correct, syncope, reduction to schwa (as in Veroli, see above), neutralization of vowel contrasts would all be results of the prosodically weak status of the penultimate vowel of proparoxytones: being the weakest vowel, it would have undergone a more radical process of reduction than all the other vowels. In this process of reduction the step before syncope would have been complete loss of contrast, this short and weak vowel being unable to preserve phonemic distinctions. Given this situation, there are two logically possible developments: being completely unspecified, the vowel either has a default realization or receives its content from another vowel (since it is weak, it is expected that it is prone to assimilation). This is precisely the outcome found in the dialects examined: in some of them the penultimate vowel of proparoxytones is always [i] or [e], in the others is a copy of the following vowel. In varieties displaying vowel copying, a word like ['sigoro] 'cigar' has a completely unspecified penultimate vowel, which receives its content from the vowel place node of the following consonant.

(11) /'s i g Ø r o/ ['sigoro]

C V C V C V

o o o o o o root node

· · ·
· · ·
· · ·
| \ |
o o

Vowel Place node

The metrical representation of proparoxytones in (10) can explain why their penultimate vowel is the target of harmony. But why is the final vowel the trigger? After all, the preceding vowel carries word stress, thus being more prominent and stronger than the secondary stress of the final vowel. Recently Hyman (2002) has proposed an explanation of directionality asymmetries in vowel harmony as the result of conflict between two principles:

- i.) in affixes there is usually more vowel reduction than in roots, which favours left-to-right root-controlled harmony on suffixes
- ii.) generally, segmental assimilation is more frequently anticipatory than perseverative, which favours right-to-left suffix-controlled harmony

Together the two tendencies correctly predict that prefixes rarely trigger harmony on the root, whereas the opposite is frequent. As for suffixes, the first tendency seems to be stronger: “[s]uffix controlled V[owel]H[armony] is less frequent than root-control, presumably because roots do not as readily undergo reduction as do affixes” (Hyman 2002: 24). But if a root vowel undergoes more reduction than an affix vowel, the tendency towards anticipatory assimilation is no more overridden, and can be at work. This model predicts just the actual data found in the dialects discussed here: anticipatory assimilation from an affix vowel to a weak root vowel.

The solution proposed has so far taken into account only proparoxytones. When, due to the presence of one or more clitics, stress is before the antepenultimate syllable, two vowels are the subject to harmony (cf. the last two examples in (1b)). It is undisputed that in these words the final vowel carries a secondary stress (for Italian, among others Canepari 1977: 96). In this case there are two intertonic vowels, both weaker than the word-final vowel, instead of only one: spreading of the features of the final vowel to all the preceding weak segments is the expected outcome.

5. Liquid consonants

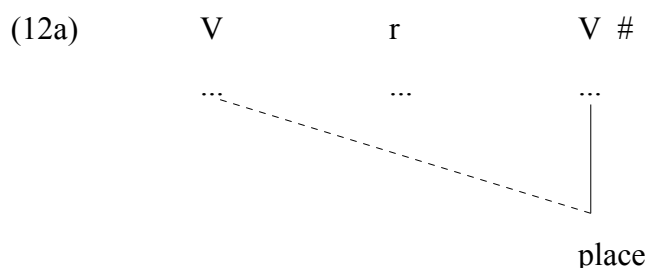
In several dialects the possibility of harmony depends on the presence of a liquid consonant. In this respect, it must be pointed out that most of the dialects examined here, unlike Italian, lack the consonant /ʎ/ in their inventory. This can hardly be casual: the northern border of the area where harmony is widespread is also the border between varieties with and without /ʎ/. South of this border, cognate words have a palatal semivowel [j(:)] instead of /ʎ/ (compare for instance Florentine [fiʎ:o] ‘son’ with Sevigliano [fij:o]).

Moreover, the Garfagnana area, in northern Tuscany, includes a small isolated

outcrop of the harmony process under discussion, and whereas in most part of Tuscany /ʎ/ contrasts with /l/, in some areas of Garfagnana /l/ is the only lateral. Interestingly, here a palatal stop is found instead of /ʎ/ (for instance ‘son’ is [fiʝo]), and some villages in the same area display vowel harmony which takes place only between liquid consonants.

Lack of /ʎ/ implies that in these dialects there are only two liquid consonants, /r/ and /l/, which are predictably alveolar. Phonologically, their place of articulation need not be specified, since does not distinguish them from other liquids; once they are specified for manner, this is enough to contrast them with respect to all other consonants. The latter on the contrary require also phonological specification of place: there are three nasals /n m ɲ/, two semivowels /j w/, several fricatives /s f ʃ .../, stops /t k p.../ and affricates /ts tʃ .../.

Thus liquid consonants, the only segments which in several dialects do not block vowel harmony, are also phonologically placeless. Since vowel copying boils down to a process which spreads all place features of a vowel, the hypothesis of underspecification of place features in liquids offers an explanation for their transparency: vocalic place features are not blocked by liquids because they do not have place features (12a), whereas all other consonants, which must be specified for place, possess a place node that interrupts spreading (12b). In a feature geometric model, an obvious way to encode it would be representing a place node on the same level for vowels and consonants.



A more specific potential counterargument to our analysis involves precisely the transparency of liquids. Steriade (1995) objects that transparency of liquids could depend on their being sonorants, rather than on the lack of distinctive place of articulation. She observes that there exist many languages in which transparent segment are only sonorants, and although /s z/ are frequently the only fricatives of a language, yet they do not behave as transparent with respect to assimilation rules: “the syndrome of liquid placelessness [...] has no connection to issues of distinctiveness: the liquid is transparent not because its place features are predictable from its stricture, but for different reasons, which remain still unclear” (Steriade 1995: 146).

If /s z/ do not contrast with other fricatives, they seem to contradict the principle of contrastive underspecification: their place of articulation is predictable from their stricture, thus it should be non contrastive and transparent, but it is not so in many languages. Nonetheless, we may wonder if this situation depends on the

groundlessness of contrastive underspecification, or rather on the special status of /s z/. In many respects /s z/ are exceptional: in complex onsets and codas with stops they cause the most frequent type of violation of sonority scale; frequently they are the only consonants which can occur as the first segment of complex onsets or as the last of complex codas; /t d/ apparently share their same place of articulation, but when they are changed to fricatives by some process, in numerous languages they become [θ ð], not [s z]. If /s z/ have an unclear phonological status, it could be questioned whether they are firm counterexamples to contrastive underspecification.

Besides, it must be pointed out that alternative explanations for transparency of liquids in the dialects discussed here are not obvious. All the other sonorants (that is, nasals and semivowels) block harmony, thus Steriade's hypothesis is not valid here.

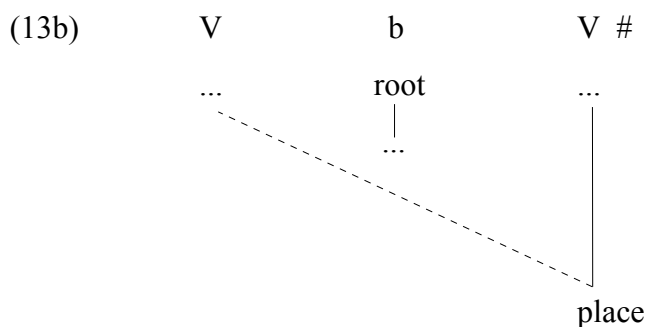
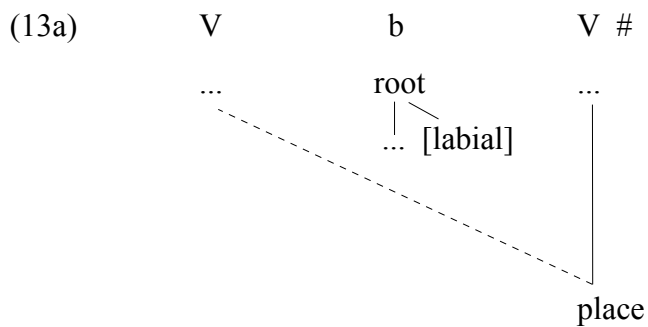
5.1. Feature activation

Also most of the other varieties, in which harmony takes place across any consonant, do not have /ʁ/ in their consonant inventory, thus their liquids have to be unspecified as well. Nonetheless, their harmony is not influenced by consonantal place of articulation at all. More generally, dialects with and without restrictions on the type of intervocalic consonant are in other respects very similar, and sometimes their areas are contiguous. But if in both groups of dialects place features are on the same tier, we should always have blocking of harmony with non liquid consonants; and if place features are not on the same tier, we should never have blocking. Since the difference cannot reside in difference between the phonologies of the two groups of dialects, some sort of parametric variation must be admitted to explain it.

Clements (2001) offers a proposal along this line: to account for problematic cases of transparency, he assumes that, while the geometrical organization of features is universal – with only one hierarchy of features and feature nodes available to all languages – a specific language is free to activate only a subset of this hierarchy. All constituents in the feature representations of a given language must be constituents of the universal feature hierarchy (Clements 2001: 98), but not all constituents of the universal feature hierarchy must be active in a given language. As a consequence,

only some features will be autosegmentalized, whereas the other features are simply bounded on the root node: only if a feature or feature node is necessary to capture a generalization is present in an autosegmental representation.

Adopting this view, we can still assume that feature geometric organization is universal, but only some of the dialects discussed above activate their place nodes in both consonants and vowels: in this case, represented in (12) above, place features of consonants – if present – block harmony. In the other dialects only vowels activate their place node, while place features in consonants remain attached to the root node (13). Even if consonantal features are present, when the place node of a vowel spreads it is not blocked, since the former are not projected on the autosegmental tier of the latter.



6. Conclusions

In previous analyses the penultimate vowel of proparoxytones was specified as the target of assimilation, but this descriptive observation, however expressed in formal

terms through directionality of rules and/or statement of prosodic domains, did not receive a real explanation. Once further phonetic and phonological phenomena of proparoxytones were taken into account, a different picture emerged, suggesting a weak prosodic status for this position. This makes it a good target, and a universal tendency towards anticipatory assimilation justifies the leftwards direction of harmony.

Blocking of harmony by non liquid consonants in several dialects was another major problem. But since liquids are the only two consonants without contrastive place features, resort to underspecification can explain their transparency. On the other hand, also dialects without consonantal interference on harmony require place specification in all the non-liquid consonants: assuming a relativized notion of universal feature geometry, their consonant place specifications do not interact with vowel features.

