Processes of vowel harmony in the Servigliano dialect of Italian: A comparison of two non-linear proposals for the representation of vowel height[1]
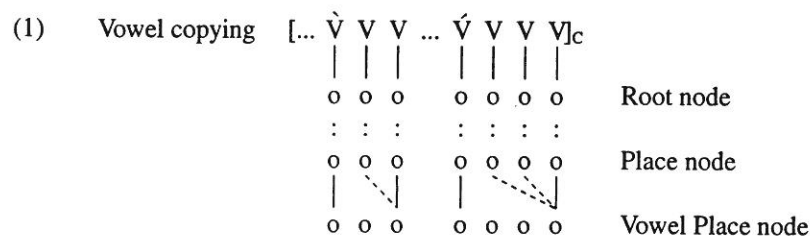
Holly J. Nibert

Abstract

A complex set of facts from the Servigliano dialect of Italian is explained in terms of four phonological processes formalized within the framework of Prosodic Phonology. Three of these processes, post-tonic vowel copying, metaphony, and pretonic vowel raising, involve vowel harmony in the clitic group domain (C), are complementary in nature in terms of their targets, and reveal a unique, interesting interplay between prosodic structure, metrical structure, and the feature hierarchy. While post-tonic vowel copying involves a total assimilation in all features to a final vowel, the remaining two harmony processes entail a partial assimilation in height to a high final or high stressed vowel, respectively. It is shown that the use of [+high] as the assimilatory feature in metaphony is problematic, since, in conjunction with binary values of the features [low] and [ATR], it fails to straightforwardly capture the scalar nature of this raising process. This inadequacy is due to the use of more than one feature to define the single parameter of vowel height. An alternative model proposed by Clements (1989, 1991a, b) represents this parameter in terms of occurrences of a single feature [open] hierarchically organized into tiers dominated by an aperture node. It is shown that the use of occurrences of [open] to define vowel height makes it possible to directly generate metaphonic raising in Servigliano as a scalar, assimilatory phenomenon rather than as a coincidental result.
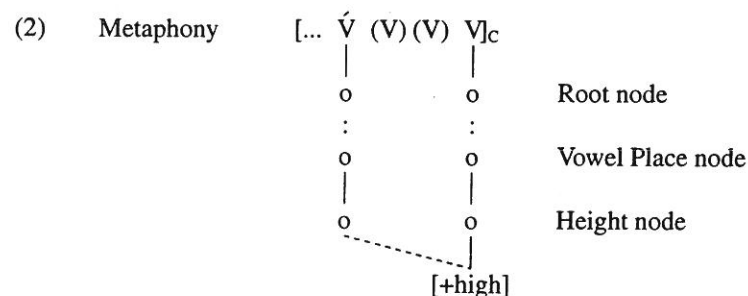
Introduction

In the Servigliano dialect of Italian, spoken in the extreme south of the Marches, there are three processes of vowel harmony, two of which can be in a feeding relationship. These processes can be described as follows: 1) nonfinal post-tonic vowels completely assimilate to a final vowel, as do pretonic, proclitic vowels to the final vowel in a proclitic sequence; 2) a high final vowel triggers the raising of a tonic mid vowel; and 3) a high tonic vowel triggers the raising of pretonic mid vowels in the word. The data used to illustrate these processes come from Camilli (1929). One of the main goals of the present study is to elucidate these three harmonization processes and the interaction among them in the Servigliano dialect. The second main goal is to show that Clement's (1989, 1991a, b) aperture node analysis of vowel height is best able to capture the degree raising phenomena (processes 2 and 3 above) displayed in the dialect.
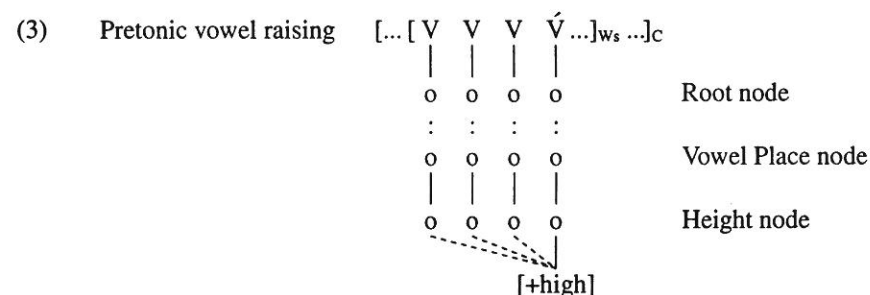
Regarding this first goal, it will be shown that all three harmonization processes apply in the domain of the clitic group (*C*), one of the phonological constituents for rule application in the prosodic hierarchy (Hayes 1989; Nespor and Vogel 1986). The first process, which will be referred to as *vowel copying*, produces sequences of a single vowel quality as shown in (1).

(1)   Vowel copying   [... V̀ V V ... V́ V V V]c

An image depicting the autosegmental structure with Root node, Place node, and Vowel Place node tiers.

The second process will be termed *metaphony* in keeping with the Romanist tradition. Its application is illustrated in (2).

(2)   Metaphony   [... V́ (V) (V) V]c

An image depicting the autosegmental structure with Root node, Vowel Place node, and Height node tiers, with [+high] linked.

Pretonic vowel raising will be the name given to Servigliano's third harmonization process, which applies roughly as shown in (3), where]ws refers to a strong or nonclitic element in *C* (Nespor and Vogel 1986).

(3)   Pretonic vowel raising   [... [V V V V́ ...]ws ...]c

An image depicting the autosegmental structure with Root node, Vowel Place node, and Height node tiers, with [+high] linked.

An additional phonological process that occurs in Servigliano is *atonic vowel reduction*. This process will be treated in Section 1 of the present study since it determines the inventory of vowels made available to vowel copying and pretonic vowel raising. In Sections 2 through 4, data illustrating vowel copying, metaphony, and pretonic vowel raising, respectively, will be presented and analyzed. Section 5 includes a summary of findings thus far, focusing particularly on the interaction among the three vowel harmony processes.

In the rule formulations given to account for the phonological processes in Sections 1–5, a set of features using binary values of [high], [low], and [ATR] to define vowel height will be used. It will be shown, however, that this system of specification is not able to capture the process of metaphony in a straightforward manner. Therefore, Section 6 will examine an alternative model for the representation of vowel height in terms of its ability to reflect the nature of this process. This alternative model is Clements' (1989, 1991a, b) hierarchical model of vowel height. It will be shown that this model is superior to the other in that it facilitates a direct, elegant account of the phonological processes treated in this paper, especially the scalar nature of metaphony. Concluding remarks are given in Section 7.

1. Servigliano atonic vowel reduction

The Servigliano dialect of Italian has an underlying system of seven vowels, all of which surface in tonic position: /i, e, ɛ, a, ɔ, o, u/. In atonic position, the opposition between the vowels of the two mid pairs, /e, o/ and /ɛ, ɔ/, is neutralized, resulting in a reduced system of five vowels: [i, e, a, o, u]. Alternations illustrating vowel reduction in Servigliano are provided in (4):

(4) a. /ɛ/ reduced to [e]

sténne	'he spreads'	stennéte	'you (PL) spread'
véngo	'I come'	venéte	'you (PL) come'
llétto	'I call'	llettá	'to call'
spéllo	'I skin'	spellá	'to skin'

 b. /ɔ/ reduced to [o]

dórmo	'I sleep'	dorméte	'you (PL) sleep'
móro	'I die'	moréte	'you (PL) die'
dóle	'to hurt'	dolésse	'it hurt' (PAST SUBJ)
skórdo	'I listen'	skordá	'to listen'

In the formal analysis of these and subsequent facts, I will assume that the feature specifications presented in Calabrese (1985, 1991) for the northern Salentino dialect of Italian likewise apply in Servigliano, as both dialects inherited the same seven vowel system from Proto-Romance. The fully specified system is provided in (5) below.

(5)

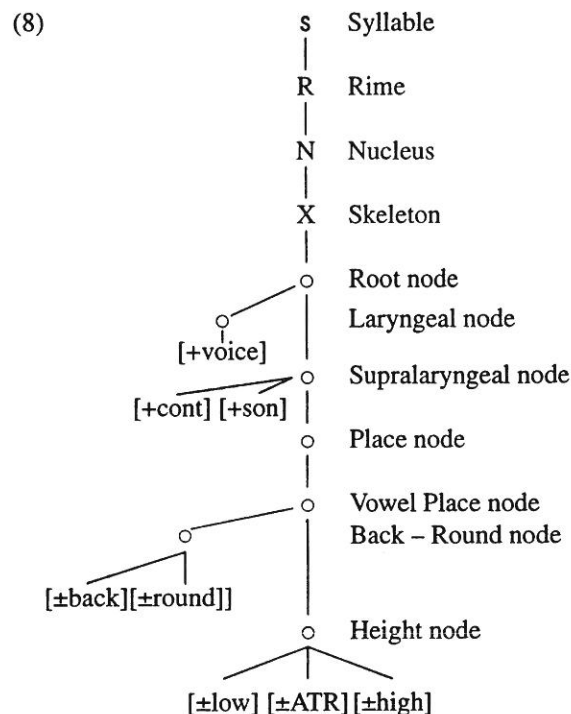|	i	e	ɛ	a	ɔ	o	u
high	+	−	−	−	−	−	+
low	−	−	−	+	−	−	−
back	−	−	−	+	+	+	+
round	−	−	−	−	+	+	+
ATR	+	+	−	−	−	+	+

In keeping with the view that vowel harmony is a feature filling as opposed to a feature changing process (cf. Lieber 1987), I will adopt the framework of radical underspecification in my analysis of the Servigliano facts (cf. Kiparsky 1982; Archangeli 1988a, b; Archangeli and Pulleyblank 1986). Along the lines of Archangeli and Pulleyblank (1986, 1989) and Pulleyblank (1988), the underlying vowel system of Servigliano can be described using the under-specified representations in (6).

(6)

	i	e	ɛ	a	ɔ	o	u
high	+						+
low				+			
back					+	+	+
ATR			−		−		

The fully specified representations in (5) are generated from those partially specified in (6) by the following redundancy rules:

(7) a. [ ]   → [−high]
 b. [ ]   → [−low]
 c. [+low] → [+back]
 d. [ ]   → [−back]
 e. [+low] → [−ATR]
 f. [ ]   → [+ATR]
 g. $\begin{bmatrix} -\text{low} \\ +\text{back} \end{bmatrix}$ → [+round]
 h. [ ]   → [−round]

Given the underspecified representations in (6), the neutralization in height of the open and closed mid vowels in Servigliano can be viewed as the delinking of the feature [−ATR] from a vowel in atonic position, assuming that phonological features are hierarchically organized under different nodes (cf. Clements 1985; Sagey 1990). I will assume that vowel features are positioned as shown in the partial tree structure in (8), following Odden (1991) (see also Archangeli and Pulleyblank 1986, 1987).

