

Metaphony Revisited

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Metaphony, a phonological characteristic of many Italian dialects, is an assimilatory process raising stressed mid-vowels when followed by high vowels. Its peculiarity is that when the targets are [-ATR] mid-vowels, they are either diphthongized or tensed or raised to high [+ATR] vowels, depending on the dialect. In this paper, an account of this process and of its peculiarities will be proposed in light of the theory of phonological markedness proposed by Calabrese (1995). It is hypothesized that the configuration [+high, -ATR], which is produced when metaphony applies to mid [-ATR] vowels, is disallowed because of its markedness. The different outcomes that we observe in this case are due to different, independently motivated, repair strategies which have the function of eliminating disallowed configurations.

Various historical and morphological aspects of this process will also be investigated.*

0. Introduction

Southern Italian dialects are characterized by a conditioned sound change which affected stressed mid-vowels when followed by high vowels. Interestingly, the changes that affected these mid-vowels were strikingly different depending on their specification for [Advanced Tongue Root]. [+ATR] mid-vowels were raised to high vowels in all dialects. In contrast, [-ATR] mid-vowels were characteristically diphthongized in most dialects, tensed to [+ATR] mid vowels in some dialects, and raised to high [+ATR] vowels in other dialects. In Calabrese (1985), I proposed an account for this sound change and the dialectal variation that accompanies it in the different southern Italian dialects. The proposal was essentially the following: metaphony is an assimilatory process spreading the feature [+high] of a high vowel onto a preceding stressed mid vowel. When this process affects mid [-ATR] vowels, it creates the configuration [+high, -ATR]. This configuration is disallowed due to the presence of an active constraint against it. UG provides a number of repair strategies to fix disallowed configurations: in particular, fission, which splits a disallowed configuration into two allowed ones; delinking, which changes one of the values of a disallowed configuration; and negation, which reverses all of the values of the disallowed configuration. Application of fission to the disallowed configuration [+high,

-ATR] accounts for the diphthongs found as outcomes of the application of metaphony to mid [-ATR] vowels. This is the repair strategy selected in most dialects. In some other dialects, however, delinking is selected instead of fission: this accounts for the cases where [+high, +ATR] vowels are found in the metaphony of mid [-ATR] vowels. In still other dialects negation is selected: this accounts for the cases where mid [-ATR] vowel are tensed to mid [+ATR] vowels in a metaphonic context. In this article, I will review some aspects of this account in light of some recent developments in my theoretical thinking, in particular in light of the theory of phonological markedness developed in Calabrese (1995). The paper is organized as follows: after a brief theoretical introduction outlining some of these new developments, I will address the problem of the best analyses for dialects in which this sound change was morphologized, and account for the historical development of metaphony. I will then review the criticisms of my analysis of metaphony by a number of linguists. I will end by discussing a possible analysis of metaphony in the framework of Optimality Theory, one of the most recent developments in Phonological Theory.

1. Theoretical background

In Calabrese (1995) I developed a theory of phonological markedness along the lines of the theory of implicational laws proposed by Jakobson (1941). The starting point is the fact that languages differ in their phonological systems. For example, Italian has the vowel system in (1a), but French that in (1b):

(1) a.	i	u	b.	i	y	u
	e	o		e	ø	o
	ɛ	ɔ		ɛ	(œ)	ɔ
	a			a	(o)	

However, phonological segments in phonological systems are not selected at random, but according to precise structural generalizations. For example, no language has the five vowel system in (2), but the systems in (3) are common.

(2)	y	i	ɔ
	e		
	æ		

(3)	a.	i	u	b.	i	u	c.	i	u	
		a			æ	a		ɛ	ɔ	
	d.	i	u	e.	i	u	f.	i	y	
		e	o		ɪ	ʊ		ɛ	œ	
		ɛ	ɔ		e	o		æ	a	
		a			ɛ		ɔ			
				a						
(4)	high	+	+	y	œ	e	ɔ	o	i	u
low	-	-	+	-	-	-	-	-	+	+
back	-	-	-	-	-	-	-	-	-	-
round	-	+	+	+	-	-	+	+	-	+
ATR	+	-	+	-	+	-	-	+	-	+

Let us see how we can account for the structural variation in phonological systems and at the same time achieve the goal of excluding systems such as that in (2), while allowing the systems in (3). Phonological segments are bundles of distinctive features. It is a fact that not all the combinations of these distinctive features have the same status. Some are impossible because of constraints on human articulatory and perceptual abilities. An example is the combination [+high, +low], which is not possible because it involves actions that are physiologically incompatible. Other combinations are complex from the point of view of ease of articulation and perceptual saliency. For example the [-back, +round] vowels /y, ø/ observed in French are complex because lip rounding in the presence of tongue fronting produces an acoustic configuration which is not optimal from a perceptual point of view. Other feature combinations are instead phonologically simple, that is, optimal from the point of view of ease of articulation and perceptual saliency. This is, for example, the case of the feature combination [-back, -round] in the vowels /i, e/.

I argue that the impossibility or complexity of feature combinations is formally expressed in Universal Grammar by constraints on feature cooccurrence. The acoustic/articulatory impossibility of a given feature combination is formally expressed as a prohibition which excludes the cooccurrence of the relevant features. Thus we have the prohibition in (5):

(5) * [+high, +low]

Segments characterized by a feature combination mentioned in a prohibition are impossible and never occur in a phonological system. In turn, the acoustic/articulatory complexity of a given feature combination is formally expressed as a marking statement which marks as complex the occurrence of one of the features in the context of the other feature. Thus the complexity of the feature specification [+round] in front vowels is represented as in (6) (where the underlined feature specification is the marked one):

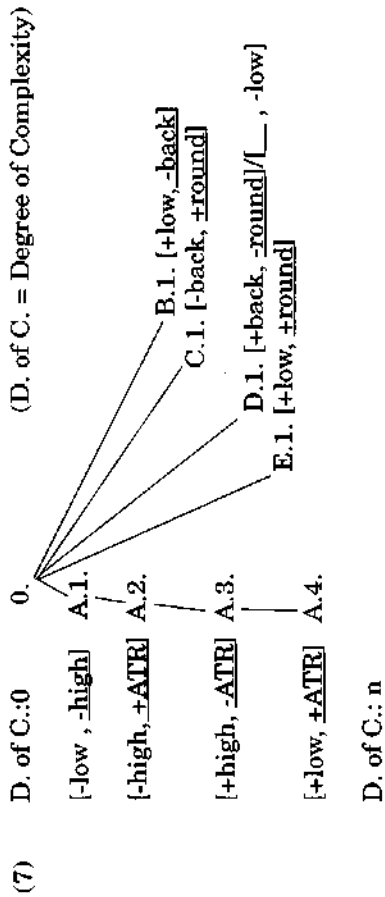
- (6) [-back, ±round]

Simple and optimal feature combinations are those which have a value opposite to that of the marked feature. A variety of criteria – acoustic, articulatory and phonological – are used to establish the marking statements (see Calabrese, 1994, 1995 for discussion). Thus, for example, we can say that the feature [+round] in the marking statement in (6) is marked in the context of the feature [-back] because it is the use of this very feature that causes the acoustic non optimality of front rounded vowels (see Stevens, Keyser & Kawasaki, 1986). At the same time, there is phonological evidence that the feature [+round] is marked in the context of [-back] as shown by its behavior in phonological processes of vowel harmony (see Vaux, 1993; Calabrese, 1995).

I propose that segments characterized by a feature combination mentioned in a marking statement may occur in a phonological system if and only if the relevant marking statement is deactivated. Otherwise the marking statement is active and the relevant segment is absent. In this sense languages differ in deactivating certain marking statements but not others. For example let us consider the case of the marking statement [-back, ±round] which characterizes front rounded vowels as complex. French differs from Italian in deactivating this marking statement so that the front rounded vowels [y, ø] are present in its phonological inventory but not in that of Italian. We thus account for the structural difference we observe in the vocalic inventories of French and Italian. Observe that although front rounded vowels are possible in French, this theoretical model characterizes them as marked in so far as a marking statement must be deactivated to acquire them. This should account for the well known difficulties associated with these vowels and for the fact that they are learned later in the acquisition of French (cf. Jakobson, 1941).

The structure of vowel systems can be accounted for by assuming the hierarchically organized set of marking statements in (7).

The hierarchical tree structure in (7) accounts for the differences in complexity among the different marking statements (see Calabrese 1995 for discussion of the different aspects of the tree in (7)).¹

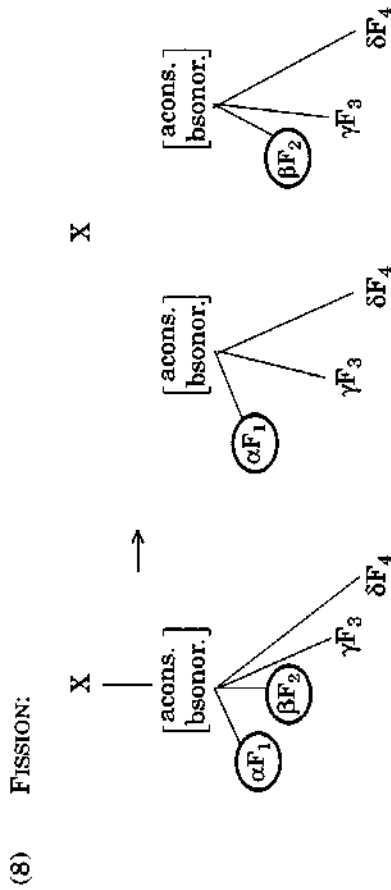


All of the systems in (3) can be generated by the marking statements in (7); however, the unattested vowel system in (2) will never be generated according to the statements in (7). We thus have an account for the structural properties of phonological systems.²

The hierarchy of marking statements allows us to account for basic properties of phonological systems such as implicational relationships between segments and differences in frequency of occurrence among segments. If we accept Jakobson's (1941) proposal that markedness relationships are reflected in language acquisition and language loss, these hierarchical lists should help predict which segments are acquired first in language acquisition and lost first in language loss.

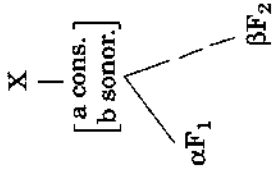
When a marking statement is active in a language, the segment characterized by the feature complex of this marking statement is disallowed and thus absent from this language. When speakers encounter such a disallowed segment as the outcome of a phonological rule or a foreign sound, they have two options. 1) They may accept the cost of deactivating the relevant marking statement; the violating segment will then be allowed in the system as a borrowing (if it appears in a foreign word) or as an allophone (if it is the output of a phonological rule). Or 2) they may try to adjust them in order to satisfy this constraint. Interestingly, this reaction does not operate in a random fashion. I argue that this is due to the existence of the procedures which have the function of repairing the disallowed configurations. I call these procedures 'simplification procedures'. These proce-

dures, which are closely related to the marking statements, account for the interaction between the structure of a phonological system and the different effects of phonological rules. Three simplification procedures can be identified: fission, delinking, and negation. 'Fission' is an operation that splits a feature bundle containing a disallowed configuration into two successive bundles, each containing only one of the features of the disallowed configuration. In other words, it is an operation that breaks a complex disallowed sound into two simpler allowed sounds. This is, for example, the operation that replaces the vowel /y/ with the diphthong [iu] in the pronunciation of speakers of languages lacking front rounded vowels. Some other sample cases of fission are listed in (12). 'Delinking' is an operation by which one of the incompatible features of a disallowed configuration is delinked and replaced with a compatible feature. This is, for example, the operation that replaces the vowel /y/ with either [i] or [u] in the pronunciation of speakers of languages lacking front rounded vowels (see below for more discussion of the operation of delinking and a formal analysis of this case). 'Negation' is an operation that takes the values of the incompatible features of the disallowed configuration and changes them into their opposites. (For some examples and more discussion of negation see note 3). I formalize these rules in (8)-(10) (the features that are targets of the rules are circled):



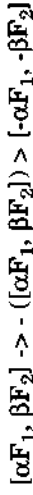
where the feature bundle on the left of the arrow contains the configuration of features $[\alpha F_1, \beta F_2]$ disallowed by the active marking statement/prohibition $*[\alpha F_1, \beta F_2]$ ($\alpha, \beta, \gamma, \delta = +/-$).

(9) DELINKING:



where αF_1 conflicts with βF_2 because of the active marking statement/prohibition $*[\alpha F_1, \beta F_2]$ ($\alpha, \beta = +/-$).

(10) NEGATION:³



where αF_1 and βF_2 are conflicting feature values because of the active marking statement/prohibition $*[\alpha F_1, \beta F_2]$ ($\alpha, \beta = +/-$).