CHAPTER 4

METAPHONY AS LOSS OF CONTRAST

1. Introduction

Metaphony in Italian dialects has been the object of numerous studies concerning its origin, its development, its interaction with morphology, its phonological representation, to name just some of the relevant issues. The goal of this chapter investigates one of the problems raised by the last of these issues: the characterization of what phonological features best represent metaphony. Although only a single aspect of one of the various dimensions of metaphony, this problem is anything but simple, especially if the answer to it aims at offering a unified account of metaphony, that gives a general representation being able to encompass the seemingly unlimited variation in metaphonic dialects. For that reason the proposal put forward here is tentative, and the details have still to be checked up against the full array of data.

However, our representation does not simply adopt a specific type of features, but has consequences on the very explanation of metaphony as well. One fundamental tenet, shared by virtually all authors, is that it is an articulatorily-based assimilatory process: non-high stressed vowels become high when the tongue position of the word-final vowel is high. Instead we want to argue that, first and foremost, it is a form of neutralization. Moreover, this line of reasoning will be extended to the analysis of other phenomena, traditionally described as assimilations, which in some Italian dialects take place in pretonic vowels.

2. General properties of metaphony

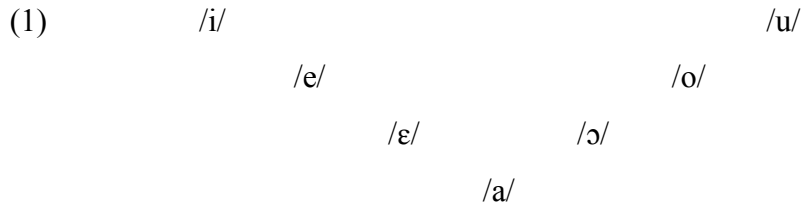
Summing up its basic features in a very concise and theoretically neutral way, metaphony can be defined as a process raising the stressed vowel of a word when its unstressed word-final vowel is high ([i] or [u]). However, this definition is deceptively simple. Metaphony has various parameters of variation (see Maiden (1991), Maiden & Savoia (1997) for a general overview of metaphonic systems). The variability includes:

1. the number and type of affected vowels: in (almost) all dialects displaying metaphony, high-mid vowels are raised to high, but many dialects raise also the low-mid vowels (and a few dialects raise only *only* them). A small group of dialects raise all vowels, including /a/
2. its output: the raising of a high-mid vowel always yields a high vowel (/e/ > [i], /o/ > [u]), but the output of low-mid vowels varies according to the dialect: in some dialects it is a high-mid vowel, in others is a rising diphthong (/ɛ/ > [e], [jɛ], [je]; /ɔ/ > [o], [wɔ], [wo]); /a/, if raised, is realized as [æ] or [ɛ] (in a few Abruzzese dialects even as [i])
3. the number and type of trigger vowels: if metaphony is present /i/ is always a trigger, but /u/ is a worse ‘trigger’ (there are more exceptions, or a more restricted application when /u/ is the word-final vowel, and so on). Besides, several dialects underwent processes of reduction in unstressed vowels, for example merging all vowels save /a/ to schwa, thus nowadays in many metaphonic systems the word-final vowels which trigger(ed) metaphony have become [ə].

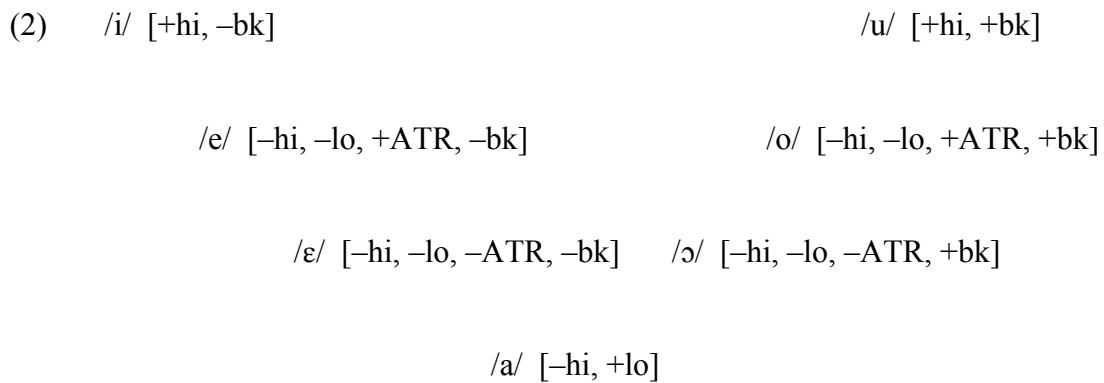
2.1. Problems in the representation of metaphony

Most metaphonic dialects have the vowel system in (1) (apart from the metaphonic dialects of southern Calabria, eastern Sicily, and part of Salento, which have a five-vowel system, without high-mid vowels; northern dialects which display(ed) metaphony may have other vowels as well (/y/, for example), or lack the contrast

between high-mid and low-mid vowels, but these differences are not relevant to our discussion).

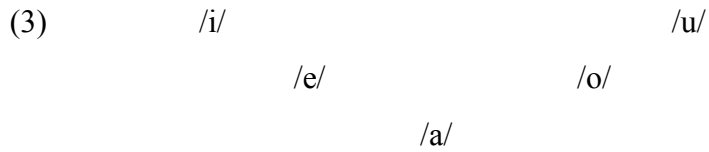


The most usual interpretation¹ of (1) in terms of phonological features is in (2) (some authors use [tense] instead of [ATR]).



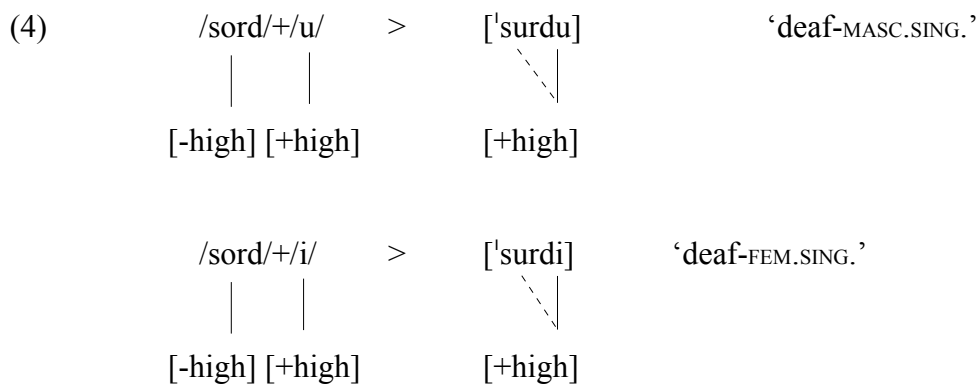
In unstressed vowels the contrast between high-mid and low-mid vowels is always lost. This means that the inventory of word-final unstressed vowels, which are the trigger of metaphony, is reduced to three levels of height, as in (3) (actually, many dialects do not display either [o] or [u] word-finally; southern Calabria, eastern Sicily, and Salento have only [a i u], and, as mentioned above, in some dialects there are radical processes of vowel reduction in unstressed word-final position).

¹ Kaze (1991: 165) assumes that /ɛ/ and /ɔ/ are [+low] as /a/, thus needing only three levels of height; cf. Calabrese (1995: 399 n21) for reasons why this solution would be phonetically and phonologically problematic).



Virtually all authors see metaphony as an anticipatory assimilatory process. Accepting this view, the only feature value the triggering vowels /i/ and /u/ share is [+high]: it must be the spreading feature.

Whatever the formalism adopted, the representation of metaphony is straightforward when only high-mid vowels are raised, as in (4): they change from [–high] to [+high].



(Ascrea, Lazio; Maiden 1991: 161)

When also lower vowels, especially low-mid ones, raise, the simple representation in (4) is no more sufficient. According to (2), input low-mid vowels are [–high, –ATR], and output vowels are high-mid [–high, +ATR] or diphthongs. Although (4) assumes spreading of [+high], low-mid vowels change the value of [ATR], whereas [–high] remains unchanged.

- (5)
- | | | | |
|---------------------|---|------------------------------|------------------------|
| /bbell/ + /u/ | > | [^h b : e l : u] | ‘beautiful-MASC.SING.’ |
| | | | |
| [-ATR] [+high] | | [-ATR] [+high] | |
-
- | | | | |
|---------------|---|-----------------------|-----------------------|
| /bbell/ + /i/ | > | [^h b:eli] | ‘beautiful-FEM.SING.’ |
|---------------|---|-----------------------|-----------------------|

(Ascrea, Lazio; Maiden 1991: 161)

Raising of /a/ to a low-mid front vowel, although restricted to few areas (e.g. Ischia: ['kanə] 'dog' vs. ['kenə] 'dogs' (Savoia & Maiden 1997: 19)), is troublesome as well: a [+low, –high] vowel becomes [–low, –high], while the trigger is (or rather was, in this specific case: **cani*) still [+high].

If only low-mid vowels raise (6), the problem is even more radical, because no output vowel has the [+high] feature of the word-final vowel. Yet, a few dialects displaying this type of metaphony do exist.

- | | | | | |
|-----|--------------------------|------------|--------------------------|----------------|
| (6) | [mar ¹ tɛl:o] | ‘hammer’ | [mar ¹ tɛl:i] | ‘hammer.pl.’ |
| | [om ¹ bɾɛl:o] | ‘umbrella’ | [om ¹ bɾɛli] | ‘umbrella.pl.’ |
| | [¹ dente] | ‘tooth’ | [¹ denti] | ‘teeth’ |

(Garfagnana area, northern Tuscany; Venturelli 1979: 101²)

Also the diphthongization of low-mid vowels (7b) is an unexpected result, if metaphony is simply an assimilation.

2 But /ɔ/ is not raised.

(7a)		Sing	Plur	
	Fem	[¹ nera] * <i>nera</i>	[¹ nerə] * <i>nerē</i>	‘black’
	Masc	[¹ nirə] * <i>neru</i>	[¹ nirə] * <i>neri</i>	
(7b)	Fem	[¹ bɔna] * <i>bɔna</i>	[¹ bɔnə] * <i>bɔne</i>	‘good’
	Masc	[¹ bwuonə] * <i>bɔnu</i>	[¹ bwuonə] * <i>bɔni</i>	

(Arpino, Lazio, Maiden 1991, 165. Here neutralization of all word-final vowels – save /a/ – to [ə] has made metaphony synchronically opaque)

3. Metaphony and feature theory

As evident from the data in the preceding section, if metaphony is a raising process spreading [+high] the most problematic case is the output of low-mid vowels.