(8)

s	Syllable
R	Rime
N	Nucleus
X	Skeleton
o	Root node
[+voice]	Laryngeal node
[+cont] [+son]	Supralaryngeal node
o	Place node
o	Vowel Place node / Back – Round node
[±back][±round]]	
o	Height node
[±low] [±ATR] [±high]	

Since atonic vowel reduction does not target tonic vowels, it must apply after the assignment of primary word stress. Adopting the rule formalism developed in Archangeli and Pulleyblank (1986, 1987) and applied in Hualde (1989), atonic vowel reduction in Servigliano now can be formulated as in (9). A vowel undergoing this process will eventually receive the default value [+ATR] during a late component of the phonology.

(9)   Servigliano atonic vowel reduction
        operation: delinking
        argument: [−ATR]
        target condition: stressless vowel

$$
\begin{array}{l}
\text{N} \\
\mid \\
\text{x̌} \\
\mid \\
\text{o} \quad \text{Root node} \\
\vdots \\
\text{o} \quad \text{Height node} \\
\ddagger \\
\text{[−ATR]}
\end{array}
$$

where x̌ = stressless vowel

2. Servigliano vowel copying

In his description of Servigliano, Camilli (1929: 224–225) observes that nonfinal post-tonic vowels completely assimilate to the final vowel. As illustrated by the data in (10) below, the final vowel may be that of a word, as in (10a), or that of an enclitic dependent on the word, as in (10b).[2] Furthermore, the final vowel may be any one of the five possible atonic vowels [i, e, a, o, u]. This process of vowel harmony will be referred to as *vowel copying*.[3]

(10)   a.   VERB
        prédok-o   'I preach'   *prédik-i*   'you preach'
        prédak-a   'he preaches'   (cf. *predik-á*   'to preach')

        NOUN
        birikókan-a   'apricot tree'   *birikókun-u*   'apricot'
        pérsak-a   'peach tree'   *pérsuk-u*   'peach'
                                          pérsik-i   'peaches'

        doménnak-a   'Sunday'   *doménnek-e*   'Sundays'
        álam-a   'soul'   *álem-e*   'souls'
        pétten-e   'comb'   *péttin-i*   'combs'
        stómmuk-u   'stomach'   *stómmik-i*   'stomachs'

       b.   VERB + CLITIC(S)
        métt-a=la   'put (IMPER) it   *mítt-u=lu*   'put it (MASC.SG)'
                        (FEM.SG)'
        métt-e=le   'put it (FEM.PL)' *mítt-i=li*   'put it (MASC.PL)'
        (cf. *mítt-i* /mett-i/ 'put')
        métt-a=ča=la 'put it (FEM.SG)   *mítt-u=ču=lu* 'put it (MASC.SG)
                        there'   there'
        métt-e=če=le 'put it (FEM.PL)   *mítt-i=či=li* 'put it (MASC.PL)
                        there'   there'
        (cf. *če* 'there')
        salút-a=ma=la 'greet (IMPER) her for me'
        (cf. *salút-a* 'greet'; *me* 'for me')

        NOUN + CLITIC
        párd-u=tu   'your father'   *mátr-a=ta*   'your mother'
        (cf. *pátr-e* 'father')   (cf. *mátr-e* 'mother')

Camilli (1929: 225) notes a few exceptions to this process, namely the plural feminine nouns [ákore] 'country maple tree (PL)' (vs. [áko] or [ákara] '(SG)' /akor-/), and [fíkore] 'September fig tree (PL)' (vs. [fíko] '(SG)' /fikor-/).

As has been stated, vowel copying involves a complete assimilation of post-tonic vowels to the trigger (i.e., the final vowel). This assimilation can be understood as the iterative spreading of the trigger's Vowel Place node leftward onto preceding atonic vowels, triggering the delinking of their own Vowel Place nodes.[4] Since intervening consonants are ignored by vowel copying and fully unspecified /e/ is targeted by it, this rule must apply at maximal tier scansion

---

2.   Following Zwicky (1977), the symbol "=" will be used for clitics and "−" for affixes. Only inflectional suffixes are indicated in (10). In regard to enclitics specifically, in Servigliano (as in Standard Italian) they include the direct and indirect object pronouns when the verb is [−Tense] (i.e. when the verb is in the form of an infinitive, gerund, or in some cases, imperative). These same personal pronouns are proclitic to a tensed verb. Furthermore, Servigliano (unlike Standard Italian) has three possessive pronouns (-mu/-ma, -tu/-ta, -su/-sa, which only occur in the singular) that are enclitic to nominals expressing family relationships (Camilli 1929: 227). Examples of these noun + clitic sequences appear in (10b).

3.   See Kaze (1989: 78–82) for an account of these facts that is formally and substantively different from the one to be offered here. He refers to this process as *post-tonic vowel copying*, since his analysis does not include the data that will be presented here in (11).

4.   It should be noted that the example *prediká* (vs. *prédoko*, *prédaka*, etc.) indicates that vowel copying does not simply involve spreading onto an empty nuclear X-slot (this is true only when the target is /e/), since the underlying feature values of a target vowel surface when it is not in post-tonic position.

(i.e., at the level of the syllable head or nucleus, which constitutes the highest level of structure dominating or providing "access" to the Vowel Place node) (Archangeli and Pulleyblank 1987). If vowel copying applied at minimal tier scansion (i.e., if the rule scanned the Place tier, the lowest level of structure providing access to the Vowel Place node), unspecified /e/, which lacks a feature tree structure, would be incorrectly skipped by the rule.

In regard to the domain of application of vowel copying, it is clear from the data in (10b) that this process does not apply at the word level of the phonology. Along the lines of Zwicky (1977), the examples *mítti* vs. *míttili* vs. *mítticili* show that the presence of enclitics in no way affects the location of primary word stress on the host. Since primary word stress in Servigliano, as in Standard Italian, is calculated from the right edge of the word, and specifically, must fall on one of the last three syllables (a well-formedness condition violated by *mítticili*), clitics in Servigliano must be word external.[5] Since the final vowel of an enclitic may serve as the trigger of vowel copying, it follows that this process must apply in a domain beyond the word level.

Vowel copying can be explained when this larger domain is taken to be the clitic group (*C*), adopting the proposal put forth in Hayes (1989) and Nespor and Vogel (1986) for a prosodic hierarchy of constituents for rule application. Within Nespor and Vogel's (1986) framework, the trigger of vowel copying may temporarily be defined as the rightmost atonic vowel in the domain of *C* (trigger= $V]_C$), e.g. $[[prédaka]_W]_C$, $[[míttu]_W[lu]_W]_C$, $[[míttu]_W[\check{c}u]_W[lu]_W]_C$. An additional set of data presented in a separate section of Camilli (1929: 224), however, presents a challenge to this definition of the trigger of vowel copying. These data reveal a process of total assimilation that involves the vowels of proclitics and is very similar to the process displayed in (10). The data are presented in (11) below.

(11)   a.   2 CLITICS + VERB

to=lo=dík-o   'I tell it (NEUT) to you (SG).'   (cf. *te* 'to you')
jjo=lo=díc-i   'you (SG) tell it (NEUT) to him.'   (cf. *jje* 'to him')
či=li=métt-o   'I put it (MASC.PL) there.'   (cf. *če* 'there')
ttu=lu=šígn-a   'he marks it (MASC.PL) down   (cf. *te* 'for you')
                    for you (SG).'

---

5. Examples of words in Servigliano with final, penultimate, and antepenultimate stress, respectively, are *minzudí* 'midday', *minzína* 'gasoline', and *pérsuku* 'peach'. Vogel and Scalise (1982) and Sluyters (1990) note that Standard Italian also allows for preantepenultimate stress in a small number of conjugated verb forms, namely, the third person plural of the present indicative and subjunctive of first conjugation verbs. Servigliano does not exhibit this highly marked stress pattern, as all third person plural verbal forms are identical to those of the third person singular (Camilli 1929: 228–229).

b.   3 CLITICS + VERB

mè=ssa=la=píjj-a   'he takes it (FEM.SG) from   (cf. *se* =
                    me'   reflexive
                                                   pronoun)

tè=ččo=lo=dák-o   'I give it (NEUT) to you (SG)' (cf. *če* =
                                                   reiterative
                                                   clitic
                                                   pronoun)

c.   4 CLITICS + VERB

me=ttè=ssa=la=píjj-a   'he takes it (FEM.SG) from me...?'

The above data show that in a sequence of two or more proclitics, there is a complete assimilation to the final vowel in the sequence, whether it be [i, e, a, o, u]. The examples in (11b and c) show that the process is sensitive to the presence of stress, in this case secondary stress (indicated with a grave accent mark).[6] Specifically, when a secondary stress falls on the third clitic (counting from right to left away from the host) in the proclitic sequence, as is most frequently the case, neither the stressed vowel nor the vowel of a fourth clitic (if present) assimilates to the vowel of the first clitic.[7] These facts show great similarity to those presented earlier in (10). Both data sets reveal: 1) a complete vowel assimilation, 2) identical triggers [i, e, a, o, u], 3) the same directionality of spreading (leftward), 4) a similar sensitivity to stress, and 5) an identical domain: *C*. Given these similarities, it would be desirable to express these

---

6. Earlier it was mentioned that in Servigliano, primary stress assignment takes place in the domain of the phonological word (*W*). It applies to independent (non-clitic) words only. In regard to secondary stress assignment, the data reveal that it must apply at least at the clitic group (*C*) level before the application of vowel copying, since this process is influenced by the presence of secondary stress on proclitics. While it is beyond the scope of this paper to propose a comprehensive analysis of secondary stress assignment in Servigliano, it is not implausible to posit the assignment of secondary stress in a domain beyond *W* (such as in *C*): Roca's (1986) analysis of secondary stress assignment in Spanish found it to apply at the postlexical level (which in Nespor and Vogel's [1986] theory translates as some level beyond *W*), and he proposes an extension of this analysis to Standard Italian. (The few available sources on secondary stress assignment in Standard Italian (cf. Sluyters 1990; Vogel and Scalise 1982) examine secondary stress at the word level only and therefore offer limited insight into the topic at hand.)