The procedures in (8) and (9) create incomplete representations. In the case of fission the first subcomponent lacks a specification for F_2 and the second for F_1 . In the case of delinking, a new specification for F_2 must be inserted. I propose that the absent feature specifications are inserted by the last resort convention in (11) which always creates optimal configurations by inserting "unmarked" specifications:

(11) Given the marking statement $[\alpha F, \beta G]$, fill in $-\beta G$ in a feature bundle that contains αF , but no specifications for G , and fill in αF in a bundle that contains βG , but no specifications for F .

The function of the simplification procedures is not to preserve the underlying inventory of segments by eliminating all disallowed feature configurations, but to prevent an increase in the complexity of a phonological system by repairing complex feature configurations.

I will focus on fission here⁴. It has long been recognized that certain cases of phonological breaking occur in the pronunciation of non-native segments (see Trubeckoj 1939 and Andersen 1972 among others). Some sample cases are listed in (12):

- (12) a. $y \rightarrow iu$ in the Italian pronunciation of French and German [y];
in the Romanian pronunciation of French and Turkish words.
b. $i \rightarrow ui$ in the Lithuanian pronunciation of Russian [i];
in the Finnish pronunciation of Russian [i].
d. $\ddot{a} \rightarrow an/\text{a}\eta$ in the non-native pronunciation of nasal vowels in many
languages.
f. $\eta \rightarrow n\eta$ in the non-native pronunciation of Italian.
g. $\acute{\lambda} \rightarrow l\eta$ in the non-native pronunciation of Italian.
h. $f \rightarrow hw$ in the Ukrainian pronunciation of Russian [f] (Tru-
betzkoy 1939)
(see also the Korean pronunciation of foreign [f], cf.
Pyun 1987).

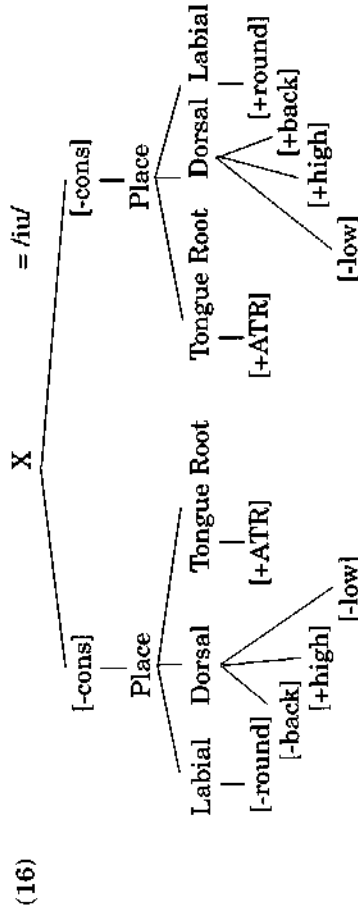
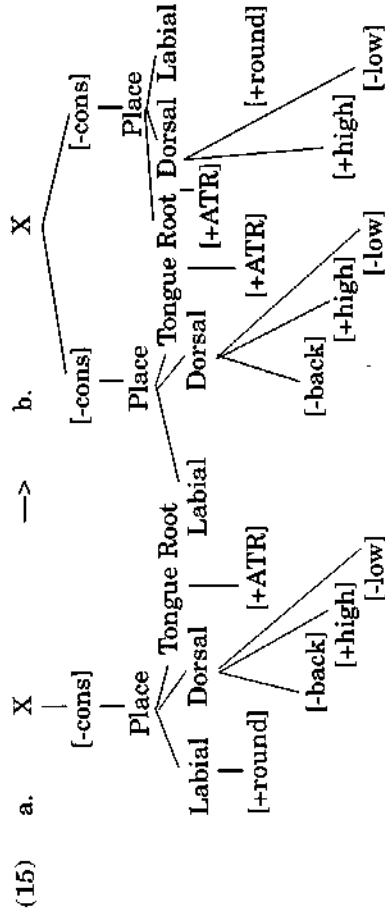
For example, consider the non-native pronunciation of the front rounded vowel /y/. As illustrated by (12a), this vowel can be pronounced as the diphthong [ju] by speakers of languages not having this vowel in their inventory. In addition, the pronunciations [i] and [u] are also possible, as in (13) (the Romanian example is from Nandris 1963: 220):

- (13) German *föhner* \rightarrow Italian: [furer, firer, firer]
French *cuvette* \rightarrow Romanian: [kjuveta, kuveta, kiveta]

In the theory proposed here, the absence of /y/ from the inventories of Italian and Romanian indicates that the marking statement [-back, +round] in branch C.1 in the vowel tree in (7) is active in these languages. Consequently, the configuration in (14) is disallowed in these languages:

- (14) *[-back, +round]

Disallowed configurations are corrected by simplification procedures. If fission applies to a feature bundle containing the feature combination disallowed by (14), it produces the configuration in (15b). After the application of (11), which fills in the missing features, we then obtain (16), i.e., the diphthong /iu/:



Thus by the fission rule, the two articulatory maneuvers of lip rounding and tongue backing, which are simultaneous in the production of the vowel /y/, are sequenced in time as in the diphthong /iu/.

An independent process which will not be discussed here assigns the nuclear head position to the second subcomponent of the fissioned vowel. The first subcomponent will instead be assigned to the nucleus margin and thus realized as an on-glide (see Harris 1983 for a similar analysis of rising diphthongs in Spanish).

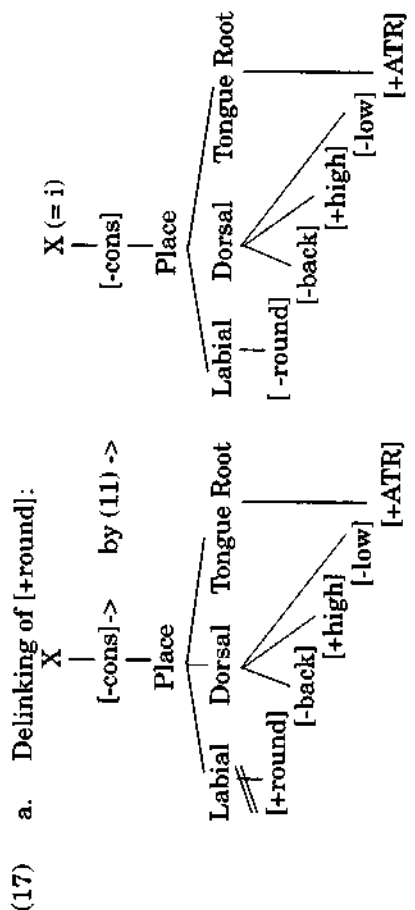
The reason for formulating fission as in (8) is the assumption that the cooccurrence, i.e., the simultaneous implementation, of two features is to be represented by having these in the same feature bundle where, by definition, a feature bundle is a set of features dominated by a single root node. Active marking statements constrained by the cooccurrence of features. Fission is, then, an operation by which one feature bundle with a configuration of features disallowed by an active marking statement is split into two feature bundles with configurations that are allowed by this active marking statement.

Notice that fission does not affect the timing unit associated with the root node of the feature bundle which undergoes fission. Fission does not add or create new timing units. As discussed by Calabrese (1988), for example, there is evidence showing that certain diphthongs produced by fission are actually short, i.e., associated with one timing unit. Furthermore, if we assume the correctness of the analysis of affrication proposed in Calabrese (1995) – where affrication is assumed to be an instance of fission applying to repair complex laminal stops –, the two feature bundles composing the affricate produced by fission are crucially associated to the same timing unit. This does not imply, however, that in a given language one of the two feature bundles produced by fission cannot acquire its own timing unit by an independent language-specific process.

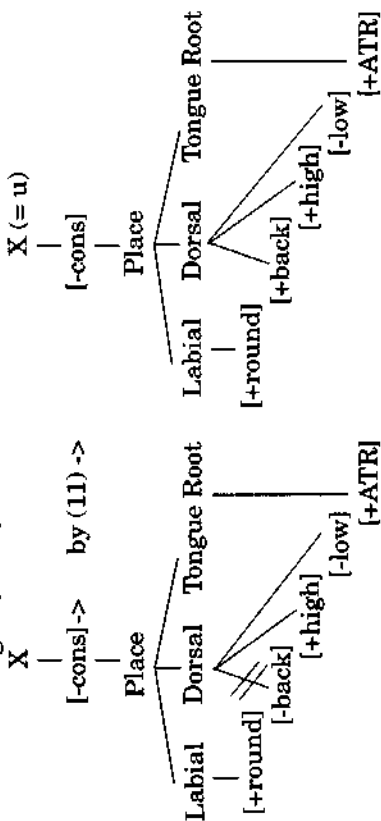
An interesting question involves the linear order of the two sub-components of the fissioned configuration. In Calabrese (1988, 1995), I observed that the feature that comes first in the fission process appears to be the unmarked one in the disallowed configuration (see Andersen 1972 for a similar proposal). Thus the feature [back], which is the unmarked feature in the configurations [-back, +round], is the one that generally appears as first in fission processes, as we see in the pronunciation of the vowel /y/ as /ju/, and in the pronunciation of the vowel /i/ as /ui/ by speakers of many different languages which do not have these vowels.

I assume that this is the unmarked case. Marked exceptions to this generalization do exist, however. This is the case of the pronunciation of the foreign vowel /y/ as the diphthong /ui/ by Korean speakers, for example.⁵

Delinking of a particular feature ([+round] in the case of [i] and [-back] in the case of [u]) accounts for the other outcomes of [y] in (13). These cases are illustrated in (17a-b):



b. Delinking of [-back]:



2. Metaphony in Arpinate

As mentioned earlier, southern Italian dialects were characterized by a conditioned sound change which affected stressed mid vowels when they were followed by high vowels. Given that some suffixal vowels were high, this sound change lead to widespread stem allomorphy. Subsequent sound changes such as vowel reduction in unstressed syllables led to the morphologization of this sound change, which became associated with certain morphological categories. Let us consider one of the dialects where this occurred, the dialect of Arpino. The following analysis is based on Parodi (1892). This dialect has the vowel system in (18), where the feature specifications for the vowels are those given in (4), and repeated here in (19) for the relevant vowels:⁶

(18)	i	u	o	ɔ	a	e	ɛ	ə	o	u
	high									
	low									
	back									
	round									
	ATR	+	+	+	+	+	+	+	+	+

In this dialect, the historical rule of metaphony as in many other southern Italian dialects was morphologized because of a process of vowel reduction that affected post-tonic vowels. Metaphony is now a morphological process affecting the stressed vowel of a word in certain morphological categories, such as the masculine singular of the second nominal class, the plural of the second and third nominal classes, the second singular of the indicative present, etc. In these morphological categories, the metaphony rule affects the stressed mid vowels in the following way: when the mid vowel target of the rule is [+ATR], it is raised to its high counterpart; when it is [-ATR], it is diphthongized.

We can identify three main classes in the case of nominal morphology: ⁷ In class I, the singular is characterized by absence of metaphony and by the suffix /-a/ in the singular and the suffix /ə/ in the plural. Nouns of class I are mostly feminine. Following Harris (1992), we can account for this by the morphological redundancy rule in (20):

(20) [fem] → I

In class II the suffixal vowel is always /ə/ and we observe metaphony both in the singular and the plural. In class III, the suffixal vowel is always /ə/ as in the second, but there is metaphony only in the plural. Nouns of class III are idiosyncratically marked as belonging to this class, regardless of gender.