3.1. Calabrese’s proposal

To solve the problem raised by low-mid vowels, the the most influential proposal has been Andrea Calabrese’s idea of a filter, with both constraints and repair rules. Metaphonic dialects lack [+high, –ATR] vowels, motivating a constraint against the marked feature configuration *[+high, –ATR]. Since a change in the value of the feature [high] in [–high, –ATR] vowels would create such an illicit configuration, the constraint is activated, and triggers a repair strategy fixing the ill-formed vowel, through processes of negation, fission, delinking of features, etc. (see for example Calabrese 1985, 1995; recent OT proposals, like Walker 2005, 2006 still include the same constraint *[+high, –ATR]).

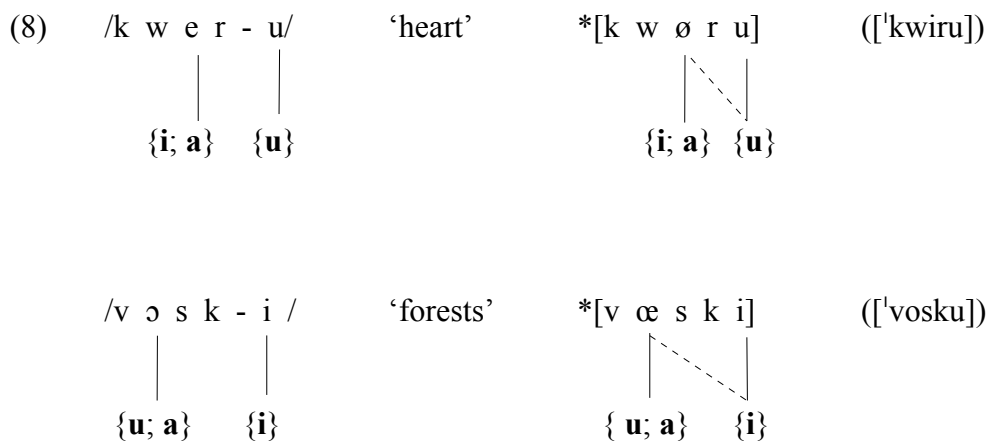
A single rule spreading [+high] thus applies to all vowels targeted by metaphony, and – at first sight unexpected – [–high] output vowels are due to a repair mechanism.

3.2. Previous Dependency Phonology analyses

If the feature [high] encounters problems, the situation for the feature system adopted in the preceding chapters seems to be even more dramatic: since metaphony is a

raising process, triggered by high vowels, this system simply cannot represent it. The only feature encoding height is **a**, which represents openness; high vowels do not form a natural class within this system, at least a natural class characterized by a positive property.

Indeed, metaphony has been brought forward as a counterexample against the feature system of Dependency Phonology (*e.g.* Kenstowicz 1990: 79-83, Kaze 1991, Clements & Hume 1995: 282). If the features of /i/ and /u/ trigger metaphony and spread their features to the stressed vowel, and they have to be represented only as **i** and **u** respectively, we should expect rounding when the word-final vowel is /u/, and fronting when it is /i/, instead of raising (Kaze 1991).



(adapted from Kaze 1991: 168; data from the dialect of Calvello)

Kaze’s argument is indisputable. If metaphony is an assimilation process triggered by /i/ and /u/, by definition one or more features of them have to spread. In an account based on Dependency Phonology features³ the only features of /i/ and /u/ are **i** and **u** respectively, and they cannot cause (only) raising.

Two my knowledge, two different attempts to circumvent the problem, Durand (1991) and Staun (2003), have been put forth.

3 It must be pointed out that the problem is the use of openness as the only property to represent vowel height, not the use of unary features. Indeed, since high vowels raise the stressed vowels, but non-high vowels do not lower them, a unary feature [high] would be at least as satisfactory as [±high].

Staun (2003) suggests that the negation of **a**, $\sim\mathbf{a}$, spreads. $\sim\mathbf{a}$ represents “closed tongue body constriction” (Staun 2003: 14) (an analogous proposal also in Maiden (1991: 138-141)): since high vowels are $\sim\mathbf{a}$, this property would spread to vowels having **a**, and would delete it.

Yet, the possibility of negating unary features is formally dubious, as is the idea that the *absence* of a property can spread: “[this] formulation of metaphony [...] is at variance with the widely accepted idea that assimilation processes should be analyzed as spreading of autosegments” (Calabrese 1992: 483, with regard to Maiden 1991)). It is true that feature negation has been used by several proponents of Dependency Phonology (*e.g.* Anderson & Ewen 1987), but it seems to clash with the very nature of unary features:

However, quite clearly it is somehow counterintuitive to allow unary components to be negated. Negating a value presupposes that the nature of the primitive is such that it can assume more than one value and it is precisely the nature of the unary component that it can have one value when it is present or be absent. This is the reason that we have reservations about the account offered within a dependency-based representation. (Staun 2003: 46)

Besides, one of the fundamental empirical advantages of unary over binary features is that the lack of evidence for a binary feature value is directly accounted for as absence of that feature: if there are no convincing examples of processes referring to [–nasal] or [–round], a feature theory which admits only [nasal] and [round] does not overgenerate.

But if $\sim\mathbf{a}$ is possible, negation is similar to the minus value in binary features, and height is represented by an equipollent rather than privative feature: what does formally prevent us from negating all the other features, thus predicting processes such as delabialization triggered by high front vowels or denasalization triggered by obstruents? “[I]ntroduction of the negator diminishes the explanatory force of the overall model since it denies the basic postulate of monovalency. For example, nothing prevents us from writing $\{\sim\mathbf{u}\}$ to designate [–round]” (Kenstowicz 1990: 83).

Also Durand (1990) mentions the use of $\sim\mathbf{a}$, but offers also another solution in the framework of Dependency Phonology to save Calabrese's idea of a constraint $*[+\text{high}, -\text{ATR}]$. Assuming that the vowel system of metaphonic dialects is as in (9), he argues that the spreading feature is $[\text{ATR}]$ (or \mathbf{ATR} in our notation). The presence of a constraint $*\{\mathbf{a}, \mathbf{atr}\}$ explains the output of low-mid vowels (diphthongs or high mid vowels).

- (9)
- | | |
|--|---------------------------------------|
| $/i/ \{\mathbf{i}, \mathbf{atr}\}$ | $/u/ \{\mathbf{u}, \mathbf{atr}\}$ |
| $/e/ \{\mathbf{i}\}$ | $/o/ \{\mathbf{u}\}$ |
| $/\varepsilon/ \{\mathbf{i}, \mathbf{a}\}$ | $/\omega/ \{\mathbf{u}, \mathbf{a}\}$ |
| $/a/ \{\mathbf{a}\}$ | |

Also this proposal is problematic in several respects: first, the way segments are decomposed into features becomes rather arbitrary (under this analysis $/e/$ would more purely palatal than $/i/$, for example), is different from the most natural representation of seven-vowel systems in Dependency Phonology (see (10)), and loses several generalizations about neutralizations and assimilations in Italian dialects the latter captures.

Moreover, it is unclear how metaphonization of low-mid vowels should work: why diphthongization of $/\varepsilon/$, which would create a $\{\mathbf{a}, \mathbf{i}, \mathbf{atr}\}$ vowel, should be realized as $[e]$ or $[j\varepsilon]$? Diphthongization at least needs a fairly complex mechanism, more intricate than Calabrese's.

To conclude, while both solutions could “work” technically, they require a weakening of the theory or *ad hoc* assumptions. Besides, both try to somehow mirror solutions with binary features: $\sim\mathbf{a}$ instead of $[\text{+high}]$, monovalent \mathbf{atr} to save Calabrese's idea, which is based on the constraint $*[+\text{high}, -\text{ATR}]$. But if Dependency Phonology implies a radically different feature system – without $[\text{high}]$, and without having recourse to $[\text{ATR}]$ to represent the contrast between high-mid and low-mid vowels (see again (10)) – a more radical yet, I believe, more consistent move is departing from the assumption that metaphony is a raising phenomena, that $[\text{ATR}]$

is motivated in metaphonic dialects, and trying to explore the consequences of these two assumptions.

4. Problems with [ATR]

Adopting binary features, [ATR] – as shown in (2) – is a necessary feature to represent a vowel system with four vowel heights, since [low] and [high] alone can represent three levels of height at most. Without it, /ε/ would be identical to /e/, /ɔ/ to /o/.

But the status of [ATR] in the representation of the vowel systems of Italian dialects is rather different from in the status it has in other languages for which it is well motivated:

1a) In languages having all (or most) vowels contrasting for [ATR] (many Bantu languages, for instance), the changes in tongue height are small in comparison with the expansion that occurs in the pharyngeal region (Ladefoged & Maddieson (1996: 304). Tongue root retraction appears to be a separate dimension from height.

1b) In Italian dialects /ε ɔ/ are significantly lower than /e o/, thus position of tongue root is never independent of tongue height.

2a) Languages as the members of the Bantu family usually have two sets of vowels differing only in [ATR]: for example in Akan (a Kwa language) /e i o u/ contrast with /ε ɪ ɔ ʊ/, /a/ being the only vowel without a [+ATR] counterpart.

2b) In Italian dialects supposed [ATR] is contrastive only for mid vowels.

3a) Advancement of tongue root is accompanied by lowering of the larynx as well: more appropriately, [ATR] could be described as expansion of the pharyngeal cavity (Ladefoged & Maddieson 1996: 300).

3b) Lowering of the larynx has never been reported for supposed [ATR] vowels in Italian dialects.

4a) [–ATR] back vowels are more retracted than their [+ATR] counterpart.

4b) Italian /ε ɔ/ are not more retracted than /e o/.

5) Diachronic and synchronic phonology of Italian dialects does not offer positive evidence for [ATR]: many processes refer to the other vowel features, no one to supposed [ATR] (save for its neutralization in unstressed vowels).

Some authors adopt [tense] instead of [ATR]. Leaving aside their differences, which makes interchangeability between them difficult (see *e.g.* Stewart (1967)), arguments in 2) and 5) are valid for [tense] as well. Moreover, usually lax vowels are shorter than tense vowels, whereas in Italian dialects /ε ɔ/ are not shorter than /e o/.

On a more general level, the very existence of [tense] has been questioned. Whereas [ATR] is strongly motivated in some languages, it has been claimed (*e.g.* Carr (2005) for a recent discussion) that [tense] is not necessary, and phonetic tenseness and laxness of vowels are predictable from other parameters, like vowel length.