7. Camilli (1929: 224) notes a less frequent pattern of secondary stress in which the second clitic (again, counting from right to left away from the host) in a sequence of three is stressed. When this pattern occurs, the stressed vowel undergoes vowel copying, thereby allowing the vowel of the third clitic to be targeted as well: e.g. *ma=ssà=la=píjj-a, to=ččò=lo=dák-o*. If a fourth clitic is present, however, its vowel receives secondary stress and does not undergo vowel copying: e.g. *mè=tta=ssà= la=píjj-a*. These examples reveal an isolated application of vowel copying to a single stressed vowel position, which as said, appears in a less than frequent pattern of secondary stress. This vowel copying application therefore is considered exceptional and will not be discussed further in the present analysis.

assimilations as a single rule, since this would allow for a simpler grammar.[8]

To achieve this end, the definition of the trigger of vowel copying as $V]_C$ must be altered, since it does not encompass the data in (11): the triggering vowel in the sequence $[[to]_W[lo]_W[díko]_W]_C$, for example, clearly is not positioned at the right boundary of C. Essentially, any definition of vowel copying's trigger that pinpoints a single vowel in C will be unsatisfactory, since there exists the possibility that the process could originate from two different vowels in a sequence of Ws contained in one C. For example, given a sequence of two W_ws proclitic to a W_s with antepenultimate stress (where W_w = a weak or clitic element in C, and W_s = a strong or nonclitic element in C (Nespor and Vogel 1986: 155)), we would expect to find vowel copying at both ends, as illustrated by the hypothetical but possible example $[[jju]_{Ww}[lu]_{Ww}[prédaka]_{Ws}]_C$ ('he preaches it (MASC.SG) to him/them (/jje/)'). Of course, further data is needed to confirm this prediction. Regardless, it seems that an adequate definition of vowel copying's trigger should incorporate this possibility. Therefore, the trigger of vowel copying will be defined as the rightmost vowel in any W contained in C: $[...[...V]_W ...]_C$.
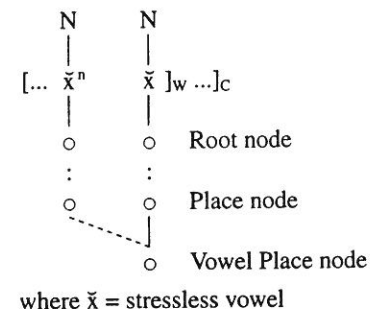
Although this definition may appear to generate more triggers than the data reveal, it produces correct results. As stated at the beginning of this section, vowel copying applies iteratively in a leftward direction. It is for this reason that not every trigger's underlying quality surfaces and shows evidence of copying. Specifically, if various triggers occur in a string uninterrupted by stress, only the rightmost one will surface and seem to have spread, since the others will be consumed by it. As an illustration, consider the sequence $[[métti]_W[če]_W[la]_W]_C$, which contains three triggers (in italics). When vowel copying applies, the Vowel Place (VP) nodes of the triggers simultaneously spread leftward onto atonic vowels, resulting in the delinking of their own VP nodes: the VP node of [a] extends to the Place node of [e], delinking its VP node, although it is now associated to the Place node of [i] (whose VP node is now disassociated, since the vowel to the left carries stress). The VP node of [a] then spreads to the Place node of former [i] (now [e]), delinking its VP node. It is in this way that

only the rightmost trigger [a] endures: end result $[[métta]_W[ča]_W[la]_W]_C$ (see derivation (13c) for illustration).

As has been indicated, spreading in vowel copying applies iteratively up until a vowel carrying stress, whether primary or secondary. In other words, a target condition for the rule is that a vowel must be completely atonic, or stressless, to undergo it. A further stress condition on vowel copying is that the trigger cannot carry primary word stress. This condition accounts for examples such as [minzudí] ('midday') with final word stress in which the rightmost vowel in W does not copy leftward.[9] Synthesizing what has been said about vowel copying, the following rule now may be formulated:

(12)   Servigliano vowel copying
     operation: iterative spreading
     direction: leftward
     tier scansion: maximal
     argument: Vowel Place node
     trigger: $[...[...V]_W ...]_C$
     trigger condition: stressless vowel
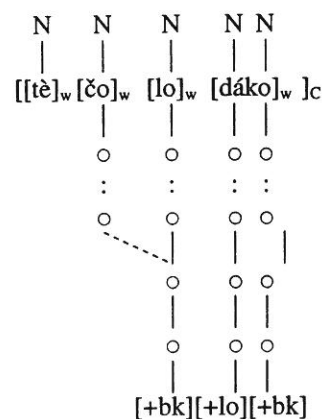   target condition: stressless vowel

where $\breve{x}$ = stressless vowel

Derivations are provided in (13):

---

8. It should be noted that vowel copying may also occur when the definite articles *lu, la, lo, li, le* are preceded by the prepositions *pe* ('for, by, through') or *de* ('from') (e.g. *pe lo kállo* or *po lo kállo* 'through the corn (collective)'; *de lu pórku* or *du lu pórku* 'from the pig'), or when these same clitics (*lu, la, lo, li, le*) as direct object pronouns are preceded by *che* [ke] ('that (rel. pron.)') or *no* ('no') (e.g. *ke la píjja* or *ka la píjja* 'that takes it (FEM.SG)'; *no lu fá* or *nu lu fá* 'he doesn't do/make it (MASC.SG)') (Camilli 1929: 224). (Note that if *che* and *no* preceded more than one clitic pronoun, they would not undergo vowel copying for reasons of stress (see (11b, c)).) Vowel copying occurs in the above sequences only frequently, however, whereas in the sequences in (11) it occurs obligatorily. The variation displayed in the above examples may be due to how the *ws pe, de, che, no* are interpreted: as independent (i.e. $[[pe]_W]_C [[lo]_W [kállo]_W]_C$; $[[ke]_W]_C [[la]_W [píjja]_W]_C$), or as clitics dependent on a noun/verb (i.e. $[[po]_W [lo]_W [kállo]_W]_C$; $[[ka]_W [la]_W [píjja]_W]_C$).

---

9. A reviewer points out that these target and trigger conditions also might be expressed in terms of a vowel needing to be a weak member of a foot. This is based on the possibility of a word like *prédiki* in (10a) having the foot structure $(prédiki)_\Sigma$ when vowel copying applies and an example like *mè ssa la píjja* in (11b) having the foot structure $(mèssala)_\Sigma (píjja)_\Sigma$ when vowel copying applies. In other words, this analysis assumes that clitics and inflectional endings are incorporated into a left-headed foot at the C level.

(13) a. /te=če=lo=dak-o/
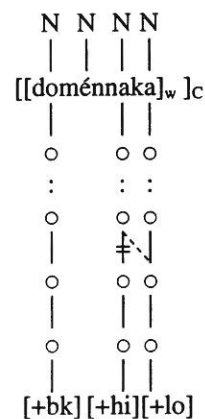C level:

[[tè]_w [če]_w [lo]_w [dáko]_w]_c

1) Vowel Copying

N   N   N   N N
| | | | |
[[tè]_w [čo]_w [lo]_w [dáko]_w]_c

o   o   o o
:   :   : :
o   o   o o
  ⸝‧‧‧| | |
  o   o o
  | | |
  o   o o
  | | |
[+bk] [+lo][+bk]

[tè čo lo dáko]
'I give it (NEUTER) to you (SG)'

b. /domennik-a/
C level:
[[doménnika]_w]_c

1) Vowel Copying

N N N N
| | | |
[[doménnaka]_w]_c

o   o o
:   : :
o   o o
| ‡⸝
o   o o
| | |
[+bk] [+hi][+lo]

[doménnaka]
'Sunday'

c. /mett-i=če=la/
C level

[[métti]_w [če]_w [la]_w]_c

!) Vowel Copying

N N   N   N
| | | |
[[métte]_w [ča]_w [la]_w]_c

o   o   o   Root
:   :   :
o   o   o   Place
‡‧‧‧‡‧‧‧⸝
o   o   o   Vwl. Pl.
| |
o   o   Height
| | or Back-
[+hi]   [+lo]   Round

N N   N   N
| | | |
[[métta]_w [ča]_w [la]_w]_c

o   o   o   Root
:   :   :
o   o   o   Place
  ⸝‧‧‧‧⸜
      o   Vwl. Pl.
      |
      o   Height
      |
   [+lo]
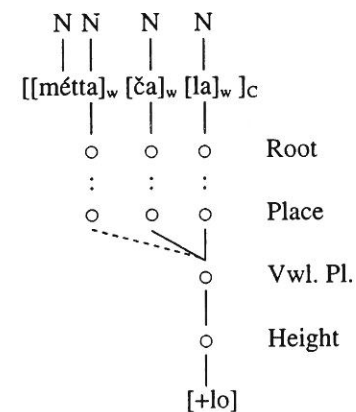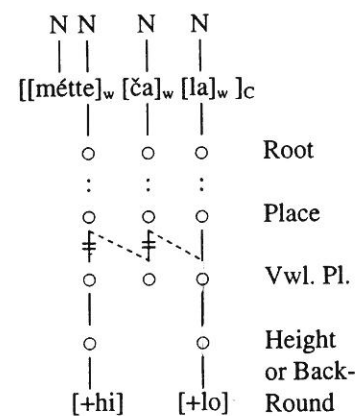
[méttaçala]
'put it (FEM.SG) there'

(See the preceding paragraph for a detailed explanation of the two steps in c.)

3. Servigliano metaphony

As stated earlier, Servigliano has an inventory of seven underlying vowels, all

of which surface in tonic position: /i, e, ε, a, ɔ, o, u/. Four of these tonic vowels, the closed and open mid pairs /e, o/ and /ε, ɔ/, respectively, undergo metaphony when followed by an /i/ or /u/ in final position. The mid vowels /e, o/ and /ε, ɔ/ are raised one degree in height in this context, resulting in [i, u] and [e, o], respectively. Examples showing metaphonic alternations are provided in (14):

(14) a. /e/ raised to [i]

métt-o	'I put'	mítt-i	'you put'
kréd-o	'I believe'	kríd-i	'you believe'
kwést-o	'this (NEUT)'	kwíst-u	'this (MASC.SG)'
kwést-e	'these (FEM.PL)'	kwíst-i	'these (MASC.PL)'
pés-a	'heavy (FEM.SG)'	pís-u	'heavy (MASC.SG)'
més-e	'month (MASC.SG)'	mís-i	'month (MASC.PL)'
métt-a=ča=la	'put it (FEM.SG) there'	mítt-u=ču=lu	'put it (MASC.SG) there'
métt-e=če=le	'put it (FEM.PL) there'	mítt-i=či=li	'put it (MASC.PL) there'

b. /o/ raised to [u]

fjór-e	'flower (MASC.SG)'	fjúr-i	'flower (MASC.PL)'
spós-a	'wife (FEM.SG)'	spús-u	'husband (MASC.SG)'
póč-e	'flea (MASC.SG)'	púč-i	'flea (MASC.PL)'
róšš-a	'red (FEM.SG)'	rúšš-u	'red (MASC.SG)'
skjifós-a	'fussy (FEM.SG)'	skjifús-u	'fussy (MASC.SG)'
lóng-a	'long (FEM.SG)'	lúng-u	'long (MASC.SG)'

c. /ε/ raised to [e]

modést-a	'modest (FEM.SG)'	modést-u	'modest (MASC.SG)'
sgwéz-a	'sinister (FEM.SG)'	sgwéz-u	'sinister (MASC.SG)'
ššwért-a	'eccentric (FEM.SG)'	ššwért-u	'eccentric (MASC.SG)'
pétten-e	'comb (MASC.SG)'	péttin-i	'comb (MASC.PL)'
prédok-o	'I preach'	prédik-i	'you preach'
pérsak-a	'peach tree (FEM.SG)'	pérsuk-u	'peach (MASC.SG)'
		pérsik-i	'peach (MASC.PL)'

d. /ɔ/ raised to [o]

sprót-a	'pedantic (FEM.SG)'	sprót-u	'pedantic (MASC.SG)'
mór-e	'he dies'	mór-i	'you die'
mórt-a	'dead (FEM.SG)'	mórt-u	'dead (MASC.SG)'
móš-a	'depressed (FEM.SG)'	móš-u	'depressed (MASC.SG)'
birikókan-a	'apricot tree (FEM.SG)'	birikókun-u	'apricot (MASC.SG)'

Camilli (1929) notes some exceptions to metaphony, such as the three place adverbs [ékko] 'here', [ésso] 'there', and [éjjo] 'there' when followed by an enclitic with a [+high] vowel (e.g. [ékki=li]). (Note, however, that vowel copying does occur in these forms.) In addition, [o] historically derived from [au] fails to undergo metaphony when in tonic position (ó < au): [kós-a]/[kós-u] 'thing', [pók-a]/[pók-u] 'little', [trópp-a]/[trópp-u] 'too much'. (In atonic position, however, o < au will undergo raising, albeit by a process different from metaphony that will be discussed in Section 4: /kos-ett-u/ → [kos-ítt-u] by metaphony → [kus-ítt-u] by pretonic vowel raising.) Camilli (1929) shows various other exceptional items as well, e.g. [alégr-u] 'merry', [amór-u] 'mulberry', [moróš-u] 'ogre', [teléfruk-u] 'telegraph', etc.