The situation in the three main nominal classes can be diagrammatically represented as in (21):

(21) a. Nominal endings and metaphonic alternations:

	<i>Singular</i>	<i>Plural</i>	
I:	/-a/	/-ə/	No metaphony
II:	/-ə/	/-ə/	Metaphony
III:	/-ə/	/-ə/	No metaphony

b. Table of metaphonic alternations:

<i>Singular</i>	<i>Plural</i>
/-ù-/	/-ù-/
/-ò-/	/-ù-/
/-é-/	/-i-/
/-ɔ-/	/-wó-/
/-é-/	/-jé-/
/-á-/	/-á-/

The most interesting alternations are observed in the case of adjectives not idiosyncratically assigned to class III. In this case, they show up in class I if feminine because of rule (20), otherwise they are assigned to class II. Sample cases are given in (21). Adjectives and nouns of class III are exemplified in (22):

(22) a. Class VII adjectives:

	<i>Singular</i>	<i>Plural</i>	
Masc. Fem.	sùlə sóla	sùlə sóla	'alone'
Masc. Fem.	níra néra	níra néra	'black'
Masc. Fem.	bwónə bónə	bwónə bónə	'good'
Masc. Fem.	vjékkjə vékkjə	vjékkjə vékkjə	'old'

b. Class III Adjectives and Nouns:

	<i>Singular</i>	<i>Plural</i>	
Masc.	fjóra	fjóra	'flower'
Masc.	mése	mése	'month'
Masc./Fem.	fórta	fwórta	'strong'
Masc.	vérme	vjérme	'worm'

In the verbal system, the suffixal vowel of the Indicative Present singular is always /ə/. The second person singular is however characterized by metaphony (I will not consider the plural or other verbal categories).⁸

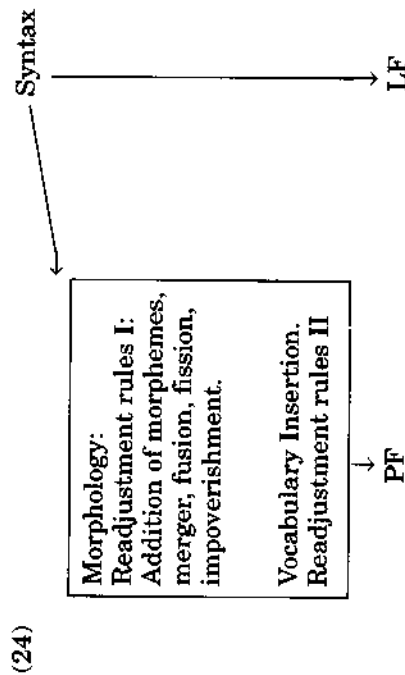
(23) Metaphonic alternations in the present singular of verbs

1sg	vədə	kórre	séntə	métte	kállə
2sg	vidə	kürre	sjéntə	mjéttə	kwóllə
3sg	vədə	kórre	séntə	métte	kállə

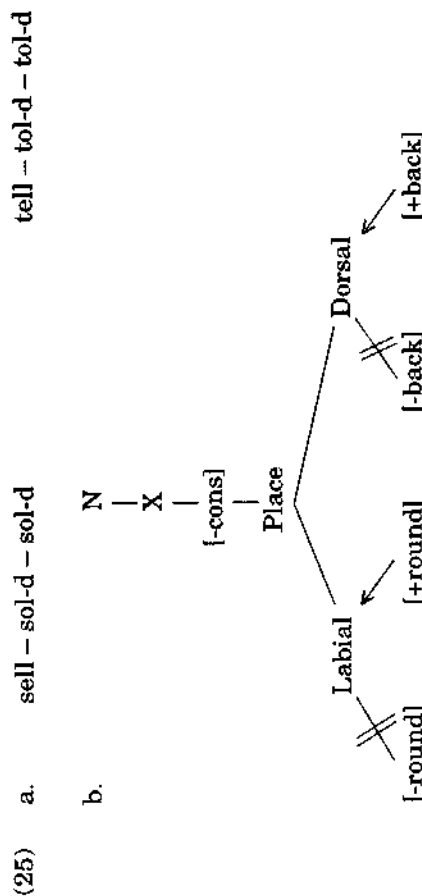
'see' 'run' 'feel' 'put' 'pick'.

What is the best way to account for the morphophonemic alternations in (21-23)? Let us begin by excluding an analysis such as that proposed for metaphonic systems similar to that of Arpinate by Maiden (1991) where metaphonic allomorphy is accounted for by listing surface alternants. If adopted, it makes the system of regular morphological alternations found in this dialect totally accidental. In such an analysis, in fact, there would be no way of expressing the generalization that if in the singular of nouns or in the first person of verbs we have a mid [+ATR] or [-ATR] vowel, then in the plural of these nouns or in the 2nd singular of these verbs we must have a high vowel or a diphthong, respectively.

Here I will propose an account of the metaphonic alternation of Arpinate based on Distributed Morphology, one of the latest developments in morphological theory (see Halle & Marantz 1993, Harris 1994). DM assumes the basic organization of grammar schematized in (24), where a Morphological Structure (MS) component is included in the familiar "principles and parameters" layout.



DM recognizes that MS is a level of grammatical representation with its own principles and properties. Readjustment rules are an important part of this morphological component. There are two sets of readjustment rules. The first set of readjustment rules operates on the hierarchically organized structures provided by the syntax. The apparent mismatches between the organization of the morphosyntactic pieces and the organization of the phonological pieces, which are commonly found in natural languages, are the result of these readjustment rules, which manipulate terminal elements of the syntactic representations (see Halle & Marantz 1993, Harris 1994 for more discussion of these rules). This first set of readjustment rules is followed by vocabulary insertion, which inserts phonological features into the terminal nodes. The second set of readjustment rules operates on the phonological representations of morphemes introduced by vocabulary insertion. This second stratum of rules, which are the counterpart of the morphophonemic rules of structural linguistics, manipulates these phonological representations and implements all of the changes needed to produce the correct phonological outputs, and thus account for surface allomorphy. An example of this type of readjustment rules is that needed to account for the allomorphy we observe in past forms of the irregular verbs in English. The past participle and past forms of the irregular verbs frequently differ from nonpast forms and/or from each other in the phonological composition of the stem. Thus for example we have alternations like those in (25a). We can account for these alternations with the readjustment rule in (25b):



Conditions on rule (25b): a) it applies in the past of stems such as: *sell, tell*, etc...

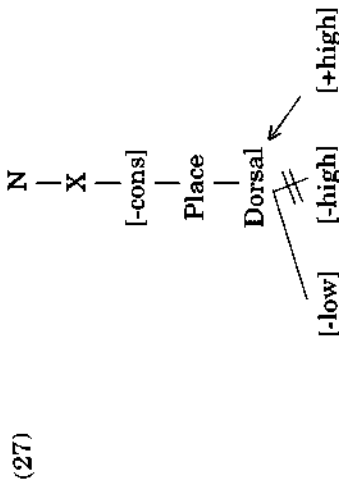
Let us turn to Arpinate again. The first thing we have to do is to identify the lexical items that constitute the words of this language. If we consider the fragment of the nominal system exemplified in (21-23), we can propose that the lexical items in (26) characterize the nominal inflectional morphology of Arpinate:

- (26) [sg] → /a/ / [__, I]
 [pl] → /ə/

The system in (26) states that /a/ is the suffix of the singular in nominal class I, whereas /ə/ is elsewhere suffix, i.e., that which appears in all other nominal classes.

Now let us consider the metaphonic alternations. In Distributed Morphology, all changes in the phonological shape of morphemes motivated by morphological categories are implemented by Readjustment Rules. Metaphony in Arpinate is one such change. The issue is now that of determining the best way of representing this rule.

One could propose two readjustment rules to express the morphological operation of metaphony: one of raising which applies to stressed [+ATR] mid vowels, and one of diphthongization which applies to stressed [-ATR] mid vowels. But the point is that [-ATR] mid vowels are diphthongized in exactly the same morphological environments in which [+ATR] mid vowels were raised. Now, if we suppose that these changes are brought about by two different rules, these two rules would overlap strikingly in their structural description. If we assume that maximal simplicity and generality are required in the formulation of a morphological analysis, an overlap like this in the structural description of the two readjustment rules should be excluded. A correct morphological analysis should therefore account for the two metaphonic changes of Arpinate through the application of a single readjustment rule. I hypothesize that in Arpinate there is only one readjustment rule accounting for the metaphonic alternations: the effect of this rule is to raise stressed mid-vowels to high vowels under certain morphological conditions. I formulate this readjustment rule as follows (using simplified tree and prosodic structures):

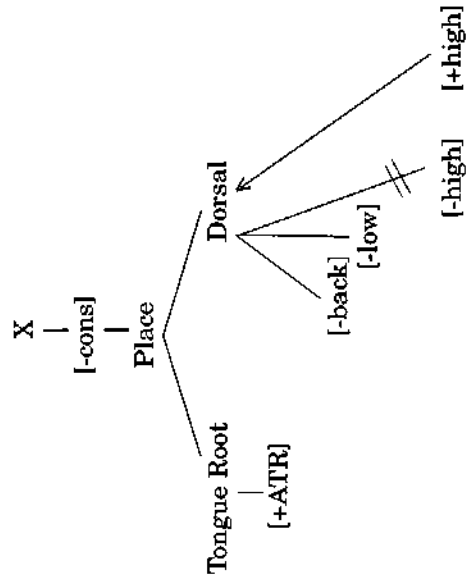


Conditions on rule (27):⁹

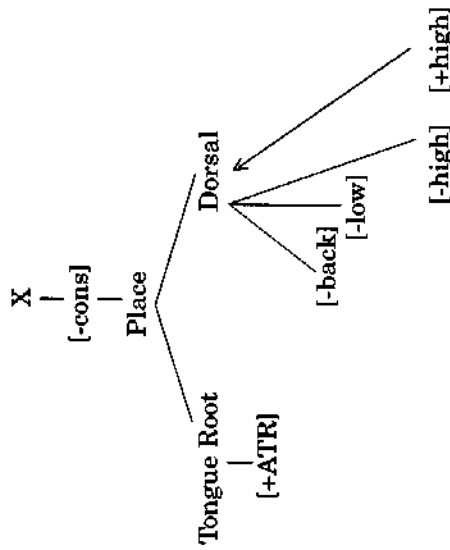
- * []
 - * []
 - * []
- a) — it applies in the sg and pl of nominal class II, in the pl of nominal class III, in the 2nd sg of the present indicative.

As shown, the metaphony rule inserts the feature [+high] onto the vowel X, if X contains the features [-high, -low] and if X is stressed. In (28) and (29), I give two sample derivations:

- (28) [mése] → [míse]



(29) [vérmə] → [vɪrmə]

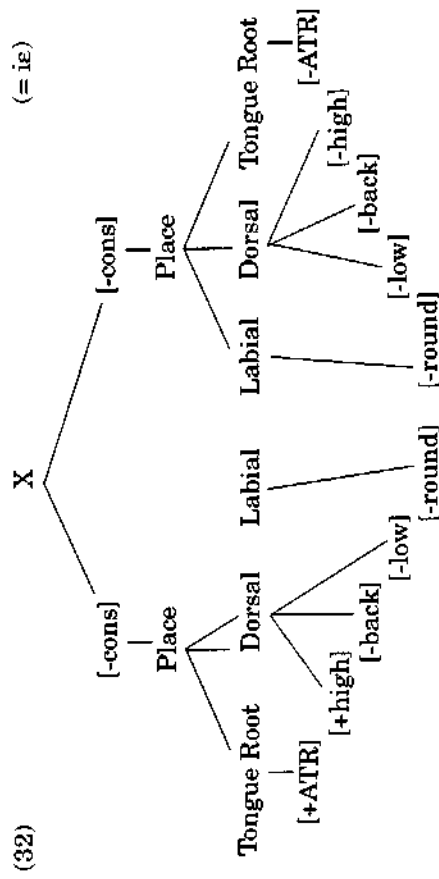
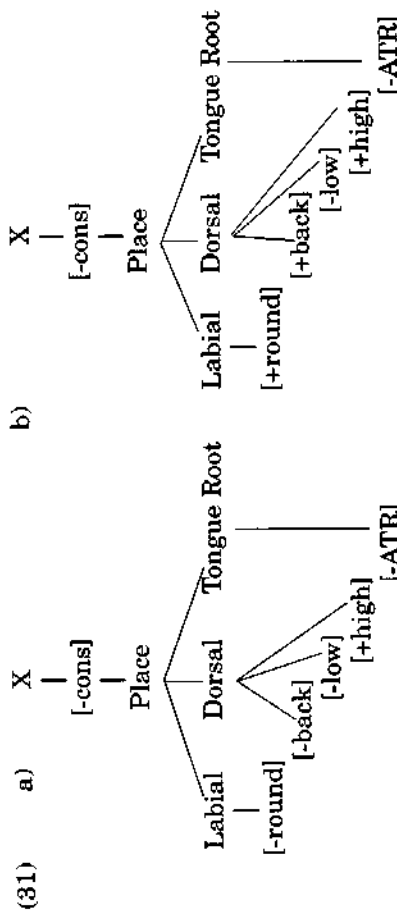


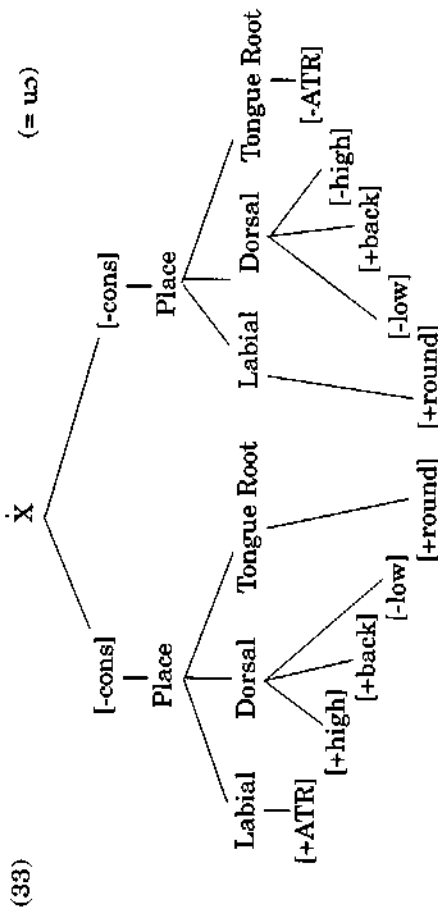
In the case of the mid [+ATR] vowel, rule (27) directly causes raising of the vowel and thus accounts for the outputs in (21-23). Let us consider what happens in the case of the mid [-ATR] vowels. In the case of [-ATR] vowels, I assume that the metaphony rule creates a high [-ATR] vowel. The problem is why there is diphthongization in this case. Following Calabrese (1985, 1995), I propose that the diphthongization that we find in this case is an instance of a simplification procedure used to adjust a phonologically complex configuration. In particular, I propose that diphthongization is an instance of fission, a procedure that adjusts a marked phonological configuration by breaking it into two simpler configurations. In this case, fission is used to repair the configuration [+high, -ATR] produced by the application of the metaphony rule.