4.1. An alternative representation of vowel height

The most natural representation within Dependency Phonology of the vowel system in (1) is given in (10).

$$\begin{array}{rcccl}
 (10) & \{\mathbf{i}\} & i & & u & \{\mathbf{u}\} \\
 & \{\mathbf{i} \rightarrow \mathbf{a}\} & e & & o & \{\mathbf{u} \rightarrow \mathbf{a}\} \\
 & & \{\mathbf{a} \rightarrow \mathbf{i}\} & \varepsilon & \text{ɔ} & \{\mathbf{a} \rightarrow \mathbf{u}\} \\
 & & & & \mathbf{a} & \{\mathbf{a}\}
 \end{array}$$

In this way vowel height can be represented without recurring to [ATR]. The contrast between low-mid and high-mid vowels does not depend on the presence vs. absence of feature, but on the relative prominence of **a** and **i**.

Moreover, low-mid and high-mid vowels turn out to be the most complex

segments (they have an asymmetric relation among their features instead of simple co-occurrence). Neutralizations can be seen as loss, simplification within segments: (10) predicts that, in case of neutralization, the contrast between low-mid and high-mid vowels should be the first to be lost. This is confirmed by the alternations between stressed and unstressed vowels, since the latter lose this contrast.

5. Metaphony as neutralization

If the representation in (10) is adopted, the problems raised by the use of [ATR] (or [tense]), disappear; indeed, they originate from the use of a feature which refers to tongue root position to encode what appear to be height distinctions (and this choice in its turn originates from the impossibility to represent all height contrasts only with [high] and [low]). Instead, vowel height is seen as a uniform dimension, rather than as the result of the combination of several features, since its various levels all depend on the relative prominence of a single feature, **a**.

Although it can be argued (10) has a several merits over (2), still the problem in the representation of metaphony remains. Adopting the **a i u** features, metaphony cannot be seen as the spreading of a feature. But if (10) offers some advantages in other respects, it is worth exploring whether an alternative account of metaphony is viable which is based on such features.

When compared to classical cases of vowel harmony, like that of Turkish, metaphony displays one fundamental difference: in a language like Turkish one is forced to assume that vowels undergoing harmony are never underlyingly specified for the harmonic feature(s), and receive it (them) from the trigger vowel: a suffix vowel is back or front, rounded or unrounded only depending on the final vowel of the root (see chapter 5, § 2.).

In metaphony, on the contrary, the target vowel has its own underlying specification for the harmonic feature, which is deleted only when the appropriate target vowel is present. Thus the stressed vowel of ['bbelli] (5) has to derive from a low-mid vowel, otherwise the stressed vowel in ['bbella] would be unexplainable: the underlying form is /bbell/. Clearly we cannot say that [ɛ] in ['bbella] is due to

In dialects displaying metaphony, the full array of vowel contrasts is possible in stressed position only when the final vowel includes the features **a** (vowels /a e o/, 11a), whereas stressed /e/ and /o/ merges with /i/ and /u/ if the word-final vowel lacks **a** (vowels /i u/, 11b). It means that in the latter case the stressed vowel licenses a reduced number of contrasts, suppressing the most complex possibility (contrast between high-mid and low-mid vowels): only three levels of height are possible, /a/, /e o/ and /i u/.

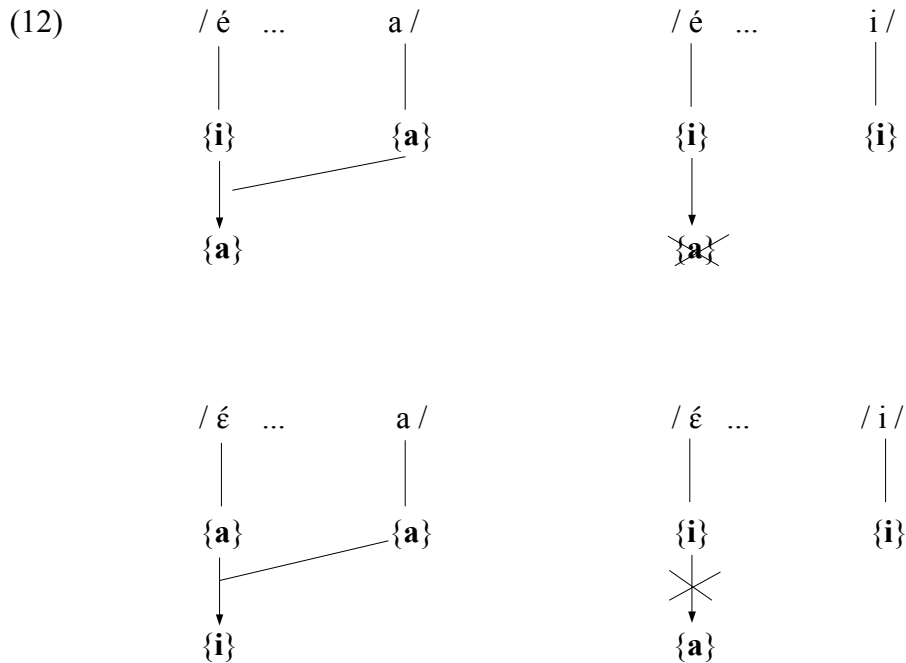
neutralization process.

Significantly for this approach, metaphony causes the impossibility of contrasts between high-mid and low-mid vowels: as mentioned above, this representation predicts that it is the most marked contrast in a vowel system like that in (1), and should be the first to be lost in case of simplification.

Empirically, contrasts vary in their subtlety: the difference between *e.g.* /a/ and /i/ is much greater than between /ɛ/ and /e/, or /e/ and /i/. This state of affairs is captured by the notation in (10): the difference between {**a**} and {**i**} is based on two different features, while the difference between {**i**; **a**} and {**a**; **i**} depends only on the relative structural role of the same features (head vs. dependent). Also the contrast between high-mid and mid vowels relies on a minimal difference: the presence (in {**i**; **a**}) vs. absence (in {**i**}) of the feature **a** in dependent position, which is the less prominent one.

The situation of dialects displaying metaphony can be characterized as a need to enhance the perceptibility of the feature **a** when it is involved into the subtlest contrasts. Formally, we say that to preserve its role of head or dependent into a stressed vowel, **a** has to be shared with the other vowel of the foot it belongs to; otherwise, its role is lost. When it is head (in /ɛ/ or /ɔ/), losing its prominent status causes the other feature (**i** or **u**) to pass from dependent to the same prominence of **a**: thus the vowel is realized as mid. When **a** is the dependent feature (in /e/ or /o/), the loss of its dependent status simply causes its complete loss: there cannot be something weaker than a dependent feature. Also in this case, however, what is lost is not directly the feature (there is no spreading of the absence of a property), but its role in the relation with the other feature of the stressed vowel, a role which becomes too weak. On the other hand, if **a** is present also in the word-final vowel, its role in the stressed vowel is more perceptible.

This proposal entails that if **a** is not present word-finally (that is, if the word-final vowel is high), it cannot enter into contrasts based on head-dependent relations: only the simple combinations {**a**, **i**} and {**a**, **u**} are allowed for mid vowels, and the contrast between low-mid and high-mid vowels is neutralized.



Under this light, dialects ‘raising’ only high-mid vowels, or low-mid vowels as well are just two different phonetic implementations of the same loss of contrast (for instance $\{a, i\}$ is $[e]$ or $[\epsilon]$ respectively), and ‘raising’ of low-mid vowels is no more a problem, as it was with $[+high]$.

A few dialects change low-mid vowels into high-mid, but high-mid vowels remain unaffected (6): it is unexpected as the result of assimilation to $[+high]$, but it is simply another way of neutralizing the contrast between low-mid and high-mid vowels. The same contrast is lost, only the input vowels involved change.

5.1. Sonority and neutralization

Since in this account it is the absence of **a** that causes neutralization, it has to be explained why this specific feature has such an effect. Loss of stress is a favourite context for vowel neutralization, but here we have to do with a segmental property instead.

It must be pointed out that from an articulatory point of view **a** represents openness, but from an acoustic point of view it is sonority (see chapter 2, § 4.2.1): $[a]$ is the most sonorous vowel (and therefore the most sonorous segment), whereas the

more a vowel is high the more its sonority decreases. Now, stress and sonority are not two unrelated phenomena. Stressed vowels are more sonorous than unstressed vowels, and in several languages stress is sensitive to vowel quality: more sonorous vowels (mid and low) tend to attract stress from less sonorous (high and centralized) vowels (for example stress in Mordvin falls on the leftmost of the vowels [e, o, æ, a], avoiding [i, u, ə] (Kenstowicz 1996); on this topic, see also de Lacy (2005)).

Given this correlation, it should be expected that, as stress increases perceptibility of contrasts, so does sonority. Conversely, as destressing causes neutralization, so sonority reduction (that is, reduction of **a**) should be associated with reduction of contrasts. In metaphony a contrast is more easily perceptible if it has a wider domain.

5.2. Open problems

As mentioned in § 2., in some dialects also /a/ is raised; this output cannot be explained as reduction of contrasts. But it happens in few dialects, and usually the vowel is not raised up to [ɛ]: it can be seen as a contextual variant of /a/, articulatorily influenced only at the phonetic level by the higher position of the tongue.

Diphthongization of low-mid vowels instead of raising is much more troublesome. Also in this case there is a reduction of contrasts, since high-mid vowels become high, but the neutralization hypothesis has nothing to say about the presence of a glide [j] or [w], which is unexpected. For the time being, our proposal is restricted to dialects without diphthongization.

6. Appendix: pretonic harmonies as reduction of contrasts

Neutralizations of vowel contrasts due to the quality of the stressed vowel (more complex contrasts are suppressed when one vowel does not contain **a**) take place in pretonic position in some Italian dialects: the only variety we will investigate, adopting a solution analogous to the one put forth above for metaphony, is that of Servigliano (Camilli 1929; see Maiden 1988, 1995 examples from other dialects).

The dialect of Servigliano (province of Ascoli) has a seven-vowel system /a, e, ɛ, i, o, ɔ, u/ in stressed vowels, whereas unstressed vowels are /a e i o u/. However, the

CHAPTER 5

TURKISH VOWEL HARMONY, CONSONANTS AND SYLLABLES

1. Introduction

One of the most studied and discussed cases of vowel harmony is that of Turkish; indeed, in many handbooks of phonology it is presented as a prototypical example of this phenomenon. Nevertheless, there remain some issues that have not yet received a fully satisfactory analysis, and still merit discussion.