The remaining tonic vowels, /i, u, a/, are not altered by metaphony, as shown by the data in (15):

(15) a. /i/

díč-e	'he says'	díč-i	'you say'
amík-a	'friend (FEM.SG)'	amík-u	'friend (MASC.SG)'

b. /a/

pátr-e	'father (MASC.SG)'	pátr-i	'father (MASC.PL)'
kár-a	'dear (FEM.SG)'	kár-u	'dear (MASC.SG)'

c. /u/

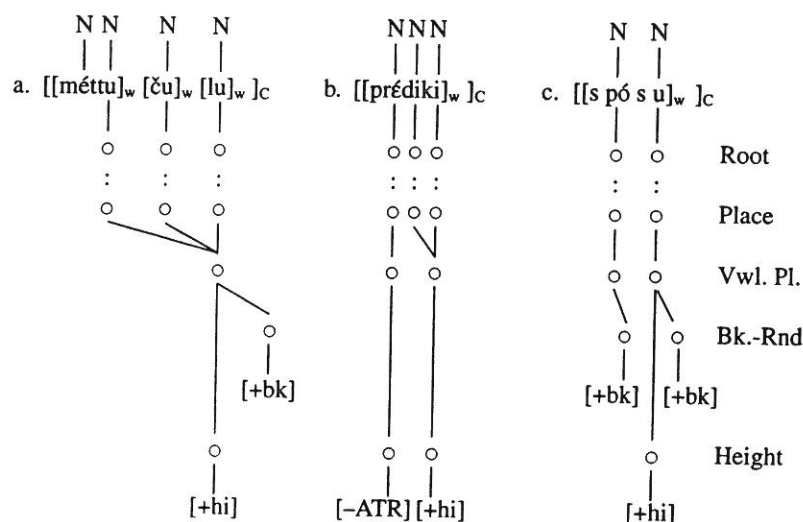|			
mút-a	'mute (FEM.SG)'	mút-u	'mute (MASC.SG)'
mút-o	'mute (NEUT)'	mút-i	'mute (MASC.PL)'

The triggers of metaphony have been identified as /i/ or /u/ in final position. While the majority of the examples in (14) show these vowels at the end of a word, the alternations méttačala / méttečele vs. míttučulu / míttičili (/mett-i/) demonstrate that the trigger may also come from a clitic dependent on the word. Therefore, like vowel copying, metaphony must apply at the clitic group level (C) (Hayes 1984, Nespor and Vogel 1986). Note that if metaphony were to apply at the phonological word level (W), the form *míttačala, rather than méttačala, would be generated: the /i/ at the end of the word domain in [mett-i]$_W$ would first raise tonic /e/ to [í] before becoming an [a] itself through vowel copying at the clitic group level (*[[mítta]$_W$[ča]$_W$[la]$_W$]$_C$). Since *míttačala is not the form that surfaces, metaphony must apply in the C domain, the trigger being the final vowel (trigger= V]$_C$).

According to the underspecified vowel representations in (6), the triggering vowels /i/ and /u/ form a natural class in that they are [+high]. Metaphony can be understood as the spreading of this [+high] feature leftward from a clitic-group final vowel to the vowel in C with primary stress. While in most of the examples in (14) the stressed vowel is the syllable head adjacent to the trigger (e.g. [mísi] /mes-i/, [písu] /pes-u/), in other examples the target and trigger are

separated by intervening syllable heads (e.g. [prédiki] /prɛdik-i/, [míttučulu] /mett-i=če=lu/). This second possibility indicates that, unlike vowel copying, metaphony does not apply at maximal scansion, since at the maximal level of structure available to the rule (i.e. N) adjacency is violated.
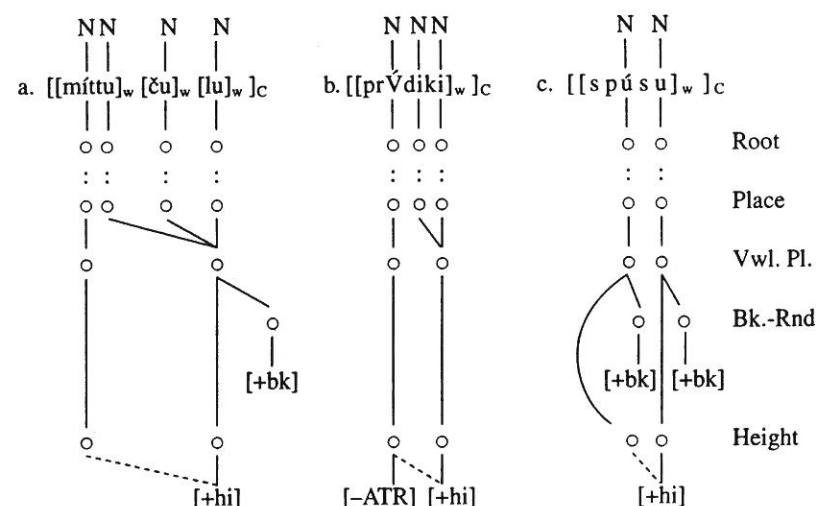
The alternative option is for metaphony to apply at minimal scansion, in which case adjacency is defined with respect to the Height tier, as it immediately dominates the argument [+high] in the feature hierarchy (Archangeli and Pulleyblank 1987, Odden 1991). The non-effect of intervening vowels on metaphonic spreading is explained when the notion of minimal scansion is combined with the ordering of metaphony after vowel copying, as both processes apply at the *C* level. The result of vowel copying is that post-tonic vowels are connected to a single Vowel Place node, as shown below in step 1 of (16). When metaphony subsequently applies, the target and trigger are adjacent to one another with respect to their Height nodes, since the trigger's Vowel Place node is shared by other post-tonic vowels and since this node is absent from the feature tree structures of consonants (see step 2 of [16]).[10]

(16) 1) Result of vowel copying

a. [[méttu]ᵥᵥ [ču]ᵥᵥ [lu]ᵥᵥ]꜀   b. [[prédiki]ᵥᵥ]꜀   c. [[s pó s u]ᵥᵥ]꜀

Root · Place · Vwl. Pl. · Bk.-Rnd · Height

[+bk] [+hi] [−ATR] [+hi] [+bk] [+bk] [+hi]

---

10. The representations in (16a) and (16c) of the feature tree structure of the intermediate forms *méttučulu* and *spósu*, respectively, show that the targets [é] and [ó] lack a Height node when metaphony applies. Since one of the conditions of metaphony is that a vowel carry primary stress, the rule must scan metrical structure in addition to the Height tier in order to locate its target. It is in this way that [é] and [ó] are identified as targets of spreading, their Height nodes becoming present when they acquire the argument [+high]. Also in regard to (16), the representation in step 2 of example (b) is not final. Further discussion of it will follow shortly.

(16) 2) Metaphony:

a. [[míttu]ᵥᵥ [ču]ᵥᵥ [lu]ᵥᵥ]꜀   b. [[prV́diki]ᵥᵥ]꜀   c. [[s pú s u]ᵥᵥ]꜀

Root · Place · Vwl. Pl. · Bk.-Rnd · Height

[+bk] [−ATR] [+hi] [+hi]

In regard to the target of metaphony, it has been described as the vowel in *C* with primary word stress. The rule of metaphony now can be formalized as follows in (17):

(17)   Servigliano metaphony
        operation: spreading
        tier scansion: minimal
        argument: [+high]
        trigger: V]꜀
        target condition: primary stressed vowel

N   N
[... X́   X]꜀

Root node · Vowel Place node · Height node
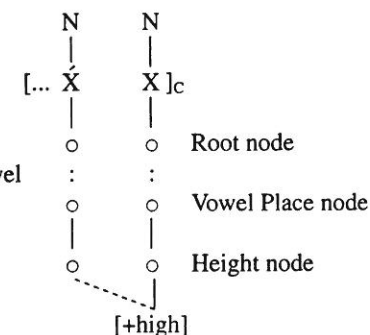
[+high]

As illustrated by the examples *míttučulu* ([é] → [í]) and *spúsu* ([ó] → [ú]) in (16a) and (16c), respectively, the metaphonic raising of the closed mid vowels is straightforward: the feature [+high] is spread to the target with no consequence to any already present feature specification. In the case of the open mid vowels, however, the spreading of [+high] is problematic. As shown by the example *prédiki* ([ɛ] → [é]) in (16b), the feature configuration *[+high, −ATR] is created, which Calabrese (1991) identifies as ill-formed in a number of Italian dialects because it represents a degree of complexity greater than that allowed in them (see also Calabrese 1988). Since this configuration fails to surface in

Servigliano (*[prídiki]), it must be the case that it is too complex in this dialect as well.

Calabrese (1991) argues that an ill-formed configuration like *[+high, −ATR] functions as a filter in the grammar that can trigger various simplification rules to repair it when it arises during a derivation. The simplification rule that seems to apply to *[+high, −ATR] in Servigliano when it is produced by metaphony is negation, a strategy which changes the values of the features involved to their opposites, in this case [+high, −ATR] → -([+high, −ATR]) → [−high, +ATR]. The feature values that result are precisely those that define [e] and [o], the vowels that surface when metaphony applies to [ɛ] and [ɔ], respectively. Following this solution, the derivation of the form *prédiki* initiated earlier in (16b) can be completed as in (18). Step (18b) reflects the necessary separation of [+high] into two separate instances before the rule of negation can apply as shown in (18c) (Calabrese 1991: 91, 93–4). Note, however, that step (18b), so crucial to this solution, can be considered highly problematic, since it represents a violation of the OCP (cf. Leben 1979, McCarthy 1986). (This problem does not arise in the analysis to be presented in Section 6.)