Let us develop this proposal in more detail. As shown in the markedness tree in (7), I hypothesize that the configuration [+high, -ATR] is phonologically complex (see section 3 for discussion of this point). Given the complexity of the configuration [+high, +ATR], we should expect a tendency to disallow the appearance of this configuration in vowel systems. I propose that this is the case in Arpinate, and in other southern Italian dialects having metaphony. Thus, I hypothesize that the degree of complexity of the configuration [+high, -ATR] is not allowed in Arpinate. Given what I proposed earlier, the marking statement in (30) is therefore active in this language.

(30) * [+high, -ATR]

Now, the application of the rule of metaphony to [-ATR] vowels creates feature bundles containing exactly the configuration blocked by the marking statement in (30). My hypothesis is then that the disallowed configuration [+high, -ATR] obtained in this way is repaired by a simplification rule, specifically, the rule of fission. Therefore, given the feature bundles in (31a-b) created by application of the metaphony rule to the [-ATR] mid vowels /ɛ/ and /ɔ/ by fission, we will obtain the contour segments in (32) and (33):





(32) represents the diphthong [ie] and (33) represents the diphthong [ɔɪ].¹⁰ Observe that the order of the two subcomponents of the diphthongs in (32-33) is accounted for by the hypothesis that the unmarked feature of the active marking statement goes first in the process of fission. The unmarked feature in the marking statement in [+high, -ATR] is the feature [+high] (see section 3, note 15). Therefore this feature is expected to surface in the first subcomponent of the fissioned vowels in (32) and (33).

As discussed for [ju] on p. 14, an independent process changes the sequences in 32-33 into the rising diphthongs [je, wɔ] by restructuring their syllabic organization.

We thus obtain an explanatory account of the process of diphthongization found in metaphonic contexts in Arpinate. The diphthongization is brought about by the application of fission as a simplification rule to the complex configuration [+high, -ATR] produced by the application of the rule of metaphony.

Observe that by hypothesizing an interaction among a morphological readjustment rule, a constraint and a simplification rule, we can formulate a rather simple and restrictive morphological analysis of the Arpinate facts. There is a very general readjustment rule and the different surface outputs we observe are obtained by using independently motivated constraints and simplification procedures. The crucial hypothesis of this analysis is therefore that the morphological component, like the phonological one, contains static conditions, the marking statements, which if active can trigger the application of procedures that repair the configurations that violate them.

Observe that given this analysis of metaphony in Arpinate one must assume that readjustment rules may create configurations disallowed by phonological constraints; i.e., they may be non-structure-preserving. This goes against Kiparsky's (1982, 1985) principle stating that all lexical rules (=readjustment rules in this work) must be structure-preserving. However, there is evidence that this principle is not correct. For example, Calabrese (1995) argues that structure preservation cannot be maintained for Rotuman. Rotuman is a language which has been shown to have segregation of vowels and consonants into two different morphological planes (see Saito 1981, McCarthy 1986). This language underlyingly has the six-vowel system /i, e, a, ɔ, o, u/. On the surface, however, Rotuman displays the vowel system: /i, e, æ, a, ɔ, u, y, ø, ɤ/. The vowels /æ, y, ø, ɤ/ are not underlyingly but are always derived through different phonological processes (for example *futi/füt* complete/incomplete forms of 'pull'). Crucially, the processes that produce those vowels must apply, as argued by McCarthy (1986) and Saito (1981), before the morphological operation of tier conflation, as shown by the fact that sequences of tautomorphic identical vowels are affected by the process (see *popore/pöpör* compl./incompl. forms of 'suddenly' in contrast with the bimorphemic *motolori/motolör* compl./incompl. forms of 'moto-lorry'). Clearly, then, the processes that produce the vowels /æ, y, ø, ɤ/ belong to the stratum of the lexical rules of Rotuman since they must apply before the morphological operation of tier conflation. Thus, in Rotuman we have lexical rules that produce segments which are not present in the underlying inventory. This represents a clear counterexample to the Structure Preservation principle.

In Calabrese (1995), I argued that Structure Preservation is better interpreted not as a principle which blocks the creation of configurations not contained in the underlying inventory of segments, but as a principle that controls the increase in markedness of the phonological system of the language. In the case of Arpinate metaphony, this goal is accomplished by replacing the highly marked high [-ATR] vowels with the less marked rising diphthongs through the simplification procedure of fission.

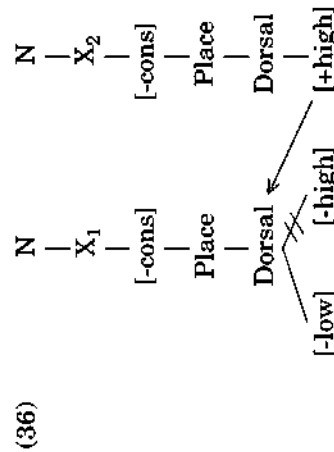
3. Historical excursus

As already mentioned above, the morphological metaphony system of Arpinate derives from a set of transparent phonological alternations obscured by subsequent sound changes affecting final

vowels. We can in fact reconstruct the original metaphonic alternations for most southern Italian dialects. For most of these dialects we can reconstruct the vowel system in (34), identical to that we find in Arpinate, with the feature characterizations in (19), repeated here as (35):

(34)	i	u				
	e	o				
	ɛ	ɔ	a			
(35)	i	e	a	ɔ	o	u
	high	+	-	-	-	+
	low	-	+	-	-	-
	back	-	+	+	+	+
	round	-	-	+	+	+
	ATR	+	-	-	+	+

Metaphony spread across the southern Italian dialects as a sound change affecting stressed mid vowels when followed by a high vowel.¹¹ The metaphony rule can be formulated as in (36):¹²

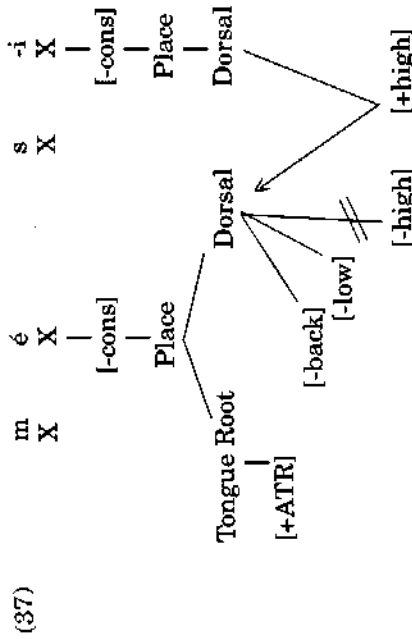


Condition on rule (36):¹³

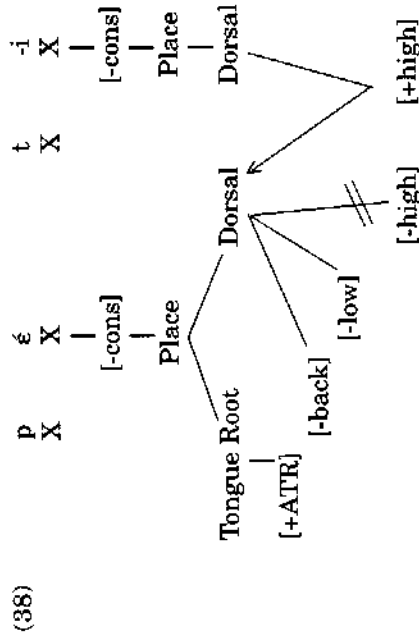
- * _____
- * _____
- * [* _____]

As shown, the metaphony rule spreads the feature [+high] of a high vowel X₂ onto the preceding vowel X₁, if X₁ contains the features [-high, -low] and if X₁ is stressed. This is the rule that was later morphologized in the Arpinate dialect. When it applied to mid [+ATR]

vowels it created standard high vowels as shown in the sample case in (37). This is the outcome that is found in all southern Italian dialects:



When rule (36) applied to mid [-ATR] vowels, it created a high [-ATR] vowel, as shown in the sample case in (38):



Following what was proposed for Arpinate, we can say that the diphthongization that we find in this case is an instance of fission used to repair the configuration [+high, -ATR] produced by the application of the metaphony rule.¹⁴ This is the outcome that is found in many southern Italian dialects.

In section 5 we will see that outcomes other than diphthongization are found across southern Italian dialects when metaphony

applies to mid [-ATR] vowels: in particular, in some dialects mid [-ATR] vowels are raised to high; in others, mid [-ATR] vowels are tensed to mid [+ATR] vowels. As I will argue in that section, these outcomes are those predicted if we apply to the configuration [+high, -ATR] the other available simplification procedures: delinking and negation. Delinking accounts for the cases in which mid [-ATR] vowels are raised to high vowels and negation for the cases in which these vowels are tensed to mid [+ATR] vowels. An interesting consequence follows from this analysis of metaphony. We see that the results of metaphony vary from dialect to dialect. Instead of proposing a different rule of metaphony for each different dialect to account for this dialectal variation, I am proposing that the metaphony rule was always the same, and that the dialectal variation was a result of the fact that a different simplification rule was chosen to repair the disallowed configuration produced by the metaphony rule in the case of the [-ATR] mid-vowels in each dialect. I hypothesize that in the historical development of each particular dialect, one of the possible simplification strategies has been grammaticalized as the solution to the disallowed configuration produced by the metaphony rule. In this way, I account for the observed dialectal variation in the phenomenon of metaphony. Therefore, the range of variation that we find should be limited to the range of results produced by the simplification rules. And in fact this is what we find.

A crucial point of the analysis proposed here involves the status of the configuration [+high, -ATR]. It is plausible to hypothesize that this configuration is phonologically complex. Acoustically vowels characterized by this configuration are not optimal in so far as tongue root retraction does not enhance the acoustic effects produced by the raised tongue position (see Stevens, Keyser & Kawasaki 1986).¹⁵ High [-ATR] vowels tend to be historically eliminated from vowel systems (see note 3). At the same time, the presence of [+high, -ATR] vowels in a vowel system implies the presence of [+high, +ATR], [-high, +ATR] and [-high, -ATR] vowels (see Calabrese 1988, 1995). This clearly indicates the hierarchical positioning of the former configuration as a more complex one with respect to the latter ones.

Given this analysis, one would expect some problems with the complex configuration [+high, -ATR]. We can hypothesize that the degree of complexity of the configuration [+high, -ATR] was not allowed in the southern Italian dialects when the metaphony rule was introduced in the grammar. Therefore, as stated in section 2, the

marking statement [+high, -ATR] was active in the grammars of these dialects. As proposed in section 1, speakers have different options when faced with a configuration disallowed by an active marking statement. Let us consider these different options in terms of parametric settings in (39). In general, the following interactions between phonological processes and active marking statements are possible:

- (39) Given a language L in which a given marking statement S is active, and a rule R in L, if the application of R creates a configuration disallowed by S, there are the following options:
- a) The configuration disallowed by S is accepted by the grammar. Therefore S is deactivated in L.
 - b) If the configuration disallowed by S is not accepted in L, we have two further options:
 - i. The application of the rule is blocked.
 - ii. The application of the rule is not blocked. The rule creates a disallowed configuration which is then repaired by the simplification procedures.