The problem we want to focus on here is the way some consonants (velar stops and laterals) interfere with Turkish vowel harmony. This interference is problematic for at least three reasons:

1. usually vowel harmony, as its very name implies, is a process involving only vowels, thus the relevance of consonants needs an explanation
2. Turkish consonant harmony seems to behave, at least in part, unlike vowel harmony with regard to its directionality and domain
3. in some cases consonants seem to trigger vowel harmony in the following vowels, behaving as they were opaque vowels. This goes against the intuitive idea that only vowels trigger vowel harmony

The solution we will propose relies on the idea that vowel harmony is a relation among syllable nodes rather than directly among vowels. This proposal easily

accounts for the participation of consonants in vowel harmony, and for the direction of their assimilation. At first sight, this idea seems to have much more difficulty in explaining why consonants can in some cases trigger vowel harmony, since they are not the heads of syllable nodes. But we will argue that, at a closer scrutiny, this phenomenon can be explained within the framework adopted here, once it is related to Turkish syllable structure and epenthesis.

2. Properties of Turkish vowel harmony

In this section we will sketch some basic properties of Turkish vowel harmony, including cases of consonantal interference (data from Waterson 1956, Underhill 1976, Yavaş 1980, Clements & Sezer 1982, van der Hulst & van de Weijer 1991, Comrie 1997, Csató & Johanson 1998), before discussing in § 3 the problems they raise.

Turkish vowel inventory consists of eight vowels: /a e i ø y u a o u/. They are usually arranged according to three phonological dimensions, that is height, roundness and fronting.

(1)	[+ b a c k]		[– b a c k]	
	[–round] [+round]		[–round] [+round]	
[+high]	u	u	i	y
[–high]	a	o	e	ø

In Turkish there are two distinct types of harmony, one involving the front/back dimension (palatal harmony) and the other involving the rounded/unrounded dimension (labial harmony). In a Turkish word any of the eight vowels in (1) can occur in the first syllable, but the following root vowels (at least in the native lexicon) are subject to harmony: with regard to palatal harmony, they all agree in frontness with the first vowel, the vowels in a root thus being all either front (/e ø i y/) or back (/a o u u/).

(2)	[kuru]	‘dry’	[g ^j ønyɫ ^j]	‘heart’
	[buurak]	‘leave’	[k ^j edi]	‘cat’
	[kadun]	‘woman’	[k ^j ysyɫ ^j y]	‘annoyed’
	[økyz]	‘ox’	[g ^j ibi]	‘like’

Labial harmony is more restricted: it is triggered by any word-initial rounded vowel, but its target is limited to high vowels; labial harmony stops when spreading of [+round] encounters a low vowel. This means that non word-initial low vowels are always unrounded, as the examples in (3) show, and /o/ and /ø/ can be found only word-initially¹.

(3)	[oda]	‘room’
	[øjuntʃak]	‘play, thing’

Moreover, when suffixes are added to a root (it is useful to bear in mind that Turkish is an exclusively suffixing language), also the suffix vowels agree with the harmonic features of the root: they all are either back or front, while all the high vowels are rounded if the last vowel of the root is round (4a) (again, labial harmony stops when the last root vowel and high suffix vowels are separated by low vowels; cf. the difference in the realization of the suffix *-ImIz* in (4b)).

(4a)	<i>nom. sing.</i>	<i>gen. sing.</i>
‘rope’	[ip]	[ip-in]
‘girl’	[kuuz]	[kuuz-un]
‘face’	[jyz]	[jyz-yn]
‘stamp’	[puɫ]	[puɫ-un]
‘hand’	[eɫ ^j]	[eɫ ^j -in]
‘stalk’	[sap]	[sap-un]
‘village’	[k ^j øj]	[k ^j øj-yn]

¹ Since consonantal interference involves only palatal harmony, which palatalizes velar stops and laterals, we will not discuss labial harmony any further.

- (4b) [gⁱyn-ymyz] ‘our day’
 [gⁱyn-ⁱer-imiz] ‘our days’

Actually, it is debated whether harmony is still an active process within roots: the borrowing of a very high number of words from Arabic, Persian, French, Greek, English and other languages has caused the introduction of many disharmonic roots. When suffixes are added to such roots vowel harmony is totally productive: the suffix vowels behave just as after native roots, displaying harmonic alternations, in agreement with the last vowel of the root (5).

- | | | |
|-----------|------------------------|---------------------------|
| (5) | <i>nom. sing.</i> | <i>gen. sing.</i> |
| ‘book’ | [k ⁱ itap] | [ⁱ kita:b-un] |
| ‘microbe’ | [mik ⁱ rop] | [mik ⁱ rop-un] |
| ‘friend’ | [muhip] | [muhip-in] |
| ‘suburb’ | [ban ⁱ ijø] | [ban ⁱ ijø-yn] |

However, root-internally usually loanwords are not adapted to vowel harmony (with the exceptions of epenthetic vowels, as we will see in § 2.2), leading *e.g.* Clements & Sezer (1982) to conclude that harmony is no longer active in roots. Nevertheless some authors (Goldsmith 1990: 304-309, van der Hulst & van de Weijer 1991: 44-45), on the basis of certain restrictions to a completely free co-occurrence of disharmonic vowels, argue that harmony still holds in Turkish roots. Anyway this issue, important as it is, has no direct bearing on the problems under discussion here, for our purposes it is not necessary to choose one of the two positions.

2.1. Consonant harmony

The consonants which take part in vowel harmony are /k/, /g/, /l/ (usually realized as [ɬ]) and their palatalized counterparts kⁱ/, /gⁱ/, /lⁱ/.² Consonant harmony is active also

2 For some speakers also other consonants ([r] and [ʃ]) are palatalized (Waterson 1956: 177, Clements & Sezer 1982: 241-242) and interact with harmony; we will limit our discussion to the velar stops and the laterals, which all speakers possess. Anyway, our conclusions can be generalized to the other palatalized consonants as well.

within the stem, and unlike vowel harmony its direction is not necessarily rightwards. For example, word-initial and intervocalic velar stops assimilate to the following vowel, having a secondary palatal articulation if such a vowel is front, and remaining plain if the vowel is back (6a). But if the consonant is followed by another consonant, or is word-final, it agrees with the preceding vowel (6b).

- | | | |
|------|------------------------------------|--------------|
| (6a) | [vak ^j it] | ‘time’ |
| | [ikon] | ‘icon’ |
| | [garip] | ‘strange’ |
| | [g ^j yr] | ‘thick’ |
| | | |
| (6b) | [dik ^j kat] | ‘attention’ |
| | [akrep] | ‘scorpion’ |
| | [kuɫ] | ‘slave’ |
| | [ky ^j ɫ] | ‘ashes’ |
| | [fark] | ‘difference’ |
| | [k ^j yrk ^j] | ‘fur’ |

Moreover, in a small group of words consonant harmony is violated: where a plain consonant is expected, a palatalized one is present instead (7a), which is the reason why /k^j/, /g^j/ and /ɫ/ have phonemic status. In fact, this possibility creates a few minimal pairs (7b).

- | | | |
|------|------------------------|------------|
| (7a) | [g ^j avur] | ‘infidel’ |
| | [bek ^j ar] | ‘bachelor’ |
| | [petrol ^j] | ‘gasoline’ |
| | [ɫamba] | ‘lamp’ |

(7b)	[kar]	‘snow’
	[k ^ɨ ar]	‘profit’
	[boɫ]	‘abundant’
	[boɫ ^ɨ]	‘cocktail’

Up to now we have examined instances of consonantal assimilation triggered by vowels. But the opposite situation, that cases of vowel harmony triggered by consonants seem to exist as well. There are at least three possible targets for this phenomenon: epenthetic vowels in loanwords, epenthetic vowels in the native lexicon and root-final palatalized consonants which cause palatal harmony in suffix vowels.

2.2. Vowel epenthesis in loanwords

Turkish does not allow complex onset, therefore in loanwords onsets made of more than one consonant are broken by an epenthetic vowel. This vowel is always high, but at least in a colloquial style it harmonizes with the following vowel (Yavaş 1980: 193, Clements & Sezer 1982: 246-249) (in a careful, learned pronunciation Turkish speakers tend to preserve original foreign clusters; an intermediate form of adaptation is the insertion of the same epenthetic vowel, [u], in all clusters, irrespective of the adjacent vowel).

(8)	[sipik ^ɨ er]	‘speaker’
	[tura ^ɨ fiki]	Fr. <i>trafic</i>
	[tiren]	Fr. <i>train</i>
	[pu ^ɨ rotesto]	‘protest’
	[fy ^ɨ lyt]	Fr. <i>flûte</i>

Interestingly, if the first consonant of the illicit cluster is a velar stop, the epenthetic vowel is always back, regardless of the presence of a front vowel (9b).

(9a)	[gurup]	‘group’
	[kuravat]	Fr. <i>cravate</i>
	[kuruvazør]	‘cruiser’
(9b)	[kuuredi]	Fr. <i>credit</i>
	[guurip]	Fr. <i>grip</i>
	[kuriz]	Fr. <i>crise</i>
	[kulʲyp]	Fr. <i>club</i>
	[gucrys] ³	Ger. <i>Grüss</i>

2.3. Epenthesis in the native lexicon

Also several words which belong to the core Turkish vocabulary display vowel epenthesis. In Turkish there are severe restrictions also on the possible codas, which can have two consonants at most, and only if they are a sonorant-obstruent sequence (save for a few exceptions like [vk]: e.g. [sevk] ‘drive’) are not.

This implies that an underlying cluster needs an epenthetic vowel to surface⁴. Again, the epenthetic vowel is always high and is subject to vowel harmony, its roundness and palatality depending on the preceding vowel. A list of some of these words is in (10).

(10)	<i>nom. sing.</i>	<i>3. poss. -I</i>	<i>abl. -dan</i>
‘patience’	[sabur]	[sabru]	[saburdan]
‘text’	[metin]	[metni]	[metinden]
‘judgement’	[hykʲym]	[hykʲmy]	[hykʲymden]
‘bosom’	[kojun]	[kojnu]	[kojundan]

Yet, in some words the epenthetic vowel is front, although the preceding vowel is

³ A common pronunciation among Turkish speakers leaving in Germany.