(18) a. [[prV́diki]_w]_C   b. [[prV́diki]_w]_C   c. [[prédiki]_w]_C

| | | | | | | | |

o o o   o o o   o o o   Root node
: : :   : : :   : : :

o o o   o o o   o o o   Place node
| \ | \ | \

o   o   o   o   o   o   Vowel Place node
| | | | | |

o   o   o   o   o   o   Height node
⌐ ⸜ ⌐   ⸝ ⸝ | ⸜ ⸜ |

[−ATR] [+hi]   [−ATR] [+hi] [+hi]   [+ATR] [−hi] [+hi]
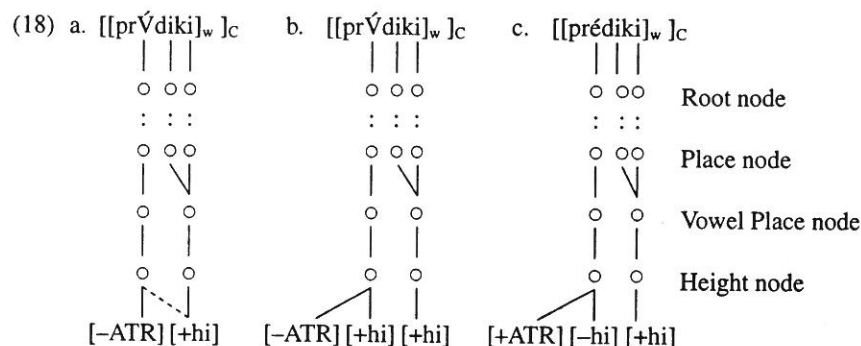
The results of the spreading of [+high] to closed and open mid vowels in Servigliano metaphony have now been discussed. Metaphony's lack of effect on the remaining tonic vowels [í], [ú], and [á] will now be addressed. In regard to [í] and [ú], the spreading of [+high] is of no consequence, since these vowels already carry this specification. In regard to [á], on the other hand, which is specified as [+low], the spreading of [+high] creates the impossible feature configuration *[+high, +low], which functions as a filter in all languages (Calabrese 1988, 1991).[11] However, while the preferred simplification rule triggered by the filter *[+high, −ATR] in Servigliano is negation, the repair rule

triggered by *[+high, +low] appears to be delinking, which functions to delink one of the features in a disallowed configuration, in this case [+high], leaving the original specification [+low]. The end result of this repair rule is that [á] is left unaltered by metaphony in Servigliano.[12]

Under the analysis of Servigliano metaphony presented thus far, the spreading of [+high] to a tonic vowel can potentially violate two different filters, namely *[+high, −ATR] and *[+high, +low], each of which triggers a different simplification rule, namely negation and delinking, respectively. Although these filters and simplification rules may be well attested in Calabrese (1991) in that they explain facts found in a number of languages and dialects, an appeal to the negation of *[+high, −ATR] to explain the case of Servigliano metaphony (or any similar case of scalar assimilatory raising, such as metaphony in southern Umbro (Calabrese 1991)) seems less than satisfactory. Calabrese (1991) argues that this type of an analysis is attractive because it makes possible the uniform treatment of metaphony in a number of related Italian dialects: a single rule of spread [+high] applied to open mid vowels results in the ill-formed configuration *[+high, −ATR], which is resolved in each dialect by applying one of three simplification rules that derives a certain result, thereby accounting for dialectal variation. While treating Servigliano metaphony uniformly with other dialects is indeed attractive, it has the disadvantage of obscuring the nature of this specific process: that the mid vowels are raised in a *gradient* fashion in anticipation of a following high vowel.

In this anaylsis, gradient raising is achieved in part through the negation of the feature combination *[+high, −ATR]. This solution makes the raising of [ɛ, ɔ] to [é, ó], their counterparts one step up in height, appear to be a coincidental rather than expected, natural result, and furthermore, it entails a violation of the OCP. At the root of this reliance on negation to produce the effect of raising is the absence of a feature for vowel height among those features in figure (6) that can raise both an open mid vowel to a closed mid vowel and a closed mid vowel to

---

11. The *[+high, +low] filter has been appealed to in various other works treating vowel harmony processes, for example, Pulleyblank (1988), Vago (1988), Hualde (1989), and Kaze (1989, 1991).

---

12. Calabrese (1991: 43–6) argues that in accordance with Kiparsky's (1982) Derivational Simplicity Criterion (DSC) (which states that among alternative maximally simple grammars, select that which has the shortest derivations), a filter can block the application of a rule to a certain segment if this application results in a disallowed feature configuration that is subsequently repaired by delinking the very feature assigned by the rule. This scenario exactly fits the case of spreading [+high] to [á] during Servigliano metaphony. While Calabrese's (1991) argument offers a simple account of the non-effect of metaphony on [á] (i.e. the process is simply blocked by the filter *[+high, +low]), it grants filters an excessive amount of power in his theory: any given filter can not only trigger simplification rules but also can remember that the application of a certain phonological rule to a certain segment produced a violation of itself, and that this violation was repaired by delinking. The filter's knowledge of this scenario then enables it to block the application of the rule to the segment in question by way of the DSC. Given that this argument attributes too much power to filters, the first analysis presented in this paper (in which [+high] is delinked from the configuration *[+high, +low] produced by the spreading of [+high] to [á]) will be maintained.

a high vowel. Due to the absence of such a feature, [+high] is used since it forms part of the feature representations of both /i/ and /u/ and captures the generalization that metaphony is an assimilatory process of raising by spreading. The feature [+high] enters into conflict with [−ATR] and [+low] because in this dialect, these three features are employed to represent the single articulatory parameter of vowel height, a point well made in Clements (1989).

While various models of the representation of vowel height different from the one using binary values of [high], [low], and [ATR] have been employed previously in the analysis of Italian metaphony (see, for example, Kaze (1989, 1991), Maiden (1991)), they have met with some difficulty.[13] In Section 6 of this paper, the Servigliano facts will be reanalyzed within the recent model proposed by Clements (1989, 1991a, b). In this model, vowel height is expressed in terms of hierarchically organized occurrences of the feature [open] under an aperture, or vowel height, node. It will be shown that the use of the single feature [open] to define vowel height makes it possible to directly derive metaphonic raising in Servigliano as a scalar phenomenon rather than as a coincidental result.

4. Servigliano pretonic vowel raising

The final process affecting vowels that will be discussed in this paper is *pretonic vowel raising* (PVR). In PVR, tonic [í] and [ú] trigger the raising of the pretonic mid vowels [e] (whether from /e/ or /ɛ/) and [o] (whether from /o/ or /ɔ/) to [i] and [u], respectively. Alternations illustrating this process are provided in (19) below. Note that all pretonic mid vowels in the word are affected by this process and that the triggers [í] and [ú] may be word final or word internal:[14]

---

13. For an account of Servigliano metaphony using an adapted version of Goldsmith's (1987) framework, see Kaze (1989, 1991). Kaze's work also presents arguments against the use of Schane's (1984) Particle Theory to account for assimilatory processes of raising. (Clements (1989) also identifies some of the shortcomings of this theory.) Furthermore, see Maiden (1991) for a general account of metaphony within the framework of Dependency Phonology. Calabrese (1991) presents arguments against the analyses presented in both Kaze (1989, 1991) and Maiden (1991). Likewise, Kenstowicz (1991) points out problems encountered in the use of Dependency Phonology to explain metaphony. It is beyond the scope of this paper to summarize all of the arguments put forth in these sources.

14. Kaze (1989,1991) gives a different account of these facts using a version of Goldsmith's (1987) framework. Specifically, he views metaphony and PVR as a single iterative process of raising triggered by a final atonic high vowel or a tonic high vowel, and blocked by tonic [á], [ɛ́], and [ɔ́], although the latter two segments undergo the process. In the present analysis, these two very different triggers (one is atonic and final, the other is tonic and final or non-final) are taken to indicate two separate vowel raising processes. In keeping with the Romanist definition of metaphony as the assimilatory raising of a tonic vowel conditioned by a final high vowel (cf. Hualde 1989, Maiden 1991), the former trigger is that of metaphony while the latter trigger is

(19) a. /e/ raised to [i]

kred-énno	'believing'	krid-í	'to believe'
verd-ó	'very green (MASC.SG)'	vird-ú	'very green (MASC.PL)'
rréšš-o	'I go out'	rrišš-í	'to go out'
leg-éte	'you (PL) tie'	lig-ímo	'we tie'
bbesoñ-á	'to need'	bbisuñ-ímo	'we need'
stommekós-a	'nauseating (FEM.SG)'	stummikús-u	'nauseating (MASC.SG)'

b. /ɛ/ (reduced to [e]) raised to [i]

sténn-e	'he spreads'	stenn-éte	'you (PL) spread'	stinn-í	'to spread'
véng-o	'I come'	ven-éte	'you (PL) come'	vin-í	'to come'

c. /o/ raised to [u]

bokkal-ó	'foolish (MASC.SG)'	bukkal-ú	'foolish (MASC.PL)'
nfork-éte	'you (PL) mount'	nfurk-ímo	'we mount'
kommonek-á	'to communicate'	kummunik-ímo	'we communicate'
bokalétt-a	'? (FEM.SG)'	bukalítt-u	'? (MASC.SG)'

d. /ɔ/ (reduced to [o]) raised to [u]

dɔ́rmo	'I sleep'	dorm-éte	'you (PL) sleep'	durm-í	'to sleep'
mɔ́ro	'I die'	mor-éte	'you (PL) die'	mur-í	'to die'
dɔ́le	'to hurt'	dol-ésse	'it hurt (PAST SUBJ)'	dul-ía	'it hurt (imp.)'
bbesɔ́ñ-a	'need (FEM.SG)'	bbesoñ-á	'to need'	bbisuñ-ímo	'we need'

Camilli (1929) shows a few exceptions to PVR, for example, the place adverb [nnenzú] 'over there?', the noun [kontadí(nu)]/[kontadí(ni)] (vs. [kontadíne]) 'peasant, farmer', and others.

The examples in (19b and d) demonstrate that PVR applies after atonic vowel reduction: this latter process first reduces /ɛ, ɔ/ to [e, o], which are then raised to [i, u] by PVR. Note that the opposite rule ordering produces incorrect results: *(/ɛ, ɔ/ → PVR [e, o] → AVR (NA)) (Kaze 1989: 75–76).

As pointed out during the discussion of metaphony in Section 3, the triggering vowels [í] and [ú] form a natural class in that they are [+high]. PVR

---

that of PVR.

therefore can be characterized as the leftward spreading of this feature from the trigger to a preceding vowel. As shown by examples such as [kummunikímo] (cf. [kommoneká]) and [bbisuñímo] (cf. [bbesoñá]), more than one pretonic vowel may be raised by this process. PVR therefore must apply in an iterative fashion. Since [e] (which is completely unspecified) and [o] (which lacks a specification for height and therefore a Height node) are identified as targets of iterative spreading, PVR applies at maximal scansion (i.e. adjacency is determined with respect to syllable heads, which maximally dominate the argument [+high] in the feature hierarchy) (Archangeli and Pulleyblank 1986, 1987). If PVR were to apply at minimal scansion (adjacency being defined with respect to the Height tier), neither [e] nor [o] would not be targeted by the rule, since at the time of spreading both lack a Height node (see derivations in (21) below).
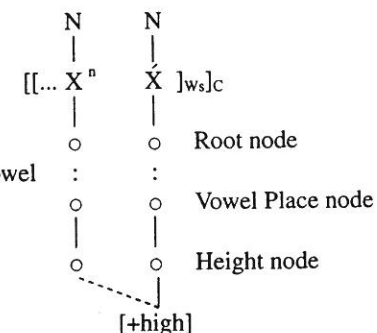
Sequences such as [[jje]$_w$[ttunnímo]$_w$]$_C$ (/jje=ttonn-imo/; 'we cut it/them'), [[če]$_w$ [fačímo]$_w$]$_C$ (/če=fač-imo/; 'we make ourselves'), and [[jje]$_w$[díče]$_w$]$_C$ (/jje=dič-e/; 'he says to him/her/them'), which show proclitics before a host with [í] or [ú], demonstrate that PVR does not extend further leftward than the word boundary.[15] Although this seems to indicate that PVR operates at the word level, other facts show that this cannot be so. Specifically, alternations such as *stommekósa* vs. *stummikúsu* and *bokalétta* vs. *bukalíttu* reveal that PVR is fed by metaphony: when as a result of metaphonic raising a tonic vowel becomes high (i.e. when [é] and [ó] are the targets of metaphony), PVR subsequently applies, since metaphony has created its triggers. (When, on the other hand, metaphony does not produce a high tonic vowel, as shown in the alternations *modésta* vs. *modéstu* and *ñenókkjo* vs. *ñenókkju*, no interaction between these two processes takes place.) Since metaphony may feed PVR, this latter process must follow the former, which was shown in Section 3 to apply at the clitic group level. Therefore, it follows that PVR must also apply in the domain of the clitic group and not of the phonological word, as a first glance would indicate.