For each phonological rule, in each grammar it must be determined which of the options is selected. Given the option (39b.i), we can expect that the marking statement [+high, -ATR] could prevent the metaphony rule from applying. This is actually what we observe in the case of the northern dialect of Veneto spoken in Vicenza, Padova, and Rovigo, in which only [+ATR] mid vowels are raised in a metaphonic context; lax vowels are not affected by the rule. Veneto, which has the vowel system in (40), has metaphonic alternations like those in (41) in the case of [+ATR] vowels (from Renzi 1985, Rohlfis 1966):

(40)

i	u
e	o
ɛ	ɔ
	a

(41)

vedo	te vidi	'I see/you see'
coro	te curi	'I run/you run'
toso	tusi	'boy/boys'

There is, however, no metaphonic alternation in the case of [-ATR] vowels:

(42)

prete	preti	'priest/priests'
modo	modi	'way/ways'

We can account for the Veneto case by hypothesizing that option (39b.i) is parametrically set in the case of metaphony for this dialect.¹⁶

In his analysis of the history and the dialectal variation found in the case of metaphony, Maiden (1991:124) observes that "lower vowels, and vowels in closed syllables, are less susceptible to metaphony than higher vowels and those occurring in open syllables". Maiden shows that there are many Italian dialects where metaphony does not apply in the mid [-ATR] vowels, as seen in Veneto, and others in which metaphony applies to mid [+ATR] vowels only in open syllables. Maiden observes that what plausibly makes the vowel in closed syllables less susceptible to metaphony is the fact that in that position vowels are lower in many dialects. If we interpret the "being lower" as actually having the feature [-ATR], we then have an account for these two tendencies.¹⁷ They would be instances of blocking of metaphony when it would produce the complex and disallowed configuration [+high, -ATR].¹⁸ Let us consider the case of blocking of metaphony in closed syllables. Let us suppose that in the case of dialects where we observe such blocking we have the rule in (43):



[] → [-ATR]/ —

Let us suppose that this rule applies before the metaphony rule as in the following words:

(44) peʃʃe/peʃʃi → peʃʃe/peʃʃi
 monte/monti → monte/monti

If we assume that the presence of the feature [-ATR] can block the application of the metaphony rule, we have an immediate account for the non application of metaphony in this case.

Therefore, we expect that if there is blocking in the case of the [-ATR] mid vowels, there could also be blocking in closed syllables. In fact, in both cases, the metaphony rule would be prevented from crea-

ting the disallowed configuration [+high, -ATR]. We can thus make sense of the different diachronic stages in the development of metaphony in southern Italian dialects as reconstructed by Mancarella (1974) (see also Maiden, 1991). Reinterpreting Mancarella, we can say that metaphony as an assimilatory change triggered by high vowels developed in the southern Italian dialects as in the scheme in (45):

(45) 1st stage: It targeted only mid [+ATR] vowels:
 mese/misi
 kroče/kruči
 peʃʃe/piʃʃi
 monte/munti
 pete/peti
 erme/ermi
 noa/nuu
 porka/porku

At this stage in some dialects, metaphony targeted mid [+ATR] vowels in open syllables, but not in closed syllables; etymologically expected mid [+ATR] vowels were [-ATR] in closed syllables:¹⁹

mese/misi
 kroče/kruči
 peʃʃe/peʃʃi
 monte/monti
 pete/peti
 erme/ermi
 noa/nuu
 porka/porku

2nd stage: It targeted all mid vowels in all types of syllables.

mese/misi
 kroče/kruči
 peʃʃe/piʃʃi
 monte/munti
 pete/pieti
 erme/iermi
 noa/nuuu
 porka/puorku

According to this reconstruction, metaphony began as a general process of assimilation to the height of a following high vowel affec-

ting all mid vowels as stated in rule (36). It affected only [+ATR] mid vowels because the option (39b.i) was parametrically set in the grammar for this process. Therefore the creation of configurations disallowed by the active marking statement [+high, -ATR] was blocked. In dialects characterized by laxing in closed syllables, metaphony was prevented from applying to vowels in this context since they were [-ATR]. In the next stage, there was a change in the parametrical settings for metaphony: in particular, (39b.ii) was parametrically set for metaphony, and therefore the creation of configurations disallowed by the active marking statement [+high, -ATR] was allowed. These configurations, however, had to be repaired by the simplification procedures. This led to diphthongization and to the other outcomes observed in the case of the metaphony of mid [-ATR] vowels.

4. Criticisms of Calabrese (1985)

4.1. Status of high [-ATR] vowels in southern Italian dialects

A common criticism of my analysis of metaphony involves the status of the configuration [+high, -ATR] and of fission as a repair strategy. As Maiden (1991) puts it "it is far from clear why innovative diphthongs should be preferrable to innovative lax high vowels". A simple answer to this objection follows when we consider that the analysis I propose is part of an overall theory of markedness. The issue is that under this analysis the diphthongs which are the outcomes of fission are phonologically simpler than the high [-ATR] vowel that we would otherwise obtain by metaphony. This is the central assumption of my entire analysis. The vowels [ij] and [e] of the diphthong [ie], or the vowels [uj] and [ɔ] of the diphthong [uo], are phonologically simpler than the high lax vowels [i, U] even though they appear in a diphthong. The simplification procedures are not structure preserving devices, but means to decrease the markedness of a system. Paraphrasing Stampe's (1972) analysis of natural processes, one could consider simplification procedures as "mental" operations that apply in speech to substitute for a class of sounds presenting a specific common difficulty to the speech capacity of the individual an alternative class identical in all other respects but lacking the difficult property. Maiden's objection simply does not hold. Innovative diphthongs are preferable to innovative high lax vowels because the former are phonologically simpler than the latter.

Another related criticism (cf. Maiden, 1991:133) is based on the

fact that high [-ATR] vowels are actually possible on the surface in many southern Italian dialects either because of a process laxing vowels in closed syllables (cf. Lausberg, 1939; Rohlf, 1966) or because of a process laxing high vowels in all positions (cf. Loporcaro, 1991). Given what was proposed in the preceding sections, for these dialects, we have to assume that certain phonological processes may create the surface configuration [+high, -ATR] without their outputs being repaired by the simplification rules. A possible account for this fact is the following.

Let us suppose that certain phonotactic factors may influence and favor the appearance of a configuration with a relative high degree of complexity. The idea is that the phonotactic configuration may contextually decrease the degree of complexity of certain segmental configurations. Thus, for example, let us hypothesize that there is a condition in UG that makes [-ATR] vowels highly valued in closed syllables – a well-grounded hypothesis, given the number of languages that implement such a condition and the fact that there are phonetic grounds to assume it. Thus if a rule is introduced in the grammar of a language that implements this condition by laxing vowels in closed syllables, we may expect that the surfacing of [+high, -ATR] vowels will be allowed despite their inherent high complexity. Simply put, the high premium value of the phonotactic condition on lax vowels in closed syllables leads to a contextual decrease of the inherent complexity of that configuration. This accounts for the appearance of [+high, -ATR] vowels in closed syllables if we assume that this phonotactic condition allows the deactivation of the marking statement against [+high, -ATR] vowels. Observe on the other hand that there are no conditions that plausibly favor the appearance of [-ATR] vowels in a metaphonic context, and therefore the degree of complexity of [+high, -ATR] vowels is not allowed to surface in that context, and the relevant marking statement is not deactivated.

This solution is apparently at odds with the analysis proposed earlier of the blocking of the application of metaphony to mid vowels in closed syllables. I accounted for this pattern by assuming that option (39.b.i) was parametrically set for metaphony in these dialects thus blocking the production of high [-ATR] by this rule. Thus the metaphony rule was prevented from applying in closed syllables because vowels were [-ATR] in that context. Now the preceding solution would allow the surfacing of high [-ATR] vowels in this case since there is a premium value for the assignment of [-ATR] in such a position. A solution to this problem, however, comes about if we assume that the deactivation of a marking statement can occur only in

relation to a given rule. It is not an independent, across-the-board phenomenon. Therefore, a marking statement can be active for a rule, but be deactivated for some other rule. This is what is implicit in the different parametric options in (39). In other words, there are processes that create allophones and others that do not. Thus I propose that the marking statement [+high, -ATR] is not deactivated in the case of metaphony, i.e., option (39b) is set for this rule. This is not true for the rule of laxing. Option (39a) is set for this rule; therefore the above mentioned marking statement is deactivated and high [-ATR] vowels can thus be produced. This may be related to the presence of the condition favoring lax vowels in closed syllables.²⁰

For the dialects in which there is across-the-board laxing of high vowels in surface representations (see Loporcaro 1991), we can assume a late phonetic rule implementing this change. As argued in Calabrese (1988), late phonetic rules are more likely to be associated with the deactivation of marking statements. Thus this laxing of high vowels would be associated with option (39a) and high [-ATR] vowels could surface without problems.²¹

4.2. Kaze (1989, 1991)

Kaze (1989, 1991) takes issue with the treatment of metaphony in southern Italian dialects discussed in Calabrese (1985) and proposes to replace the active marking statement [+high, -ATR] that I use to trigger the simplification procedures with the prohibition *([+high, +low]). He does this by assuming the following feature specification for the seven-vowel system /i, e, ε, a, ɔ, o, u/:

(46)

	i	e	ε	a	ɔ	o	u
high	+	-	-	-	-	-	+
low	-	-	+	+	+	-	-
back	-	-	-	+	+	+	+
round	-	-	-	-	+	+	+

Crucially, the vowels /ε, ɔ/ are specified as being [+low]. Kaze then assumes a metaphony rule similar to mine that spreads onto a mid vowel the feature [+high] of the following high vowel. If the target is a close mid vowel, we get a high vowel. If instead the target is an open mid vowel, we get the universally disallowed configuration [+high, +low]. This disallowed configuration is then repaired by applying fission (in Salentino), negation (in southern Umbro) and so on.

Kaze argues that relying on the prohibition* [+high, +low] instead of a marking statement prohibiting* [+high, -ATR] is preferable because the configuration [+high, +low] is universally impossible for obvious articulatory reasons.

This is definitely an interesting proposal and would actually strengthen my analysis of metaphony. However, this proposal has a fundamental weakness: the open mid vowels of the southern Italian dialects cannot be specified as being [+low]. First, phonetically, they are not low vowels; they do not have the same degree of aperture as the low vowel /a/. This is what would be incorrectly implied by using the feature value [+low] to specify them. Second, the open mid vowels of these dialects do not pattern with the low vowel from the phonological point of view. In most dialects, the metaphony rule does not affect low vowels. But this is what we would expect if open mid vowels and the low vowel /a/ share the feature [+low], since it would be quite difficult to distinguish these two sets of vowels in the structural description of the rule. There are thus good reasons to reject the idea that the open mid vowels of these dialects are specified as [+low] and to keep their specification as [-low, -high, +ATR] vowels. The consequence is that we cannot use the prohibition [+high, +low] to account for the application of fission but must stick to the marking statement [+high, -ATR].

4.3. Sluyters (1988)

Sluyters (1988:175) criticizes my account of metaphony on three counts: "In the first place, we observed earlier that metaphony is a cyclic rule. The Strict Cycle Condition, because of structure Preservation, prohibits the creation of the segments [I] and [U] in the cyclic component. Furthermore, we expect the repair mechanism [Fission] to be the expression of a universal format, a kind of automatic rule. This is certainly not the case. Even within this group of Italian dialects a large number of them do not resort to diphthongization. The format is dialect specific. Third, the ordering of the conflicting features [+high, -ATR] [-tense] in Sluyters' paper (A.C.), and not [-ATR, +high] within the diphthong is not explained". None of these criticisms holds.

Let us consider the first objection, Sluyters assumes the Structure Preservation Principle and argues that this principle should prohibit the creation of the high lax vowels by metaphony in so far as this rule is a lexical rule in the sense of Kiparsky (1982, 1985). But as shown earlier (see end of section 2), there is no reason

mid vowels, and not to the [+ATR] ones; otherwise, it would wrongly create diphthongs in the case of the latter vowels. No such putative lengthening of [-ATR] mid vowels is observed in non-metaphonic contexts. Rule (47) is thus totally stipulative.

The metathesis rule in (50) does not fare better. Although it may be motivated for the Salentino dialect considered by Sluyters, in most other southern Italian dialects there is no reason to assume it. For example in the dialect of Arpino we considered in section 2, falling diphthongs such as those found in *fautze*, *kautse*, *fraultta* are totally normal. Similarly the metathesis process in (50) cannot be assumed for the other southern Italian dialects that have metaphonic diphthongization. Therefore metaphonic diphthongization cannot be explained by assuming the metathesis rule. Sluyters' analysis is thus unconvincing and fails to provide a principled account for the diphthongization we observe in metaphony.

4.4. Maiden (1991)

Let us consider now Maiden's (1991) analysis of the diphthongization found in metaphony. Maiden (1991) provides a detailed study of metaphony in its diachronic development and synchronic phonological and morphological aspects. In his analysis of the phonology of this sound change, Maiden treats metaphony as an assimilation in height as I have done in section 3; however, he disagrees with my account of the diphthongization process found in lower mid vowels. In his account of metaphony, Maiden assumes the framework of Dependency Phonology. Following Dependency Phonology, he proposes that vowel height in a seven vowel system like that of the Italian dialects should be represented as in (51), where vowel space is characterized by four components: |i| (=palatality or acuteness); |a| (lowness or sonority); |u| (=roundness or gravity, |ə| (=centrality);

- (51) { |i| } (=i/) { |u| } (=u/)
- { i,a } (=e/) { u,a } (=o/)
- { a,i } (=ɛ/) { a,u } (=ɔ/)
- { |a| } (=a/)

(where curly brackets indicate that the segment is characterized phonologically by just that component or combination of components, and ';' symbolizes asymmetrical right-to-left 'government' relationships between components).