⁴ An alternative solution could be assuming that the underlying form in (10) and (11) is the nominative, and the 3. possessive forms result from a process of vowel deletion. If it were so, they would simply be disharmonic roots. However, there are compelling reasons against this hypothesis (Clements & Sezer 1982: 244-245, Yamaş 1980: 20).

back. Significantly, this disharmonic vowel is always preceded by a palatalized consonant. To explain the unexpected behaviour of the epenthetic vowel it seems necessary to assume an underlying palatalized consonant (Clements & Sezer 1982: 245), which starts its own harmonic domain, making the vowel front, just as front vowels do.

(11)	<i>nom. sing.</i>	<i>3. poss. -I</i>	<i>abl. -dan</i>
‘time’	[vakʲit]	[vakti]	[vakʲitten]
‘resolution’	[azim]	[azmi]	[azimden]
‘tomb’	[kabir]	[kabri]	[kabirden]
‘womb’	[rahim]	[rahmi]	[rahimden]

2.4. Disharmonic root-final velar stops

There is another context where consonants seem to influence vowels and cause disharmony. When a suffix vowel is added to some roots ending in a back vowel followed by a plain velar stop⁵, the stop itself and the suffix vowel become unexpectedly front (and the last vowel becomes long; most are loanwords from Arabic).

(12)	<i>nom. sing.</i>	<i>acc. sing.</i>
‘perception’	[idrak]	[idra:kʲi]
‘real estate’	[emlʲak]	[emla:kʲi]
‘fasting’	[imsak]	[imsa:kʲi]
‘explosion’	[infilʲak]	[infilʲa:kʲi]

The solution adopted by Clements & Sezer (1982: 239-240) is assuming that there is an underlying palatalized consonant, whose palatalization is lost when the consonant is word-final.

Note that we have to assume for both (11) and (12) that the palatalized consonant

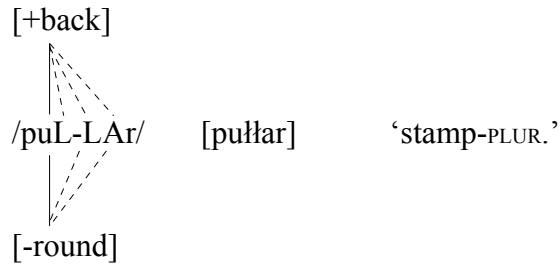
⁵ Since Turkish neutralizes voicing contrasts in coda position, there are no instances of such a phenomenon with /g/.

behaves as an opaque segment in some contexts (presence of an epenthetic vowel, presence of a suffix vowel), but also that does not preserve its feature in the others (when the epenthetic vowel is not requested, or when there are no suffix vowels), since in such cases it is realized without palatalization.

3. The representation of consonant harmony

The usual representation of suffix vowels assumes that they are unspecified for the harmonic features, which they receive from the root. The only contrast in suffix vowels which does not depend on the final root vowel is that between low and high vowels, hence the only lexically specified feature they have is [high]. Conventionally, ‘A’ will represent low suffix vowels, and ‘I’ high suffix vowels. Some examples are given in (13).

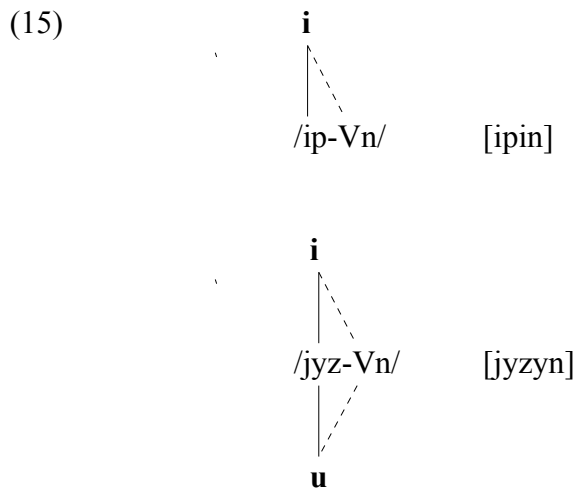
- (13)
- | | | |
|--|-------------|------------------|
| | | |
| | [ipin] | ‘rope-GEN.SING.’ |
| | | |
| | [jyzyn] | ‘face-GEN.SING.’ |
| | | |
| | [kʲedilʲer] | ‘cat-PLUR.’ |

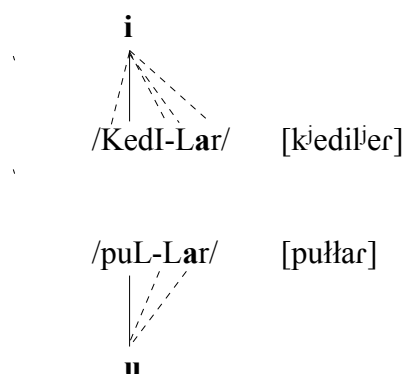


Many analyses of Turkish vowel harmony adopt the binary features in (1). Consistently with what done in the preceding chapters, we will adopt unary features instead. Translated in terms of the unary features **a**, **i**, **u**, (1) becomes (14) (an analogous representation is adopted by van der Hulst & van de Weijer (1991)).

(14)	/u/	/ʊ/	/y/	/i/	/o/	/a/	/ø/	/e/
a					a	a	a	a
i			i	i			i	i
u	u		u		u		u	

Consequently harmony is seen as the spreading of **i** (and **u**, with regard to labial harmony), instead of $[\pm\text{back}]$ (and $[\pm\text{round}]$): (13) becomes (15).





In our opinion there are at least three advantages in the use of these features:

1. the representation of the alternation between [a] and [e] becomes more straightforward. The former is phonetically not only more retracted, but also lower than the latter, yet with the use of the binary feature [back] there is some mismatch between the phonetic realization of the two vowels and the phonological feature they share ([–high]), which assigns them the same height. Instead, if the harmonic feature is **i**, it is expected that /a/ should not only front, but also raise, since the vowel has to become more palatal: [e] is a natural interpretation of {**a**, **i**}.

2. The vowel /u/ is completely unspecified, being simply a vocalic segment without any other positive connotation. This is well in accordance with the fact that /u/ is very rarely disharmonic within roots, contrary to the other vowels (although /ø/ and /y/ as well are rarely disharmonic): it is reasonable that a completely unspecified vowel is prone to undergo assimilation from the surrounding vowels. Moreover, a completely unspecified segment is the most likely candidate to be the epenthetic vowel. Indeed, epenthetic vowels always are high segments which agree with the adjacent vowels in palatality and roundness (see 10, 11, 12): if high vowels are simply the vowels lacking **a**, it means that epenthetic vowels do not have features of their own, well in accordance with the representation of /u/ in (14).

3. With binary features both [–back] and [+back] determine palatal harmony; cases of palatalized consonants followed by a back vowel, which would be problematic if [+back] spread, can receive a different interpretation if **i** is the only feature spreading. As seen in (7b), palatalized velar stops can occur with back vowels, whereas plain velar stops are impossible if the nucleus of their syllable is a front vowel. If both [–back] and [+back] spread from the nucleus, the first possibility is a puzzle. But if only **i** spreads from vowels to consonants, a back vowel cannot trigger palatal harmony, because it lacks the harmonic feature: in this case consonants are free to have palatalization or not, to independently of vowels.

(16)

	i		
‘dirt’	/K ⁱ ir/	[k ⁱ ir]	*[kir]
‘snow’	/Kar/	[kar]	
‘profit’	/k ⁱ ar/	[k ⁱ ar]	

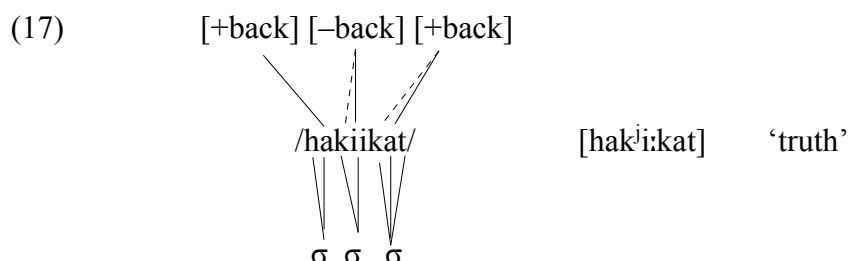
3.1. The domain of consonant harmony

As the data in (6) imply, the direction of consonant assimilation is partially different from that of vowel harmony, which is always rightwards. After demonstrating that a linear account of consonant harmony would be unsatisfactory, Clements & Sezer (1982) were the first to suggest that the domain of consonant harmony is the syllable⁶: the feature of the nucleus is spread to its tautosyllabic laterals and velar stops⁷. “The bidirectional and obligatory character of this rule, as well as the irrelevance of the

6 Cf. also Csató & Johanson (1998: 205): “syllables are lexically marked as either front or back. This quality is signalled by both the vowel and the consonant(s) of the syllable. The principles governing this phonological phenomenon can thus be best described at a suprasegmental level. It is not the frontness vs. backness of the individual segments, but the front vs. back categorisation of syllables that has distinctive function”.

7 Incidentally, in (6b) the word [akrep] has a plain velar stop, at first sight contradicting tautosyllabic harmonization. But it must be remembered that complex onsets are not allowed in Turkish: the syllabification is [ak.rep].

intervening consonants, are an automatic consequence of this analysis” (Clements & Sezer 1982: 235).



It must be pointed out that the behaviour of laterals is not identical to that of the velar stops, and is in part independent of harmony (Clements & Sezer 1982: 236-238). More precisely, velarized lateral conform to the quality of their tautosyllabic vowel (that is they can occur only in a syllable having a back vowel as its nucleus), but the distribution of palatalized laterals is much more complex. Word-initially laterals are predictably palatalized, whatever the following vowel. They are is always palatalized also when the first (not necessarily tautosyllabic) preceding or following vowel is front (*e.g.* [kalʲem] ‘pen’, [alʲbɪm] ‘album’). Word-finally a fairly high number of laterals preceded by a back vowel is palatalized. Moreover, predictable palatalized laterals preserve their palatalization also when followed by one of the few invariant suffix vowel (18a), contrary to what palatalized velars do (18b).

- (18a) [sefilʲ] ‘miserable’ [sefilʲa:ne] ‘miserably’
 [a:diʲ] ‘just’ [a:diʲa:ne] ‘justly’

- (18b) [ma:likʲ] ‘owner’ [ma:likʲa:ne] ‘residence’

(from Clements & Sezer 1982: 237)

It must be concluded that the palatalization of palatalized laterals is underlying, and that they are not affected by harmony. For that reason ‘true’ consonant harmony

involves only velar stops, and laterals will not be discussed in the following sections.