The fact that proclitic vowels in *C* are not targeted by PVR can be accounted for by appealing to the relative prominence of the constituents within *C* (cf. Nespor and Vogel 1986: 155–156). As mentioned in Section 2, in Servigliano the strong node in *C* is that *W* which contains the nonclitic element, so our earlier sequences are structured as follows: [[jje]$_{Ww}$[ttunnímo]$_{Ws}$]$_C$, [[če]$_{Ww}$[fačímo]$_{Ws}$]$_C$, and [[jje]$_{Ww}$[díče]$_{Ws}$]$_C$. By imposing the target condition [[...V...]$_{Ws}$]$_C$, which states that a vowel must be contained within *W$_s$* to be targeted by PVR, the vowels of proclitics are excluded from this raising process.

In regard to the triggers ([í, ú]) of PVR, they have been described as [+high] vowels carrying primary word stress. The rule of PVR now can be formulated

---

15. Camilli (1929: 224, 225, 232) notes an exception to this, namely, the sequence [[pir]$_w$[ú]$_w$]$_C$ (/per + u(nu)/; 'for one' (preposition + pronoun)). He cites [due pir ú(nu)] 'two for one' vs. [unu per ó(mo)] 'one per man'.

as follows:

(20) Servigliano pretonic vowel raising
operation: iterative spreading
direction: leftward
tier scansion: maximal
argument: [+high]
trigger condition: primary stressed vowel
target condition: [[...V...]$_{Ws}$]$_C$
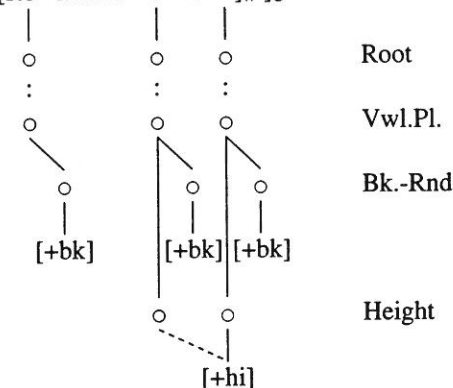

Derivations are provided in (21):

(21)
a. /bbesoñ-imo/   b. /stommek-os-u/   c. /bokkal-u/   d. /jje=ttonn-imo/

1) Primary stress assignment and atonic vowel reduction
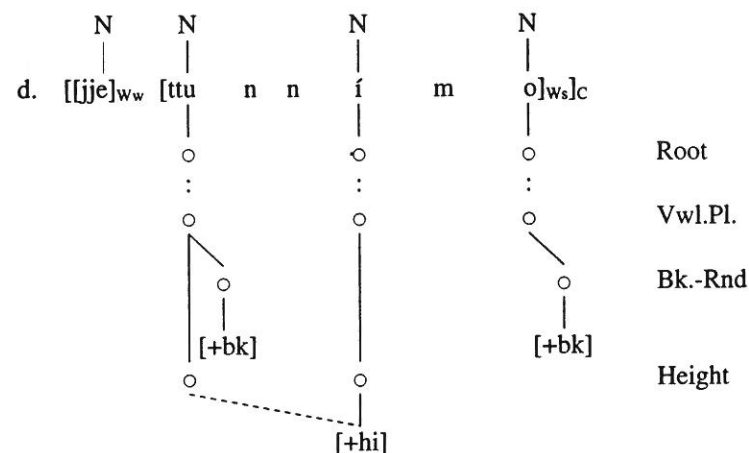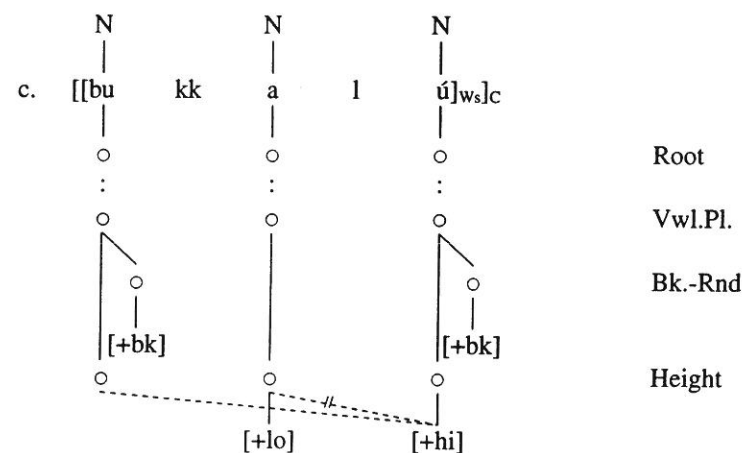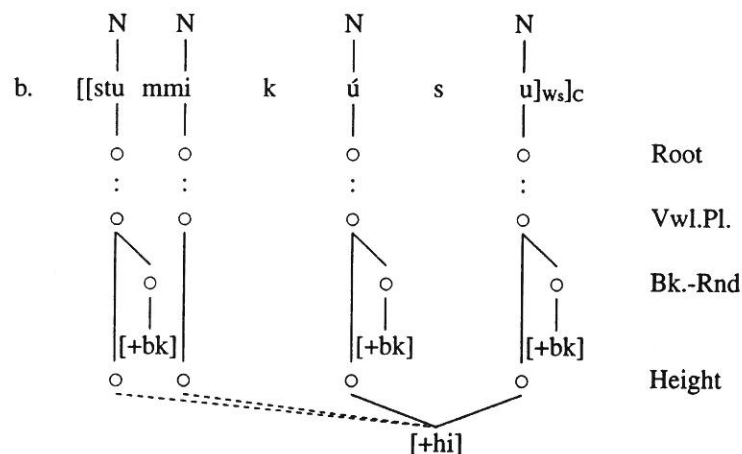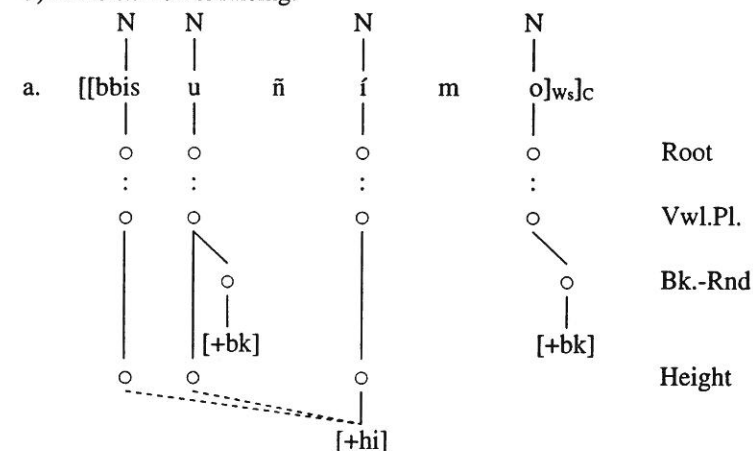a. [bbesoñímo]$_w$ b. [stommekósu]$_w$ c. [bokkalú]$_w$ d. [jje] [ttonnímo]$_w$

2) Metaphony
a. NA   b. [[sto mmek ú s u]$_w$]$_C$ c. NA   d. NA

3) Pretonic vowel raising:

a.

```
        N      N              N                N
        |      |              |                |
   [[bbis     u       ñ       í       m        o]ws]c
        |      |              |                |
        o      o              o                o          Root
        :      :              :                :
        o      o              o                o          Vwl.Pl.
               |\                                \
               o                                 o        Bk.-Rnd
              [+bk]                             [+bk]
        o      o              o                          Height
        ·······················|
                              [+hi]
```

b.

```
        N      N              N                N
        |      |              |                |
   [[stu  mmi      k          ú       s        u]ws]c
        |      |              |                |
        o      o              o                o          Root
        :      :              :                :
        o      o              o                o          Vwl.Pl.
        |\     |              |\               |\
        o      |              o                o          Bk.-Rnd
       [+bk]                 [+bk]            [+bk]
        o      o              o                o          Height
        ·····················|_____/
                           [+hi]
```

c.

```
        N              N              N
        |              |              |
   [[bu      kk        a       l      ú]ws]c
        |              |              |
        o              o              o          Root
        :              :              :
        o              o              o          Vwl.Pl.
        |\             |              |\
        o              |              o          Bk.-Rnd
       [+bk]                         [+bk]
        o              o              o          Height
        ················[·········//·|
                      [+lo]        [+hi]
```

d.

```
              N      N              N                N
              |      |              |                |
   [[jje]ww [ttu     n       n      í       m        o]ws]c
              |                              |
              o                     o        o          Root
              :                     :        :
              o                     o        o          Vwl.Pl.
              |\                             |
              o                              o          Bk.-Rnd
             [+bk]                          [+bk]
              o                     o                    Height
              ·····················|
                                  [+hi]
```

a. [bbisuñímo]   b. [stummikúsu]
   'we need'   'nauseating' (MASC.SG)

c. [bukkalú]   d. [jje ttunnímo]
   'foolish' (MASC.PL)   'we cut it/them'

In step 3 of (21), the feature [+high] spreads leftward iteratively to [o] and [e], deriving [u] and [i], respectively. (21c) shows the spreading of [+high] to [a] as well, which remains unaltered. As explained in Section 3, the impossible feature combination *[+high, +low] created during the spreading process is resolved by the delinking of [+high]. Steps 2 and 3 of (21b) illustrate the feeding relationship that can exist between metaphony and PVR.