He then proposes that the structural change involved in metaphony is the following:

- (52) V → -|a|

According to Maiden (1991:140), this rule "is to be interpreted as a demotion of the |a| component. Its causal relationship with the conditioning environment is manifested in the fact that /i/ and /u/ are -|a| (i.e., lacking the |a| component [...]). The structural change in (52) immediately accounts for the change of higher mid vowels to high vowels, as can be seen in (53):

- (53) {i,a} (=e/) → { |i| } (=i/)

Maiden, however, has problems with the diphthongization of the lower mid vowels. The structural change in (52) cannot account for the diphthongization directly. He thus postulates that there is a special "resolution" rule, similar in principle to the simplification rules proposed here, that changes the output of the application of (52) to lower mid vowels into a diphthong, as in (54):

- (54) {a,i} (=ɛ/) → (Resolution) → {i|i:a} (=ie/)

Maiden does not discuss this resolution rule in detail, or provide any independent motivation for it, nor does he try to account for it formally. The point is that there is no reason to assume a resolution rule like that in (54) in Maiden's theory. It is a purely ad hoc device needed only to account for the diphthongization found in the case of lower mid vowels. In addition to this, the formulation of metaphony as in (52), as Maiden admits, is at variance with the widely accepted idea that assimilation processes should be analyzed as spreading of autosegments. These problems, as well as other theoretical shortcomings characterizing Dependency Phonology which cannot be discussed here (see Kenstowicz 1990 for some discussion), lead me to prefer my analysis of metaphony.

5. Dialectal variation in the case of metaphony

If I am correct in proposing that metaphonic diphthongization is simply an instance of fission applied to repair the configuration [+high, -ATR] created by the application of the metaphony rule to [-ATR] mid vowels, then we might expect to also find instances in

which the other simplification rules are applied to repair the same configuration. And in fact, if we consider the different southern Italian dialects that have metaphonic alternations in the case of mid-vowels, we observe that although the outputs of the metaphony rule are mid vowels the same across these dialects when the targets are mid [+ATR] vowels, there is significant dialectal variation in the outputs when the targets are mid [-ATR] vowels. Mid [+ATR] vowels are always raised; in contrast, mid [-ATR] vowels can be diphthongized, as in Arpinate, or tensed or raised to high [+ATR] vowels, depending on the dialect. I have shown that diphthongization is actually an instance of fission which repairs the disallowed configuration [+high, -ATR] created by the metaphony rule. I will now show that the tensing and raising of mid-vowels in a metaphonic environment are instances of application of the other simplification rules. Thus, instead of postulating different rules of metaphony to explain this dialectal variation, I propose that the rule of metaphony was always the same across dialects and that the variation was due to the application of a different rule of height assimilation spread across the southern Italian dialects. Each dialect reacted to the problem posed by the output of the application of this rule to the mid [-ATR] vowels in a different way.

Let us consider the other southern Italian dialects having outcomes other than diphthongization in the case of the metaphony of mid [-ATR] vowels. There is a group of central Italian dialects that are of interest to us in this regard. Southern Umbro is one of this dialects. In southern Umbro, we have the following metaphonic alternations: [+ATR] mid-vowels are raised to their high counterparts as in most southern Italian dialects, but [-ATR] mid vowels simply become [+ATR]. For example, we have alternations like those in (55) (data from Rohlf's 1966 and AIS):

(55)	[+ATR] /e/:	vérde néra	vírdi níru	'green (sg./pl.)' 'black (fm./ms.)'
	[+ATR] /o/:	tónna róssa	túnnu rússu	'round (fm./ms.)' 'red (fm./ms.)'
	[-ATR] /e/:	tjéka péde	tjéku pédi	'blind (fm./ms.)' 'foot (sg./pl.)'
	[-ATR] /o/:	nóstra nóva	nóstru nóvu	'our (fm./ms.)' 'new (fm./ms.)'

If we assume that the rule of metaphony is the same across dialects and that the variation is due to the application of a different simplification rule, we can hypothesize that negation is the relevant simplification rule in southern Umbro. Thus, we have a simplification like the one in (56):

(56) [-ATR, +high] > - ([-ATR, +high]) > [+ATR, -high]

That is, the high -ATR vowels produced by metaphony are changed into [+ATR] mid-vowels.

Observe that independently of diphthongization metaphony, this is the best analysis for southern Umbro metaphony. The only alternative in a framework accounting for height with features like [high], [low] and [ATR] would be to assume two different rules: one that spreads the feature [+high] of the high vowels when the target is a [+ATR] mid vowel and one that spreads the feature [+ATR] when the target is a [-ATR] mid vowel. This solution is not very satisfying because it breaks what seems to be a single assimilatory process into two different assimilatory processes. I will not address here other possible analyses of southern Umbro metaphony that could be proposed in frameworks that do not rely on distinctive features like [high], [low], [ATR] to represent height, as the one recently proposed by Clements (1989) (see also Parkinson, 1994 for an analysis in similar terms). However, by getting rid of features like [high], [ATR] to represent height, we cannot account for diphthongization in dialects such as Arpinate in an explanatory way. Therefore it is preferable to adhere to a theory of height that uses the distinctive features [high], [low], [ATR].

Thus in southern Umbro, we have reasons to believe that the metaphony rule is similar to that found in other southern Italian dialects such as Arpinate and that the disallowed configuration [+high, -ATR] produced by this rule was repaired by the simplification strategy of negation.

There are also cases in which the other repair strategy, delinking, seems to have been applied. This is the case of another southern Italian dialect, Foggiano, a northern Pugliese dialect spoken in the town of Foggia (data from Valente 1975). In this dialect, we have the seven-vowel system /i, e, ε, a, o, u/. Therefore, in this dialect, we have the same situation as in the previous dialects where the marking statement [+high, -ATR] is active. In Foggiano, we now have metaphonic alternations like the following:

- (57) m'óffa m'úffa 'soft'
 k'éna k'ínu 'full'
 péte píti 'foot/feet'
 gr'óssa gr'ússu 'big'

We can hypothesize that the metaphony rule of Foggiano is identical to that of northern Salentino and southern Umbro. Therefore, we obtain high [+ATR] vowels from mid [+ATR] vowels, and high [-ATR] vowels from mid [-ATR] vowels. The disallowed configuration [-ATR, +high] is then repaired in this dialect by delinking the feature [-ATR], which is replaced with the feature [+ATR] as we see in (58):

- (58) p í d i p i d i
 X X X X X X X X
 | | | | | | | |
 root root | | | | | | | |
 | | | | | | | |
 Place | | | | | | | |
 | | | | | | | |
 Dorsal | | | | | | | |
 | | | | | | | |
 Tongue Root | | | | | | | |
 | | | | | | | |
 [-low] [+high] [-low] [+high] [-low] [+high] [-low] [+high]
 | | | | | | | |
 [-ATR] [+ATR] [-ATR] [+ATR] [-ATR] [+ATR] [-ATR] [+ATR]

The proposal made for this dialect is more problematic than the other ones. Other analyses are indeed possible. For example, one could propose that the metaphony rule in this dialect is different and simply consists of spreading the features [+high, +ATR] so that we get the final outcome directly without going through the intermediate stage of the disallowed configuration [+high, -ATR]. This solution, however, is not satisfying for two reasons. First of all, one of the requirements of the theory of nonlinear phonology is that assimilation always involves the spreading of a single node. If we treat the metaphony rule of Foggiano, a clear case of assimilation, as before, we would have an assimilation rule that spreads two features not exhaustively dominated by a single node—a rule that would be considered very unusual. The other reason to reject this analysis of metaphony in Foggiano lies in the appeal of having the same rule of metaphony in all dialects, so that any dialectal variation is just the

result of different applications of the simplification rules. Such results would be lost if we assume that Foggiano had a different metaphony rule. Thus, there are reasons to assume that we have the same metaphony rule in Foggiano that we find in other dialects and that it produced the configuration [+high, -ATR] which was then repaired by a simplification rule. Even so, we have a problem. According to historical grammars (cf. Rohlf's 1966, Loporearo 1988), the cases in which we find [i, u] from [ɛ, ɔ] in a metaphonical context are to be explained as cases of reduction of the original diphthong *ie, *uo/*ue through the following sequence of developments: (I consider the front series alone) *ié* → *íə* → *íj* → *í* where the crucial trigger is the shift of stress from the second member of the diphthong to the first.

If this is correct, supposing that the outcome /i/ from /ɛ/ in a metaphonical context is derived from delinking of [-ATR] in the configuration [+high, -ATR] would be a case of telescoping, that is, we would obtain in one step an outcome that was actually obtained through several steps. If this is correct, we would thus fail to recognize the different sound changes that led to the metaphonical alternations of Foggiano. The issue is that historical grammars usually hypothesize long sequences of sound changes because of lack of a theoretical framework that allows more radical and direct sound changes. Here I am proposing that radical sound changes like /ɛ, ɔ → i, u/ in a metaphonical context are indeed possible. I believe then that assessing the possibility of the direct sound change /ɛ, ɔ → i, u/ in a metaphonical context is an empirical question. As we will see below, there is evidence that this type of direct sound change is found in a metaphonical context.

Evidence for our analysis of raising metaphony is provided by a phenomenon labelled 'hypermetaphony' by Maiden (1991). In many Italian dialects where we observe the usual metaphonical alternations with diphthongization, or tensing, of mid [-ATR] vowels in the nominal system, we find - or at least we can reconstruct - a different metaphony pattern in the verbal system. Maiden calls this phenomenon hypermetaphony. Characteristically, in verbs, mid [+ATR] vowels become [+high] as in the nominal system. However, in the case of the mid [-ATR] vowels, we observe a different pattern than that found in nouns; in particular, the mid [-ATR] vowels instead of being diphthongized, or tensed as in nouns, become [+high] in verbs. For example, Maiden (1991:180) reports the following array of facts from the Alpine dialects of Loco and Intragna in Canton Ticino. In these dialects, the regular reflex of metaphony of the low mid back vowel

/ɔ/ is /wo/ (which is then monophthongized in the mid front rounded vowel /ø/). However, we find that the metaphonic reflex of /ɔ/ in the verb is not the expected /ø/ but instead /u/, which is the metaphonic output corresponding to /o/, as shown in (59):

(59)	1Sg	2Sg	
	part	part	'carry'
	trɔw	tru	'find'
	mɔrd	murd	'bite'
	gɔd	gud	'enjoy'

In the case of hypermetaphony, obviously we cannot say that the raising of the mid [-ATR] vowels is due to a sound change that monophthongized metaphonic diphthongs, since this change would have affected not only the diphthongs found in the verbs, but also the diphthongs found in the nouns. The best analysis assumes that the same rule of metaphony applies in both nouns and verbs, and that the verbal system is characterized by a different simplification procedure, in particular Delinking of [-ATR] instead of Fission.

An interesting case in support of this analysis is found in the Salentino dialect of Francavilla Fontana where in the present tense of verbs of the *-ere*, *-ire* conjugations we find two optional metaphonic alternants, as shown in (60) (from Maiden, 1991 but originally in Mancarella, 1970):

(60)	1Sg	2Sg	
	dɔrmu	duermi/durmi	'sleep'
	leggu	lieddɔʒi/lieddɔʒi	'read'

The variation that we observe in (60) is accounted for in the model just outlined by assuming that in the cases in (60) it is also possible to resort to delinking instead of Fission as a simplification procedure, as shown in (61):

- (61) a. $lieddɔʒ-i \rightarrow$ (Rule (36)) \rightarrow $lieddɔʒ-i \rightarrow$ (Fission) \rightarrow $lieddɔʒ-i$
 b. $lieddɔʒ-i \rightarrow$ (Rule (36)) \rightarrow $lieddɔʒ-i \rightarrow$ (Delinking of [-ATR]) \rightarrow $lieddɔʒ-i$

Observe that this is the most adequate analysis for this variation. The alternative analyses are the following: 1) we can assume that the present tense of verbs is characterized by an optional rule of metaphony which spreads both [+high] and [+ATR] and thus forms a high vowel from a mid [-ATR] vowel; or 2) we can assume that the

raising we observe in the present tense is due to a special phonological process that optionally monophthongizes metaphonic diphthongs. Both these alternatives require rules which lack independent motivation and thus are totally ad hoc and stipulative. This should be contrasted with the analysis proposed here, wherein the same rule applies both in verbs and nouns, and the variation in the verbs is accounted for by assuming the independently motivated variation between simplification procedures.²²

The account proposed above for the phenomenon of hypermetaphony is the simplest one, assuming the same general rule of metaphony and accounting for the difference by means of the independently motivated difference in simplification procedures. What is peculiar about this account however is the assumption that different simplification procedures may apply according to morphological categories. However, in this framework nothing requires that the same disallowed configuration should be repaired by the same simplification procedure. It is precisely this assumption that allows us to account for dialectal differentiation, as we have done in this section. This heterogeneity of repair inside the same language is not uncommon, for example, McCarthy & Prince (1993) observe the same type of situation in Axininca Campa where a constraint against hiatus configurations is satisfied by epenthesis in suffixal morphology (/inkoma+i/ \rightarrow *inkomati*) and by deletion in reduplicative morphology (/osampi+RED/ \rightarrow *osampi-sampi*).