3.2. Syllable-head approach

The syllabic domain of consonant harmony is easy to accommodate in a model which assumes syllable nodes to be the elements that receive the harmonic feature(s). This line of explanation, proposed by van der Hulst & van de Weijer (1995) under the label of syllable-head approach, sees vowel harmony as a relation among syllable nodes, and only indirectly, because they are syllable heads, among vowels. A harmonic feature is a property of the target vowel in the nucleus of the syllable, but, since nuclei are syllable heads, also of the syllable as a whole. The feature spreads to the other syllable nodes, and then percolates to their heads.

This approach can save locality in vowel harmony: harmony is a local process, although it frequently skips intervening consonants, because is a relation among adjacent syllables; there are not intervening elements any more. It has also been adopted to explain some cases of nasal harmony in which both vowels and some consonants are nasalized. Once the [nasal] feature is associated to a syllable, it percolates to any segment which can bear it:

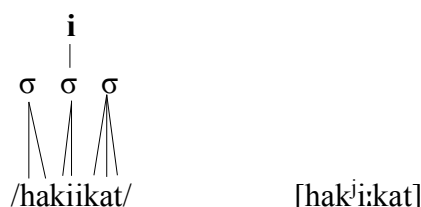
The harmonic feature is, therefore, a property of the nucleus or head of the syllable. It is a fundamental principle of linguistic structure that the properties of the head of a construction are simultaneously the properties of the entire construction. Consequently, when [nasal] is associated with the head or nucleus of a syllable, it is automatically a feature of the syllable itself. It should, therefore, be realised on all the segments in the syllable that can be nasal-bearing. (Piggott & van der Hulst 1997: 102)

Therefore the difference between vowel harmonies skipping every vowel, and vowel harmonies harmonizing at least some of them, is linked to the possibility of the consonants to bear the harmonic features: interestingly, in Turkish the only consonants which can contrast for the presence vs. absence of secondary palatalization are /k/ and /kʲ/, /g/ and /gʲ/, /l/ and /lʲ/.

Under this light, the difference between vowel harmony in a language which skips every consonant and in Turkish could be compared to the syntactic difference between English and Italian with respect to the realization of inflectional markers: while in the noun phrase *green leaves* only the noun *leaves* carries a overt marker of plurality, in the corresponding Italian phrase *foglie verdi* also the adjective *verdi* is realized as plural (and feminine), agreeing with the features of the noun. In both cases, however, we say that the feature [plural] is a property of the NP. Languages which realize inflectional features only in the head of a phrase, and languages which realize them in other elements of a phrase as well, through agreement, display a parametric variation analogous to the one put forward here for phonology.

The syllable-head approach allows us to circumvent the problems raised by consonant harmony under a segment-to-segment approach: its seemingly exceptional behaviour with respect to directionality now follows from the fact that the domain of vowel harmony must be the syllable. The representation in (17) is slightly reformulated: consonant harmony is not a process limited by a domain, but a property of (the head of) this domain.

(19)



However, in its turn this solution raises another question: if the feature of the nucleus determines that of the consonants, which are not in a head position, how can a consonant trigger vowel harmony, as it appears to be in (9, 11, 12)? Indeed, a specific prediction of this model is that consonants, insofar as dependents, should never act as vowels do⁸: “[w]ith a syllable-head approach to the vowel harmony domain, one is presumably forced to analyse this phenomenon [*i.e.* vowel harmony triggered by a consonant] as a secondary, local case of feature spreading, since consonants are not

⁸ See also Levi (2001) for a critical discussion of the the syllable-head approach with respect to the representation of palatalized laterals in Turkish vowel harmony.

visible on the syllable head tier” (van der Hulst & van de Weijer 1995: 527). Solutions for the three groups of exceptions are advanced in the following sections.

3.3. Perceptual epenthesis

In the first group of seeming consonant-induced harmony, that is loanwords, the quality of the epenthetic vowel is usually explained as a result of assimilation to the preceding consonant; since a cluster is an impossible onset in Turkish, a vowel is inserted and receives the [+back] feature of the consonant⁹ (Clements & Sezer 1982: 248). This explanation tacitly relies on the idea that Turkish speakers perceive an illegal cluster and then insert a vowel because the cluster violates the phonotactic constraints of their language. In recent years, however, it has been suggested that epenthetic vowels are already present in perception, because listeners are driven by the phonological categories and structures of their language when they hear a foreign word: data in Dupoux *et al.* (1999), Peperkamp & Dupoux (2003), Peperkamp (2005), Kabak & Idsardi (2003) show that speakers claim to perceive ‘illusory’ vowels in non-sense words that do not fit the syllable structure of their native language. Experiments clearly confirm that the epenthetic vowels are present in perception: for example Dupoux *et al.* (1999) report that 70% of the time Japanese listeners said that they heard a vowel [u] which was absent in the input presented to them, that violated Japanese phonotactics.

Whether this can be claimed that “all loanword adaptations are phonetically minimal transformations that apply in perception”, as Peperkamp & Dupoux (2003: 368) do, or not, is a question which is beyond our present interest (see *e.g.* Ito, Kang & Kenstowicz (2006) and Calabrese (to appear) for different views on this topic); but we have strong reasons to believe that epenthetic vowels in loanwords are an effect of perception, rather than the result of a phonological process which takes as its input the faithful perception of loanwords.

If Turkish epenthetic vowels are already present in perception, their back

⁹ Incidentally, since according to the feature system adopted here the harmonic feature is **i**, there would be an additional problem: the assimilation of a vowel to a back consonant would be impossible to represent. palatalis

articulation need not be seen as the result of the assimilation to a feature of the preceding consonant. Since Turkish speakers ‘know’ that, given the syllabic domain of consonant harmony, an onset made of a plain velar stop is always followed by a back vowel, they simply infer the quality of the epenthetic vowel from the acoustic properties of the preceding consonant, which has no trace of palatalization. There is no need to recur to a rule inserting a vowel and then to another rule spreading the feature of the velar consonant: the back epenthetic vowel simply is the only segment consistent with the perception of a plain velar stop.

3.4. Underlying syllables

However, an active role of palatalized consonants seems to be necessary to account for disharmonic epenthetic vowels in the native vocabulary: there the assumed underlying form displays a palatalized consonant and does not display a front vowel, which is inserted later. In this case the quality of the vowel depends on that of the consonant, rather than the opposite, as the syllable-head approach would predict.

A solution to his problem can be given if we abandon some of the standard assumptions about epenthesis and syllabification. Epenthesis is usually seen a process of vowel insertion during syllabification, to provide with a nucleus consonants which would otherwise remain unsyllabified, given the phonotactic constraints of the language in question. At the heart of this view lies the idea that syllables are derived, and underlying forms are just strings of unsyllabified segments (see *e.g.* Blevins (1995) for a general introduction to this issue). Arguments in favour of this choice are usually based on the observation that there are few minimal pairs distinguished by syllabification alone (hence syllabification is predictable on the basis of linear order), that syllabicity alternations too (for example between high vowels and semivowels) are usually predictable, that individual morphemes of a given language may not conform to its syllable structure, demanding epenthesis (Blevins 1995: 221).

However, all these arguments at best indicate that doing away with underlying syllabification is possible, not that underlying syllabification is empirically wrong. But several facts are accidental if (some form of) underlying syllabification is not

assumed (Golston 1995, 1996): root shape requirements in several languages require that roots conform to a syllabic template (for example the prototypical Proto-Indo-European root was a closed syllable); likewise, reduplicative morphology is often based on morphemes which consist solely of a syllable template, for example CV. Also psycho-linguistic evidence suggests that words are stored as sequences of syllables rather than of segments. It has been observed that speakers tend to remember some properties of words better than others: the initial segment or onset, the number of syllables and the stress pattern. Thus common errors for *sextant* are words like *secant* and *sextet*. “If a speaker stores a word as a string of segments and cannot access (part of) that string, she should not be able to compute the number of syllables or location of stress. For to do so would require access to the string of segments she (*ex hypothesi*) has no access to” (Goldston 1996: 723).

Moreover, derived syllabification lies on the assumption that underlying strings of segments are linearly ordered: assuming for an English word like [sprat] the underlying representation /sprat/, and given the phonotactic constraints of English, [spr] is the only possible onset once syllabification takes place.

But this assumption can be reversed: since *[srp], *[prs], *[psr], *[rsp], *[rps] are impossible onsets in English, we could assume that segments within a syllabic constituent are unordered underlyingly, and then predictably linearised, because the position of consonants relative to the syllable nucleus is not contrastive. The representation of the onset in *sprat* would be an unordered set (s p r)¹⁰ (Anderson 2002: 24-26, 2004). Only syllabic constituents need to be ordered relative to each other: the fact that in [sprat] [t] follows the nucleus must be specified lexically. Therefore, if only contrastive information is encoded in underlying representations, [sprat] is represented as in (20).

(20)(s p r) > ((a) (t)) [sprat]

(21)

10 Notationally, we represent syllabic constituents with round brackets and linear precedence with ‘>’: (s p r) > (t) means that all the segments in the first set precede the segment in the second; since these sets are unordered, the ordering of segments within them is totally irrelevant (put in other words, (s p r), (s r p), (r p s), (r s p), (p r s), (p s r) are notational variants of the same set).

Note that the position of the nucleus with respect to the coda need not be specified underlyingly within the rhyme ((a) (t)), which is an unordered set: if there are two distinct constituents including consonants, they have to remain distinct, thus when they are linearised the only possible position for the nucleus is between them¹¹.

Under this light, also the status of epenthetic vowels can change. If syllables are underlying, why do some vowels seem to be absent underlyingly? A general property of the syllable is that its only obligatory constituent is the nucleus. If the presence of a syllable implies the presence of a nucleus, and syllables are underlying, to represent epenthetic vowels we could make a distinction between syllables having a nucleus and having a vowel: all syllables have a nucleus, but it can be segmentally empty. We would not say any more that syllabification inserts a new nucleus; both words with a lexical vowel (22a) and words which display a surface epenthetic vowel have a syllable nucleus underlyingly, but the syllable nucleus of the latter has no featural content (22b).

$$(22a) \quad (C_1 C_2 \dots)_{\text{onset}} > ((V)_{\text{nucleus}} (C_1 C_2 \dots)_{\text{coda}})_{\text{rhyme}}$$

$$(22b) \quad (C_1 C_2 \dots)_{\text{onset}} > (()_{\text{nucleus}} (C_1 C_2 \dots)_{\text{coda}})_{\text{rhyme}}$$

Since in any case a nucleus requires a vowel to be realized, if no vowels are available a default value is assigned to it. But when a vowel immediately precedes or follows the syllable with the empty nucleus, the epenthetic vowel does not emerge. How can

11 This proposal is not an *ad hoc* solution for Turkish; for example, it makes available a new explanation to problems raised by metathesis phenomena. If linear underlying order is assumed, metathesis requires powerful rules which switch segments, or delete and then insert them. But if their order within syllabic constituents is not given, there is no reordering at all, and linear order follows from the phonotactics of the language. For instance in Faroese, when the suffix *-t* is added to the coda [sk], the relative order of the latter consonants is changed, becoming [kst] (16) (Rischel 1972). Since [ks] and [skt] are impossible codas in Feroese, the only possible realization of (s k) is [ks], and the only possible realization of (s k) > t is [kst].