5. Summary

In summary, four phonological processes in the Servigliano dialect have been identified and analyzed: 1) atonic vowel reduction (AVR), which entails the delinking of [−ATR] from vowels not carrying primary word stress; 2) vowel copying, during which the Vowel Place node of a word-final vowel in the C domain spreads leftward up until a vowel carrying stress (primary or secondary); 3) metaphony, during which [+high] spreads from the final vowel in C to the vowel carrying primary word stress in this domain; and 4) pretonic vowel raising (PVR), which entails the leftward spreading of [+high] from the vowel in C carrying primary word stress to the vowels contained in C's strong node (W_s). It has been established that primary stress assignment precedes AVR, that primary and secondary stress assignment precede vowel copying, that primary

stress assignment and vowel copying precede metaphony, and that AVR and metaphony precede PVR. These rule ordering requirements, along with the proposed domains of rule application, are illustrated in (22) below:

(22)   [ ]w: Primary Stress Assignment
                    Atonic Vowel Reduction
        [[ ]w]c: Secondary Stress Assignment
                    Vowel Copying
                    Metaphony
                    Pretonic Vowel Raising

In regard to the three harmonization processes specifically, it has been found that they interact in interesting ways. First, the structural result of vowel copying is exploited by metaphony to achieve the effect of transparency: the argument [+high] may spread from a final vowel onto a preceding nonadjacent vowel without the interference of intervening vowels because these share a single Vowel Place node with the trigger. This manner of achieving transparency to spreading (which, in other languages, is commonly attained through the full underspecification of a segment (cf. Archangeli and Pulleyblank 1987)) is rather unique. Second, the two vowel raising processes, metaphony and pretonic vowel raising, can be in a feeding relationship: when metaphony produces a [+high] tonic vowel, it creates the trigger of PVR, which then spreads the [+high] feature leftward to pretonic vowels. Third, the three vowel harmony processes together exhaust the target vowel positions that appear in the clitic group domain. Given a hypothetical string such as $[[\grave{v}]_{Ww}[V]_{Ww}[V]_{Ww}[V\ V\ \acute{v}\ V\ V]_{Ws}]_C$, vowel copying targets the following vowels (i.e. those underlined; triggers appear in italics) $[[\grave{v}]_{Ww}[\underline{V}]_{Ww}[V]_{Ww}[V\ V\ \acute{v}\ \underline{V}\ V]_{Ws}]_C$; metaphony involves $[[\grave{v}]_{Ww}[V]_{Ww}[V]_{Ww}[V\ V\ \underline{\acute{v}}\ V\ V]_{Ws}]_C$; and PVR involves $[[\grave{v}]_{Ww}[V]_{Ww}[V]_{Ww}[\underline{V}\ \underline{V}\ \acute{v}\ V\ V]_{Ws}]_C$. Curiously, the targets of vowel copying and metaphony (whose triggers are delimited by prosodic boundary) are determined by metrical structure, while the targets of PVR (whose trigger is determined by metrical structure) are delimited by prosodic boundary. In other words, Servigliano's three harmonization processes are complementary in nature and present an interesting interplay between prosodic structure, metrical structure, and the feature hierarchy.

These facts have been analyzed in accordance with Calabrese (1991) and the feature system specified in figure (6) in which vowel height is defined in terms of the binary values of [high], [low], and [ATR]. While the use of these features permits an analysis of Servigliano metaphony that is uniform with Calabrese's (1991) analyses of various related dialects, it obscures the scalar nature of metaphony in the present dialect: the raising of [έ, ɔ́] to [é, ó] is derived from the seemingly accidental outcome of the negation of *[+high, −ATR]. Therefore,

the final section of this paper will briefly examine how the rules of Servigliano vowel harmony can be reworked within Clements' (1989, 1991a, b) recent framework, which represents the single parameter of vowel height in terms of the single feature [open].
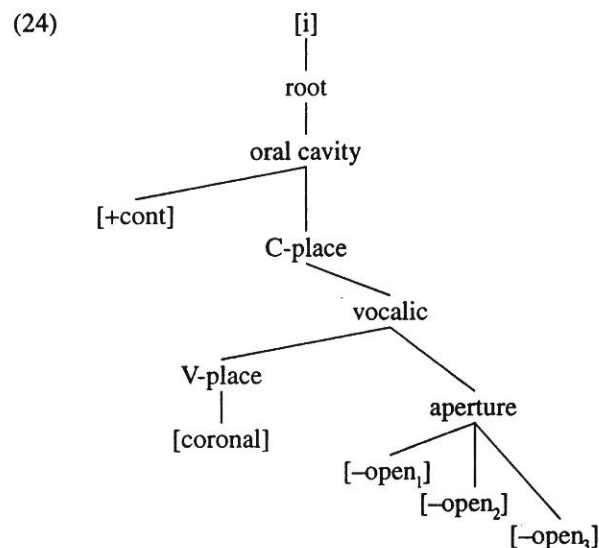
6. Clements' (1989, 1991a, b) hierarchical analysis of vowel height

According to Clements (1989: 26), vowel height is organized formally into a hierarchical system. Within this system, it is expressed in terms of a single binary feature [±open] that initially divides vowels into two primary height registers, termed upper (−) and lower (+). The upper register can be divided into two subregisters, or secondary registers, contained on an additional tier which lead to a vowel system of three heights (Clements 1989: 26, 1991a). In a vowel system of four heights, such as that of Servigliano, a further division of one of these subregisters is needed to create two tertiary registers, which appear on yet another tier. The resulting configuration is a left-branching hierarchical system as shown in (23) (Clements 1989: 27, 1991a):

(23)   Hierarchy of feature values for a vowel system of four heights (left-branching)

	(((i, u	e, o)	ε, ɔ)	a)	
[open₁]:	−	−	−	+	(primary registers)
[open₂]:	−	−	+		(secondary registers)
[open₃]:	−	+			(tertiary registers)

The various values of [open] that appear on separate tiers to define the height of any given vowel are linked to a common node for vowel height called the aperture node (Clements 1989: 27). The aperture node, along with a node for the place features of vocoids (termed the V-place node), is in turn dominated by the vocalic node (Clements 1991a, b). A more complete feature geometry tree illustrating the relationship among these constituents is provided in (24) for the segment [i] (Clements 1991a, b):

(24)

```
                          [i]
                           |
                          root
                           |
                      oral cavity
                     /          \
                [+cont]         C-place
                               /      \
                          V-place    vocalic
                             |       /      \
                        [coronal] V-place  aperture
                                          /   |   \
                                    [−open₁]  |    \
                                       [−open₂] \
                                            [−open₃]
```

Vowels not specified for a value of [open] on a certain tier in (23) later receive the redundancy feature [+open], which is inserted by the redundancy rule in (25a) (Clements 1989: 28). The redundancy rule in (25b) also holds for this left-branching system (Clements p.c.):

(25)   a. $[+\text{open}_n] \rightarrow [+\text{open}_{n+1}]$
       b. $[-\text{open}_n] \rightarrow [-\text{open}_{n-1}]$

The hierarchical analysis shown in (23) creates a secondary register on tier two that groups [i] and [e] together in opposition to [ɛ]. Clements (1989: 30) points out that some vowel systems with four heights do not observe this grouping but instead group the mid vowels [e] and [ɛ] together in opposition to [i]. This seems to be true of Servigliano's vowel system, since the neutralization between [e] and [ɛ] in atonic position reveals that they are closely related. A center-embedding hierarchical system therefore applies in this dialect as in many other Romance languages (Clements 1989: 30, 1991a):

(26)   Hierarchy of feature values for a vowel system of four heights (center-embedding)

	((	i, u	(	e, o	ɛ, ɔ	))	a)	
[open₁]:		−		−	−		+	(primary registers)
[open₂]:		−		+	+			(secondary registers)
[open₃]:		−		−	+			(tertiary registers)

In the center-embedding system, the following implications hold (Clements 1989: 30, p.c.):

(27)   a. $[+\text{open}_1] \rightarrow [+\text{open}_2]$ c. $[-\text{open}_2] \rightarrow [-\text{open}_1]$
       b. $[+\text{open}_3] \rightarrow [+\text{open}_2]$ d. $[-\text{open}_2] \rightarrow [-\text{open}_3]$
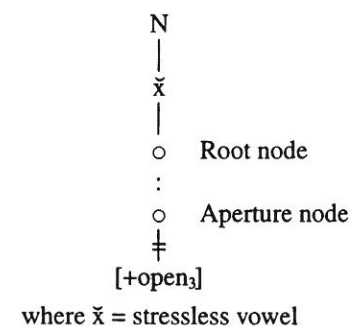
Within Clements' (1989, 1991a, b) model, atonic vowel reduction in Servigliano can be expressed as in the previous model: the feature [+open₃] delinks from the tree structure of a vowel in atonic position. This reduced system is shown in (28):

(28)   Hierarchy of feature values for a reduced vowel system of three heights

	((	i, u	e, o)	a)
[open₁]:		−	−	+
[open₂]:		−	+	
[open₃]:		−	−	

Our earlier rule of atomic vowel reduction can be reformulated as in (29):

(29)   Servigliano atonic vowel reduction
       operation: delinking
       argument: [+open₃]
       target condition: stressless vowel

```
              N
              |
              x̆
              |
              o   Root node
              :
              o   Aperture node
              ‡
          [+open₃]
```

where x̆ = stressless vowel

Clements' (1989, 1991a, b) model also facilitates a straightforward, elegant account of Servigliano metaphony and pretonic vowel raising. First, the triggers of these raising processes, /i, u/, form a natural class in that they carry a negative specification for the feature [open] on tier two. Second, their targets, [é, ɛ́, ó, ɔ́] in metaphony and [e, o] in PVR, constitute a natural class in that they carry a negative specification for [open] on tier one. These processes therefore involve the spreading of an instance of [−open] from vowels specified as [−open₂] to those specified as [−open₁]. Note that although /i, u/ are also included in the target class [−open₁], the spreading of [−open] will not affect them as they already carry a negative value for [open] on every other tier. /a/ is naturally excluded from the target class since it is [+open₁].

Now that the triggers and targets of these processes have been classified

within this framework, it is necessary to determine how the spreading of [–open] applies in each process. The representations in (30) below illustrate the effects of [–open] spreading on the aperture feature trees of targets in metaphony (30a, 30b) and pretonic vowel raising (30b) (figures adapted from Clements 1991a, p.c.):

(30)   a. Metaphony   b. Metaphony and
                                              pretonic vowel raising

$$\{\varepsilon,\mathit{ɔ}\}...\{i,u\} \rightarrow \{e,o\}...\{i,u\} \quad \{e,o\}...\{i,u\} \rightarrow \{i,u\}...\{i,u\}$$

Considering pretonic vowel raising first, (30b) shows that [–open] spreading to closed mid vowels must occur on tier two. A revised rule of this process can be formulated as follows:

(31)   Servigliano pretonic vowel raising
        operation: iterative spreading
        direction: leftward
        tier scansion: maximal
        argument: [–open$_2$]
        trigger condition: primary stressed vowel
        target condition: [–open$_1$], [...V...]$_{ws}]_c$
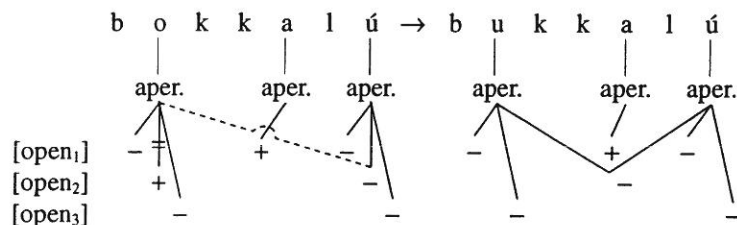

A sample derivation illustrating the application of PVR is given in (32):

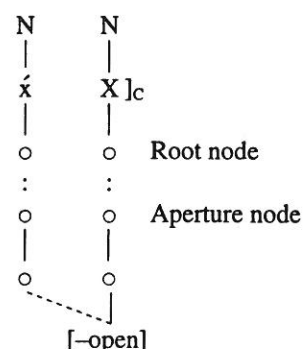(32)   /bokkalu/ [bukkalú] 'foolish (MASC.PL)'

In the above derivation, [–open$_2$] spreads leftward, resulting in the raising of [o] to [u]. The vowel [a] is rejected as a target of spreading, since it does not meet the condition of [–open$_1$]. Note that the argument [–open$_2$] is able to spread beyond [a] because it is unspecified for [open] on tier two at the moment of spreading. It is therefore postulated that in Servigliano, PVR takes place before the application of Clements' (1989, p.c.) redundancy rules to fill in unspecified values of [open]. As can be seen, then, Clements' (1989, 1991a, b) model facilitates a simple, elegant account of the transparency of [a] in PVR.