I proposed that the metaphony rule is essentially the same across the southern Italian dialects, and that the dialectal variation we observe in this case results from the use of different simplification rules to repair the configuration [+high, -ATR] disallowed by the active marking statement in (30). Myers (1991) criticizes this analysis of metaphony on the grounds that it is redundant: according to him, there is no need to separate the marking of the configuration [+high, -ATR] as ill-formed from the repair operations that eliminate it. According to him, only "repair" operations are needed. These are phonological operations which apply "persistently" throughout the phonological derivations to certain configurations and change them into other configurations. In this way, the marking of ill-formed configurations and their repair is implemented solely by these operations. He calls these operations "persistent rules". Thus, according to Myers, the different simplification procedures that apply in different southern Italian dialects are simply different instances of persistent rules that apply to the configuration [+high, -ATR], changing it in different ways. Thus in Salentino, there would be a persistent rule that

ted for the metaphonic alternations observed in the different Italian dialects by assuming an interaction between constraints and well-defined repair procedures. Recently, an alternative theoretical model has invaded the linguistic scene. This new model is Optimality Theory (Prince & Smolensky, 1993; McCarthy & Prince, 1993; McCarthy & Prince, 1995; McCarthy, 1995). After a brief introduction to Optimality Theory, we will consider how Optimality Theory would account for metaphonic alternations.

The fundamental idea of Optimality Theory is that markedness constraints refer only to targets and inputs, and not the repairs that lead to satisfaction of those targets.

Optimality Theory hypothesizes that the correct surface form is selected by a set of well-formedness constraints that are ranked in a hierarchy of relevance, so that a lower ranked constraint may be violated in order to satisfy a higher ranked one. The constraints themselves are universal, except for the fixing of particular arguments within general constraint schemata; only the ranking is language-particular. The constraint hierarchy of each language is used to evaluate a (potentially infinite) set of candidate outputs relative to some input; the candidate that best satisfies the particular hierarchy is the actual output form.

The surface forms evaluated by an Optimality-Theoretic grammar show the effect of various phonological processes in parallel: there is no serial derivation. In accordance with the idea of parallel evaluation, the consequences of all of these processes are realized simultaneously rather than serially in the candidate surface form under evaluation.

The set of possible candidates is supplied by a general function GEN that constructs all possible surface manipulations that could be performed on the input string. In some sense, we can say that GEN acts as a simplification procedure repairing complex phonological configurations. The constraints trigger the different adjustments and then check the correctness of the outcomes. Crucially, however, in contrast with the framework outlined in section 1, the repair operations implemented by GEN are totally undeterministic. In the model presented in section 1, the different modalities of application of the simplification procedures can be built into the formulation of the procedures. For example, fission is represented as in (8). GEN, however, can only be restricted by output constraints. As we will see later, this is one of the problems that Optimality Theory faces in the treatment of metaphony.

changes a [+high, -ATR] vowel into a diphthong; in Umbro, there would be a persistent rule that changes a [+high, -ATR] vowel into a [-high, +ATR] vowel and so on.

This analysis, however, is unsatisfactory. First, as observed before, in a model in which there is no separation between the marking of ill-formed configurations and their repair, it is not clear why there should be a persistent rule that causes diphthongization of [+high, -ATR] vowels. Such a rule is just a stipulation in that model and therefore cannot account for that phenomenon. In the model proposed here, an independently needed procedure, i.e., fission, straightforwardly accounts for the diphthongization of the disallowed [+high, -ATR] vowels.

Second, the different persistent rules that Myers would hypothesize to account for the dialectal variation found in the case of metaphony apply to the same configuration [+high, -ATR]. Thus, even in Myers' framework, a crucial status must be given to this configuration. It is acting as a trigger for the application of certain "rules" which function to remove it. This is very close to the analysis I propose, although Myers does not give any reason why the configuration [+high, -ATR] should play such a triggering role. The only difference between Myers' approach and mine therefore is this: according to Myers, these rules must be established on a language-particular basis, so that they may vary from language to language; my position, instead, is that these "rules" are provided by UG, and that there are only three of them, namely (8), (9) and (10). My proposal is much more constrained and therefore more explanatory.

Finally, in not recognizing the function that the configuration [+high, -ATR] plays in triggering the different "persistent rules," Myers fails to explain the nature of the dialectal variation that we find in southern Italian dialects. Why do these dialects have *different* persistent rules that have the same configuration [+high, -ATR] as a target? Why don't they have the same persistent rule? Why should persistent rules that have the same target vary in their output? I believe that in order to answer these questions, Myers would be forced to assume that the persistent rules he proposes are essentially the simplification procedures that I propose, which have the function of eliminating complex configurations from the grammar.

6. Optimality Theory

In the framework developed in the preceding pages, we account

On the basis of their function, Optimality-Theoretic constraints can be divided into two classes, "structural constraints" and "faithfulness constraints" (McCarthy & Prince, 1995; McCarthy, 1995). The structural constraints should express the structural preferences that are part of any theory of Universal Grammar: e.g., the fact that syllables tend to have onsets; or the fact that vowels tend not to be both front and rounded; or that nasals agree in place of articulation with the following consonant, etc. Through ranking, the faithfulness constraints determine the extent of activity of these structural constraints. Faithfulness constraints assert that the surface form and lexical form are identical. Thus if the relevant faithfulness constraint is more highly ranked, a structural constraint will typically show no phonological activity; it will be violated in any language with this ranking. With the opposite ranking, the structural constraint will have an effect, and the surface form will not be faithful to the lexical representation.

In McCarthy & Prince (1995), McCarthy (1995), it is proposed that faithfulness is regulated by constraints that are sensitive to a relation of correspondence between two structures, the lexical form and the surface form. Correspondence is defined in (62):

- (62) *Correspondence*
Given two strings S_1 and S_2 , correspondence is a relation R from the elements of S_1 to those of S_2 .

Segments $a \in S_1$ and $b \in S_2$ are referred to as correspondents of one another when aRb .

Thus, according to McCarthy and Prince (1995), McCarthy (1995), candidate surface forms are subject to evaluation together with the correspondent lexical form and some particular R that relates them. Faithfulness constraints assess each candidate pair with its R considering such aspects of faithfulness as the completeness of correspondence in S_1 or S_2 , the featural identity of correspondent elements in S_1 and S_2 , and so on.

Some faithfulness constraints that can be formulated under correspondence theory are the following:

- (63) *MAX*
Every segment of S_1 has a correspondent in S_2 .
(i.e. there is no phonological deletion)

- (64) *DEP*
Every segment of S_2 has a correspondent in S_1 (i.e. there is no phonological epenthesis)
- (65) *IDENT(gF)*
Let a be a segment in S_1 and b a correspondent of a in S_2 ; if a is [gF], then b is [gF] (i.e. underlying [gF] cannot change to [-gF], assuming full specification)
- In (66), it is shown how faithfulness and structural constraints interact:
- (66) Hypothetical illustration (from McCarthy, 1995):
from input= $p_1 a_2 u_3 k_4 t_5 a_6$
- | | |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| $p_1 a_2 u_3 k_4 t_5 a_6$ | A fully faithful analysis, perfect correspondence. |
| $p_1 a_2 ? u_3 k_4 t_5 a_6$ | Hiatus prohibited (by a constraint against onsetless syllables), so epenthesis of [ʔ], which has no correspondent in the input. (Violation of DEP) |
| $p_1 u_3 k_4 t_5 a_6$ | Hiatus prohibited, leading to V deletion. The segment a in the input has no correspondent in the output. (Violation of MAX) |
| $p_1 a_2 u_3 t_4 t_5 a_6$ | The k in the input has a non-identical correspondent in the output, for phonological reasons. (Violation of IDENT(gF)) |
| blurk | No element of the output stands in correspondence with any element of the input. Such an output is obviously always excluded. |

The variety of output forms shown in (66) is representative of the richness of the candidate set. It is the duty of the language particular constraint hierarchy to determine what is optimal and what is not.

Let us now consider metaphony. Following Kirchner (1993), we can account for the metaphonic process by assuming an alignment constraint requiring that the feature [+high] associated with a suffixal vowel align with the left edge of the last foot, the foot associated with the main stress. We can assume the constraint in (67):²³

- (67) $\begin{matrix} * \\ [* \\ \sigma \\ | \\ N \\ | \\ X \\ | \\ [-cons] \\ [+high] \end{matrix}$ is disallowed

If the feature [+high] aligns with the left edge as in (68) the constraint in (67) is satisfied:

- (68) $\begin{matrix} * \\ [* \\ \sigma \\ | \\ N \\ | \\ X \\ | \\ [-cons] \\ [+high] \end{matrix}$

The constraint in (67) immediately accounts for the behavior of the mid [+ATR] vowels. We also need the identity constraint in (69) which tries to preserve the underlying feature composition of the morpheme. This constraint must be ranked lower than the constraint in (67):²⁴

- (69) *IDENT [-high]*:
Let *a* be a segment in lexical representation and *b* a correspondent of *a* in surface representation, if *a* is [-high], then *b* is [-high]

	ALIGN[+hi]	IDENT[-hi]
$\begin{matrix} [m \acute{e} s \cdot i] \\ \\ -hi +ATR +hi \end{matrix}$	*!	
$\begin{matrix} [m \acute{e} s \cdot i] \$ \\ \\ -hi +ATR +hi \end{matrix}$	✓	*

Now let us assume that the constraint in (30), repeated as (71), is active:

- (71) * [+high, -ATR]

We know that there are different possible outcomes of metaphony in the case of the mid [-ATR] vowels. Let us consider three possible outcomes: diphthongization, delinking of the feature [-ATR] and delinking of the feature [+high], or blocking. Let us consider diphthongization first. In order to account for this outcome, we have to assume that one of the changes that GEN can implement is fission. At the same time we have to assume a faithfulness constraint preventing output of this operation from surfacing freely. This constraint is given in (72) (from McCarthy & Prince, 1995):

- (72) *Integrity*
No element of S_1 has multiple correspondents in S_2
For $x \in S_1$ and $w, z \in S_2$, if xRw and xRz , then $w=z$

(72) states that no cloning of features or feature bundles in the lexical input can occur. The constraint in (72) is ranked lower than the alignment constraint in (62) in a language allowing metaphonological diphthongization, as shown in (73):

(73)

	Align [+hi]	* [+hi, -ATR]	Integrity	IDENT[-hi]
$\begin{matrix} [p \acute{e} t \cdot i] \\ \\ -hi -ATR +hi \end{matrix}$	*!			
$\begin{matrix} [p \acute{e} t \cdot i] \\ \\ -hi -ATR +hi \end{matrix}$	✓	*!		
$\begin{matrix} [p \acute{e} t \cdot i] \$ \\ \\ -hi -ATR +hi \end{matrix}$	✓	✓	*	*

However, (72) is not enough to exclude other possible candidates that can be produced by GEN once something like fission is

recognized as one of its possible operations. First of all we have to exclude candidates in which the disallowed feature bundle is broken into two non-adjacent feature bundles, i.e. candidates such as those in (74):

- (74) *pítei, *epíti, *ipéti

To exclude the candidates in (74), we have to assume another constraint disallowing the non adjacent distribution of fissioned segments, such as the Linearity constraint (from McCarthy & Prince, 1995):²⁵

- (75) *Linearity*

S_1 reflects the precedence structure of S_2 , and vice versa

Let $x, y \in S_1$ and $x', y' \in S_2$, if xRx' and yRy' ,
then $x < y$ iff $- (y' < x')$

Linearity requires that the linear order among segments in the input be preserved between the correspondents of those segments in the output. Consider the input:

- (76) p₁ ε₂ t₃ i₄

Linearity is mildly disrupted in only one place in the output candidate

- (77) p₁ i_{2'} ε₂ t₃ i₄

where the subsegment [i_{2'}] is added. The disruption occurs between the segments [p₁] and [ε₂], although in this case, since [i_{2'}] is itself in correspondence with the input segment [ε₂], [p₁] actually does in the input. In contrast, in an output form like (78), Linearity is disturbed between [t₃] and [ε₂], since [ε₂] follows [t₃] in this output form. Also, Linearity is disturbed between [t₃] and [i₄], which are no longer adjacent.

- (78) p₁ i_{2'} t₃ ε₂ i₄

With Linearity, fission will always result in a local sequencing of two features, since non-local sequencing, as in [pitéi], will always incur more violations of Linearity. In OT, the optimal form is always

the one with the minimal violation of the decision-making constraint²⁶.