(20)	<i>fem. sg.</i>	<i>masc. sg. (-or)</i>	<i>neut. sg. (-t)</i>		
	fesk	feskor	fekst	*feskst	‘fresh’
	dansk	danskor	dan̥kst	*danskst	‘Danish’
	svensk	svenskor	svenkst	*svenskst	‘Swedish’

the representation in (22b) account for this?

There are several reasons to assume that, contrary to roots, inflectional morphemes are not underlyingly syllabified (frequently they are not a syllable: in many languages they can simply consist of one or more consonants, in tone languages of a tone, and so on), and are affiliated to the adjacent root syllable. But this affiliation respects linear order: a consonant prefix attaches to the onset of the first root syllable, a consonant suffix to the coda of the last one. Under these assumptions, the suffixation of a vowel is represented (with two equivalent representations) as in (23).

$$(23) \quad (C_1 C_2 \dots)_{\text{onset}} > (())_{\text{nucleus}} (C_1 C_2 \dots)_{\text{coda}} \text{rhyme} > V$$

$$\left(\begin{array}{c} C_1 \\ C_2 \\ \dots \end{array} \right)_{\text{onset}} > \left(\begin{array}{c} ()_{\text{nucleus}} \\ \left(\begin{array}{c} C_1 \\ C_2 \\ \dots \end{array} \right)_{\text{coda}} \end{array} \right)_{\text{rhyme}} > V$$

Since the consonants in the coda are not ordered after the nucleus, the latter and the suffix vowel are not separated by other elements. Moreover, it is reasonable to assume that if an empty nucleus and a vocalic node are adjacent, the latter is automatically associated to the former, as in (24) (it is simply a form of autosegmental association of features without an anchor to an anchor without features).

$$(24) \quad (())_{\text{nucleus}} V \rightarrow (V)_{\text{nucleus}}$$

As things stand, the only possible linearization of (23) is represented in (25). The consonants in the rhyme are still part of a syllabic constituent preceding the one that includes the consonants in the coda, but the two constituents are now part of two different syllables; the former becomes the coda of the preceding syllable, and the latter is realized as the onset of the final syllable. The nucleus is realized at the right

edge of the syllable, to receive the vocalic features of the suffix:

$$\begin{array}{c}
 (25) \quad \left(\begin{array}{c} C_1 \\ C_2 \\ \dots \end{array} \right)_{\text{onset}} > \left(\begin{array}{c} ()_{\text{nucleus}} \\ \left(\begin{array}{c} C_1 \\ C_2 \\ \dots \end{array} \right)_{\text{coda}} \end{array} \right)_{\text{rhyme}} > V \\
 \downarrow \\
 (C_1 > C_2 \dots)_{\text{onset}} > (C_1 > C_2 \dots)_{\text{coda}} > (V)_{\text{nucleus}}
 \end{array}$$

The underlying representation of the Turkish roots in (11), whose second vowel is epenthetic, requires a segmentally empty nucleus. Moreover, although the first vowel is back, the epenthetic vowel is front, and in previous accounts this disharmony was explained by an underlyingly palatalized consonant. According to the syllable-head approach, however, consonants should derive their palatalization from the syllable node. This implies that, although the nucleus has no segmental content, the syllable has a feature *i* (graphically represented by a superscript attached to a syllabic constituent). The underlying representation of the word [vakʲit], whose second vowel is epenthetic, is given in (26).

$$(26) \quad [(v)_{\text{onset}} > ((a)_{\text{nucleus}})_{\text{rhyme}}]_{\sigma} > ^i[(k)_{\text{onset}} > (()_{\text{nucleus}} (t)_{\text{coda}})_{\text{rhyme}}]_{\sigma}$$

Without any suffix vowel, the empty nucleus receives a default value to be linearised, and is placed in the only position which respects precedence relations in (26) and the phonotactic constraints of Turkish; the feature *i* percolates to all the lower nodes able to carry it, that is the nucleus and /k/, the result being [vakʲit].

On the other hand, the suffixation of a vowel makes word-final position the only position for the nucleus to surface respecting all phonotactic and precedence constraints.

$$\begin{array}{c}
 (27) \quad [(v)_{\text{onset}} > (a)_{\text{nucleus}}]_{\sigma} > \quad i[(k)_{\text{onset}} > \left(\begin{array}{c} ()_{\text{nucleus}} \\ (t)_{\text{coda}} \end{array} \right)]_{\sigma} > \quad I \\
 \downarrow \\
 [v \ a]_{\sigma} > \quad k > \quad i[t \ (I)]_{\sigma} \\
 \downarrow \\
 [v \ a \ k]_{\sigma} [t \ i]_{\sigma}
 \end{array}$$

3.5. Word-final palatalized velars

As the examples in (12) – reproduced below as (28) – show, some root-final /k/s seem to trigger palatal harmony in the following suffix vowels.

(28)	<i>nom. sing.</i>	<i>acc. sing.</i>
‘perception’	[idrak]	[idra:kʲi]
‘real estate’	[emlʲak]	[emla:kʲi]
‘fasting’	[imsak]	[imsa:kʲi]
‘explosion’	[infilʲak]	[infilʲa:kʲi]

It must be pointed out that most roots containing a final consonant which causes disharmony also have a final long vowel. With regard to this fact, it is useful to observe that in Turkish there is a constraint on the well-formedness of syllabic rhymes: they can be (C)V, (C)VV, (C)VC, and under restricted conditions also (C)VCC. But (C)VVC syllables are not allowed¹²: a rhyme can consist of two moras at most (Kabak & Vogel 2001: 346). This restriction causes long vowel shortening in roots when the root-final consonant is tautosyllabic.

12 A few words, as [saat] ‘clock’, have a long vowel followed by a consonant, but their long vowel can be analysed as disyllabic. For example, a language game suggests this interpretation: in ‘Kuş Dili’ (literally *Bird Language*) speakers insert a [gV] sequence after every (C)V in a word (the inserted vowel is a copy of the preceding one). In words with long vowels two [gV] sequences are inserted: for example *kağıt* [kʲaat] ‘paper’ becomes [kʲa-ga-agat] (Kabak 2007: 1387).

- (29)
- | | |
|------------|---------------|
| /hasa:r/ | |
| [hasar] | ‘damage’ |
| [hasa:ru] | ‘his damage’ |
| [hasardan] | ‘from damage’ |

Under our assumption of underlying syllabification, the restriction on the number of moras implies that the final consonant cannot be part of the underlying syllable headed by a long vowel. Extending our hypothesis of empty nuclei, the last consonant is the onset of a syllable headed by such a nucleus.

- (30) $[(h)_{\text{onset}} > (a)_{\text{nucleus}}]_{\sigma} > [(s)_{\text{onset}} > ((a)_{\text{nucleus}} (X)_{\text{coda}})]_{\sigma} > [(r)_{\text{onset}} > ()_{\text{nucleus}}]_{\sigma}$

Where 'X' in the coda is an empty slot, an unspecified segment which is filled by the features of an adjacent segment:

- (31a)
- | | | | | |
|---|---|---|---|-----|
| X | X | > | X | X |
| | | | | --- |
| a | | | a | |

- (31b)
- | | | | | |
|---|---|---|-----|---|
| X | X | > | X | X |
| | | | --- | |
| | r | | | r |

We assume that (31b) takes precedence over (31a) if both possibilities are available.

The reason for the alternation in vowel length in the words in (28) is identical to that for (29): the long vowel emerges when a suffix vowel is present, taking the last consonant as its onset. A root like /idraak^j/ is therefore represented as in (31).

- (31) $[()_{\text{onset}} > (i)_{\text{nucleus}} (d)_{\text{coda}}]_{\sigma} > [(r)_{\text{onset}} > (a)_{\text{nucleus}} (X)_{\text{coda}}]_{\sigma} > ^i[(k)_{\text{onset}} > ()_{\text{nucleus}}]_{\sigma}$

This representation predicts that when a suffix vowel is present, it will be front: it in the empty nucleus of the final syllable, to which the feature **i** is associated.

$$\begin{array}{c}
 (31) \quad /id [(r)_{\text{onset}} > (a)_{\text{nucleus}} (X)_{\text{coda}}]_{\sigma} > i[(k)_{\text{onset}} > ()_{\text{nucleus}}]_{\sigma} > I \\
 \downarrow \\
 /id [(r)_{\text{onset}} > (aa)_{\text{nucleus}}]_{\sigma} > i[(k)_{\text{onset}} > (I)_{\text{nucleus}}]_{\sigma} \\
 \downarrow \\
 [idra:ki]
 \end{array}$$

It remains to be explained why the last vowel is short and the final empty nucleus is not realized in [idrak]. Epenthesis can be seen as the last resort, to preserve the segmental material of a syllable with an empty nucleus. If there is not a suffix vowel, root-internal empty nuclei have to be realised, otherwise their onsets and codas would be lost. But if a word-final nucleus is empty, its onset can still be attached to the preceding syllable, without being lost. Given (31b), the last consonant is associated to the preceding empty slot, as in (32); being part of a syllable headed by a back vowel, is not palatalized. Since in Turkish geminate word-final consonants are not allowed, it is realized as a simple consonant.

$$\begin{array}{c}
 (32) \quad i \ d \ r \ a \quad X \qquad X \\
 \qquad \qquad \qquad \searrow \qquad \downarrow \\
 \qquad \qquad \qquad \qquad k \\
 [idrak]
 \end{array}$$

Incidentally, a process of degemination of root-final consonants not followed by a vowel is independently motivated:

(33)	/hiss – A/	[hisse]	‘feeling-DAT.’
	/his – LAr/	[hisɫ̪er]	‘feeling-PLUR.’
	/hiss/	[his]	‘feeling’

(from Kabak & Vogel 2001: 347)

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