In regard to metaphony, it has been established already that [–open] spreads to the closed mid vowels on tier two (see (30b)). When the target of metaphony is an open mid vowel, on the other hand, there are two potential applications of [–open] spreading, one on tier two and the other on tier three, as shown in (30a). Only the spreading of [–open$_3$], however, creates a feature configuration that correctly defines a closed mid vowel given the center-embedding system in (26); the spreading of [–open$_2$] creates the feature bundle [–open$_1$][–open$_2$][+open$_3$], which is non-occurring in (26) (Clements, p.c.). So, in order to respect the phonological structure of Servigliano, [–open] spreading in metaphony must occur on tier three when an open mid vowel is targeted, and on tier two when a closed mid vowel is targeted. Servigliano metaphony therefore conforms to the second (i.e. (33b)) of two rule types identified in Clements (1991a, p.c.) for scalar height assimilation phenomena, both of which are presented below in (33):

(33)   a. spread: [α open$_n$], where *n* is a specified ranked tier
        b. spread: [α open], where [α open] is unranked
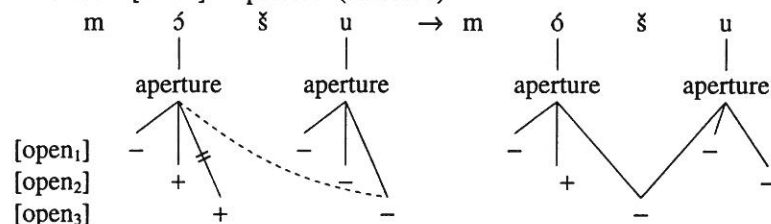   mode: structure-preserving

In other words, Servigliano metaphony involves the spreading of that instance of [–open], whether [–open$_2$] or [–open$_3$], that results in a well-formed feature configuration according to the system in (26). A revised rule of metaphonic raising is formulated in (34):

(34)   Servigliano metaphony   N   N
       operation: spreading | |
       tier scansion: minimal   x́   X]c
       argument: [−open] | |
       trigger: V]c [−open₂]   o   o   Root node
       target condition: primary stressed vowel   :   :
       mode: structure-preserving   o   o   Aperture node
                                           | |
                                           o   o
                                            `----. |
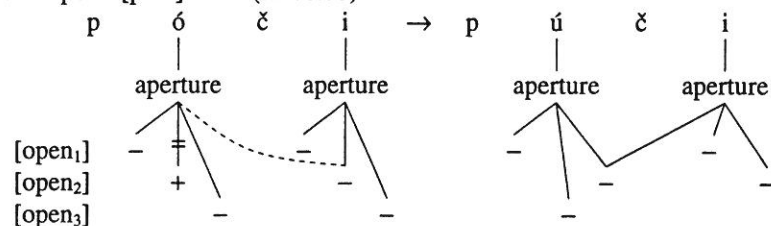   [−open]

Derivations illustrating the application of metaphony are provided in (35) (figures adapted from Clements 1991a):

(35)   a.   /mɔšu/ [móšu] 'depressed' (MASC.SG)
               m   ɔ́   š   u   →   m   ó   š   u

                    aperture   aperture   aperture   aperture

       [open₁]   − | ╪   −   −   −
       [open₂]   + | \   ---.   +   −
       [open₃]   +   −   −

       b.   /poči/ [púči] 'flea' (MASC.SG)
               p   ó   č   i   →   p   ú   č   i

                    aperture   aperture   aperture   aperture

       [open₁]   −   ╪   −   −   −
       [open₂]   +   −   −
       [open₃]   +   −   −

In (35a), the spreading of [−open₃] to [ɔ́] directly derives its raising to [ó]. In the previous model examined in this paper, the spreading of [+high] to [ɛ, ɔ] results in the intermediate, ill-formed feature configuration *[+high, −ATR] that requires the application of negation to produce the correct results [é, ó]. In Clements' (1989, 1991a, b) model, because correct results are derived directly from spreading, 1) an intermediate step positing an ill-formed representation generated by synchronic rule is not necessary, 2) a violation of the OCP does not occur, 3) Servigliano metaphony is portrayed as a scalar phenomenon, in keeping with what the surface results indicate, and 4) the assimilatory nature of this raising process is not obscured, since the feature specifications that result

from spreading include the argument of the rule (whereas the resulting feature configuration [−high, +ATR] does not reflect that an assimilation to [+high] has taken place). All of these factors constitute an advantage over the previous analysis using the features [±high], [±low], and [±ATR] to define vowel height.

7. Conclusion

The relatively complex data of vowel harmony in Servigliano can be explained by three rules of spreading: post-tonic vowel copying, metaphony, and pretonic vowel raising. While the first of these processes involves a total assimilation in all features to a final vowel, the remaining two entail a partial assimilation in height to a high final or stressed vowel, respectively. It has been shown that the use of [+high] as the assimilatory feature in metaphony has the disadvantage of not being able to directly derive the raising of the open mid vowels. Specifically, in a Calabrese-type (1991) analysis, the spreading of [+high] results in the ill-formed feature configuration *[+high, −ATR], which is repaired by negation to bring about the correct effect of raising (a solution which necessitates an OCP violation). However, this analysis makes the raising of [ɛ, ɔ] to [é, ó] seem like a coincidence rather than an expected, natural outcome.

This shortcoming is due to the use of more than one feature [±high] to define vowel height (i.e. [±low] and [±ATR]). Clements (1989, 1991a, b) proposes an alternate view of vowel height: a hierarchical analysis that organizes values of a single feature [open] into tiers dominated by an aperture node. It has been shown that the application of this model to data in Servigliano leads to an elegant, uniform account of vowel raising in this dialect. The spreading of an instance of [−open] produces immediate correct results without the subsequent application of a simplification rule, thereby reflecting the assimilatory and scalar nature of Servigliano metaphony. It also has been shown that atonic vowel reduction and the transparency of /a/, which are independent of but related to vowel raising in this dialect, can be explained in a simple manner within this model. The ease with which these phonological phenomena can be accounted for within Clements' (1989, 1991a, b) model not only lends to an understanding of these facts but also attests to the strength of this model as a representation of vowel height in natural languages.

References

Archangeli, Diana (1988a). *Underspecification in Yawelmani Phonology and Morphology*. New York: Garland.

—— (1988b). Aspects of underspecification theory. *Phonology* 5: 183–207.

Archangeli, Diana and Douglas Pulleyblank (1986). The content and structure of phonological representations. Unpublished manuscript, University of Arizona and University of Southern California.

—— (1987). Maximal and minimal rules: Effects of tier scansion. *Proceedings of the 17th Annual Meeting of NELS*, 16–35. GLSA, University of Massachusetts, Amherst.

—— (1989). Yoruba vowel harmony. *Linguistic Inquiry* 20: 173–217.

Calabrese, Andrea (1985). Metaphony in Salentino. *Rivista di grammatica generativa* 9–10: 1–141.

—— (1988). Towards a theory of phonological alphabets. Unpublished Ph.D. dissertation. Massachusetts Institute of Technology, Cambridge.

—— (1991). The notion of phonological complexity in phonological theory: A new approach to markedness theory. Unpublished manuscript, Harvard University.

Camilli, Amerindo (1929). Il dialetto di Servigliano. *Archivum Romanicum* 13: 220–271.

—— (1965). *Pronuncia e grafia dell'italiano*. Firenze: Sansoni Editore.

Clements, George N. (1985). The geometry of phonological features. *Phonology Yearbook* 2: 225–252.

—— (1989). On the representation of vowel height. Preliminary version. Unpublished manuscript, Cornell University.

—— (1991a). Scalar rules in phonology. Conference Paper; University of Michigan, May 10, 1991.

—— (1991b). Place of articulation in consonants and vowels: A unified theory. *Working Papers of the Cornell Phonetics Laboratory* 5: 37–76.

Goldsmith, John A. (1987). Vowel systems. *Chicago Linguistic Society* 23.2: 116–133.

Hayes, Bruce (1989). The prosodic hierarchy in meter. In *Phonetics and Phonology, Volume 1: Rhythm and Meter*, P. Kiparsky and G. Youmans (eds.), 201–260. New York: Academic Press.

Hualde, José Ignacio (1989). Autosegmental and metrical spreading in the vowel-harmony systems of northwestern Spain. *Linguistics* 27: 773–805.

Kaze, Jeffrey W. (1989). Metaphony in Italian and Spanish dialects revisited. Unpublished Ph.D. dissertation. University of Illinois at Urbana-Champaign.

—— (1991). Metaphony and two models for the description of vowel systems. *Phonology* 8: 163–170.

Kenstowicz, Michael (1990). Stress and generative phonology. *Rivista di Linguistica* 2.2: 55–86.

Kiparsky, Paul (1982). Lexical morphology and phonology. In *Linguistics in the Morning Calm*, I.-S. Yang (ed.), 3–91. Seoul: Hanshin.

Leben, William (1979). *Suprasegmental Phonology*. New York: Garland.

Lieber, Rochelle (1987). *An Integrated Theory of Autosegmental Processes*. Albany: SUNY Press.

Maiden, Martin (1991). *Interactive Morphology: Metaphony in Italy*. New York: Routledge.

McCarthy, John J. (1986). OCP effects: Gemination and antigemination. *Linguistic Inquiry* 17: 207–263.

Nespor, Marina and Irene Vogel (1986). *Prosodic Phonology*. Dordrecht: Foris Publications.

Odden, David (1991). Vowel geometry. *Phonology* 8: 261–289.

Pulleyblank, Douglas (1988). Vocalic underspecification in Yoruba. *Linguistic Inquiry* 19: 233–270.

Roca, Iggy (1986). Secondary stress and metrical rhythm. *Phonology Yearbook* 3: 341–370.

Sagey, Elizabeth (1990). *The Representation of Features and Relations in Nonlinear Phonology*. New York: Garland.

Schane, Sanford A. (1984). Fundamentals of particle phonology. *Phonology Yearbook* 1: 129–155.

Sluyters, Willebrord (1990). Length and stress revisited: a metrical account of diphthongization, vowel lengthening, consonant gemination and word-final vowel epenthesis in Modern Italian. *Probus* 2: 65–102.

Vago, Robert M. (1988). Underspecification in the height harmony system of Pasiego. *Phonology* 5: 343–362.

Vogel, Irene and Sergio Scalise (1982). Secondary stress in Italian. *Lingua* 58: 213–42.

Zwicky, Arnold M. (1977). *On clitics*. Bloomington: Indiana University Linguistics Club.