Furthermore we have to exclude the possible candidate in (79) where the vowel with the feature [-ATR] precedes that with the feature [+high]:

- (79) *péite

Earlier I accounted for the ordering we observe in metaphonic diphthongization by hypothesizing that the unmarked features of the marking statement are always fissioned to the left. In the OT framework, we have to assume another constraint excluding the order in (79). Various options at this regard are available. One could say that it is the alignment constraint in (67) that imposes the order [ie] so that the feature [+high] is aligned with the left boundary of the foot. Another possibility is to assume that syllable structure plays a role in the ordering between [j] and [ε].²⁷ In [ie], the nucleus is the second element of the diphthong, and if pre-nuclear elements do not contribute weight, then this diphthongization would not introduce any change in the quantity of the structure. In contrast, in [ei], the initial element of the diphthong is nuclear, and so the non-nuclear element has the possibility of contributing weight. Since the input structure is not heavy, the output structure with [ie] is more faithful to the underlying weight than the competing structure [ei].

The same result, however, could be obtained by independent and unrelated constraints that disfavor pre-nuclear vocalic elements, as in [ie]. Then the choice between [ie] and [ei] may be reduced to the ranking between those unrelated constraints. The order of features may be determined by constraints which do not themselves directly address linear order, but which govern the distribution of individual segments or substructures within each diphthongal unit.

Other constraints are also needed. If we consider the feature structure of the metaphonic diphthong more carefully, we can observe that the features [+high, +ATR] of the [i] (or [u]) of the metaphonic diphthongs are not contained in the lexical input. They must be inserted by the GEN component. The insertion of [+high] satisfies the constraint on alignment, and the insertion of [+ATR] satisfies the constraint (71). However at this point we have to block insertion of other features such as [+back] in the clones created by fission in order to avoid output forms like [pucti] or [picti] from lexical /peti/. Thus we need another constraint – probably an Identity constraint – preventing such changes. Observe that in many dialects such as Salentino, such

changes are actually found but only in back diphthongs where they affect the nuclear vowel which becomes [-back] (/ferte/ → [fuerti]). Thus the identity constraint governing the distribution of the feature [back] in this case must be made sensitive to the different types of diphthongs.

An OT treatment of diphthongization in metaphonic processes is thus successful. However, if we compare the account for metaphonic diphthongization proposed earlier and that possible in an OT framework, we can observe that the first one is definitely simpler and more elegant. The condition on the adjacency of the fissioned elements is naturally contained in the fission as a repair procedure. Also the condition on the order of the fissioned elements can be naturally formulated as part of the procedure. In the OT approach, these two conditions are replaced by a plethora of constraints which, although natural, are required only to avoid overgeneration by GEN. They are needed because of the non-deterministic approach to repair which characterizes Optimality Theory. Since the modalities of application of GEN operations cannot be determined, it is the duty of the constraint component to restrict them. But in this way, a large range of constraints may need to be stipulated, some of which may be very ad hoc, although this does not seem the case here. The issue is that Optimality Theory is concerned only with the outputs of the GEN component and with why we get them but not with how we get them. GEN is a black box that cannot be opened. But by failing to study how these outputs are brought about, Optimality Theory may have to propose quite complex analyses, and thus miss a simple and adequate account of the phenomena characterized by these outputs. This is what happens - I feel - in the case of diphthongization in metaphonic processes.

Let us now consider the other outcomes we obtain in the metaphony of mid [-ATR] vowels and dialectal variation we observe in this case, and see how OT would account for such variation. In order to accomplish this, we need to assume the additional Identity constraint in (80):

(80) IDENT [-ATR]:

Let *a* be a segment in lexical representation and *b* a correspondent of *a* in surface representation. If *a* is [-ATR], then *b* is [-ATR]

Let us put aside the problems mentioned above with respect to the Integrity constraint in (72) and assume that Integrity is the only constraint needed to account for the dialect with diphthongization. The different dialects observed in the case of metaphony can then be derived by different rankings of this constraint with the constraints (69), (71), (80) and the alignment constraint in (67). In (81) we show

the ranking needed to obtain the dialect characterized by metaphonic diphthongization of mid [-ATR] vowels:

(81)

	Align [+hi]	*[+hi, -ATR]	IDENT[-ATR]	Integrity	IDENT[-hi]
	*!				
	✓	*!			
	✓	✓	✓	*	*
	✓	✓	*!		

The ranking in (82) accounts for the dialects characterized by the raising of mid [-ATR] vowels to high ones:

(82)

	Align [+hi]	*[+hi, -ATR]	Integrity	IDENT[-ATR]	IDENT[-hi]
	*!				
	✓	*!			
	✓	✓	*!		
	✓	✓	✓	*	*

The ranking in (83) accounts for the dialects where there are no metaphonic alternations in the case of the mid [-ATR] vowels:

(83)

	IDENT[-hi]	Align[+hi]	*[+hi, -ATR]	Integrity	IDENT[+ATR]
<p>[p é t i] $\begin{matrix} \text{\\$/} & & & \\ \text{-hi -ATR} & \text{+hi} & & \end{matrix}$</p>	✓	*	✓	✓	✓
<p>[p i é t i] $\begin{matrix} \text{\\$/} & & & \\ \text{-hi -ATR} & \text{+hi} & & \end{matrix}$</p>	*!				
<p>[p i é t i] $\begin{matrix} \text{\\$/} & & & \\ \text{-hi -ATR} & \text{+hi} & & \end{matrix}$</p>	*!				
<p>[p i é t i] $\begin{matrix} \text{\\$/} & & & \\ \text{-hi -ATR} & \text{+hi} & & \end{matrix}$</p>	*!				

Crucially the metaphony pattern characterized by the tensing of the mid [-ATR] vowels cannot be derived by any ranking of the constraints we observe in (81)-(83). In an OT approach, we have to account for this pattern by assuming a totally different analysis from that proposed in the dialects showing the other metaphony patterns. The alignment constraint in (67) does not play any role in the case of dialects which display metaphony with tensing of mid [-ATR] vowels. Here I will not try to develop an analysis of this pattern in an OT framework, something which is clearly possible but somehow problematic, since no common surface constraint is satisfied by the different alternants for this pattern. I want to stress, however, OT's failure to account for this pattern in the same way as for the other patterns, a goal that was instead achieved by the theory proposed earlier.

In conclusion, an OT treatment of metaphony, although potentially successful, does not appear to be completely satisfactory. On one hand it is much more complex than that proposed earlier in requiring a great number of constraints to avoid overgeneration by GEN. On the other hand, it fails to account for the dialectal variation observed in the case of metaphony in a systematic and unitary way.

Obviously, other more general theoretical considerations independent of the treatment of metaphony discussed here may show that the OT analysis is the most desirable one.

7. Conclusions

In this article, some aspects of the analysis of metaphony in southern Italian dialects proposed in Calabrese (1985) were reviewed and updated in the light of the theory of phonological markedness developed in Calabrese (1995). This theory postulates that constraint-like marking statements and prohibitions must be assumed to express generalizations about phonological inventories. It further postulates a number of simplification procedures which have the function of preventing the surfacing of complex segments disallowed by active marking statements and prohibitions. One of these simplification procedures, fission, played an important role in the analysis. By hypothesizing the existence of fission, it was possible to achieve an adequate and simple account of diphthongization in metaphony which could be otherwise formulated only in terms of rather complex and ad hoc rules. I reviewed the criticisms of my analysis of metaphony by a number of linguists, and argued that the best analysis of metaphony, and in particular of the diphthongization we observe in metaphonic processes, can only be the one proposed here.

In reviewing the account of metaphony proposed in Calabrese (1985), I addressed the problem of the best analysis of this phenomenon for dialects in which this sound change was morphologized and I also accounted for the historical development of this sound change.

I ended by discussing a possible analysis of metaphony in the framework of Optimality Theory, one of the most recent developments in Phonological Theory. I argued that Optimality Theory cannot provide a satisfying account of the diphthongization we observe in metaphony and for the dialectal variation we observe across Italian dialects in the case of this phenomenon.

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Notes

* Some parts of this paper appear in Calabrese (1995). I thank Morris Halle, Jennifer Cole, José Ignacio Hualde, and Bert Vaux for comments and suggestions on an earlier draft of this paper.

1 Each of the marking statements involves a pair of feature specifications. However, although only two feature specifications must appear in the focus of the statement, other feature specifications needed for the proper definition of the statement may appear in its environment. Thus the marking statement constraining the occurrence of nonlow back unrounded vowels will have the feature specifications [+back] and [-round] in its focus and the feature specification [-low] in its environment, as in (i):

- (i) [-back, -round]/[___, -low]

There are two reasons for assuming this format: first, by restricting the focus of the statement to only two features, we capture the intuition that the basic relationship between features involves pairing of features, as observed by Stevens, Keyser & Kawasaki (1986). For example in the case of (i), there is a special acoustic relationship between [+back] and [-round], which is not shared by the feature in the environment, i.e., [-low] in (i). Secondly, this format is needed to obtain the proper formulation of the simplification procedures. Fission and negation appear to apply only to pairs of features. The correct results with these two procedures can thus be obtained only if simplification procedures apply to just the focus of the statement and if this focus can contain only two feature specifications.

2 There are phonological systems that contain unexpected gaps. They can be of two types: 1) asymmetrical systems such as that in (i) found in Occitan:

- (i) i y u a
e y u o
ε

or 2) systems lacking otherwise expected unmarked vowels, such as that of Japanese which lacks back round [u], but has a back unrounded vowel [u]. To account for the absence of segments that otherwise should be expected according to the marking statements that are deactivated in a given language, I hypothesize that in addition to universal marking statements, special constraints – dubbed auxiliary filters in Calabrese (1988) – must be postulated on a language-specific basis. These auxiliary filters would be assigned an extra cost, so it would be advantageous for language to eliminate them by deactivation or not to have them in the first place. For Occitan, I would propose the auxiliary filter in (ii); for Japanese that in (iii):

- (ii) [-ATR, +back]/[___, -high, -low] (for Occitan)
- (iii) [+high, +round] (for Japanese)

For a detailed discussion of this issue see Calabrese (1988) and especially (1995). 3 I consider negation to be the most problematic simplification procedure that I propose. Whereas delinking and fission may have a “natural” phonetic interpretation in a framework that does not use binary feature values, negation relies heavily on binary feature values. Certainly, there is nothing incorrect in relying on binary feature values; however, the point is that in doing so, negation is grounded only on theory-internal considerations.

The cases of simplification that lead me to hypothesize negation are the following:

- (i) a) I, U → e, o.
In the metaphonic alternation ε, ə/e, o in several southern Italian dialects (discussed in section 5); in the surface merging

of I, U with e, o in Okpe; in the diachronic changes from proto-Kwa to the modern Kwa languages; and in many other cases.

- b) [+ATR] A → ε/ə

In the diachronic changes from Proto-Kwa to the modern Kwa languages; in several [+/-ATR] harmony systems in which the [+ATR] counterpart of /a/ is either ε or ə.

- c) a+j, a+w → ε, ə

In Kabardian and in many other languages like Sanskrit, for example.

- d) y, ø → i, ə

Unconditional sound change occurred in the history of Mongolian (see Dressler 1974) (cf. also the pronunciation of /ɣ/ as [ɣ] by English speakers (Gödel pronounced like *girdle*) (see Kiparsky 1973).

- e) ə → ø

In the pronunciation of English /s/ by foreign speakers (see Jones 1960).

Given the UG active marking statements *[-high, -ATR], *[-low, +ATR], *[-low, +high], *[-back, +round], and *[-back, -round], these cases of repair can be accounted for by negation in the following way:

- (ii) a) [+high, -ATR] → -([+high, -ATR]) → [-high, +ATR] (= (i)a)
- b) [+low, +ATR] → -([+low, +ATR]) → [-low, -ATR] (= (i)b)
- c) [+high, +low] → -([+high, +low]) → [-high, -low] (= (i)c)
- d) [-back, +round] → -([-back, +round]) → [+back, -round] (= (i)d)
- e) [+back, -round] → -([+back, -round]) → [-back, +round] (= (i)e)

In the course of my research, I have not encountered other cases of repair that can be analyzed as negation (For more discussion of negation see Calabrese (1988, 1995)).

Note that negation could be considered a case of overapplication of delinking to the features of a configuration disallowed by an active marking statement. The convention in (11) that creates optimal feature configurations after the application of the simplification procedures would give the same results as negation, if it can have access to the delinked features.

4 Whereas negation and delinking seem to operate in harmony systems (cf. Calabrese 1988, 1995), fission seems to be restricted to operate in conjunction to local, non-iterative phonological processes such as metaphony, umlaut or palatalization (see Calabrese 1995). The reasons for this are unclear to me. They may be due to the fact that application of fission to the output of an iterative process such as a harmony rule would make this process completely opaque. Further research is needed on this point.

5 Also, syllable structure may be playing a role in the sequencing of the two subcomponents. For example, in the case of fission applying to nasal vowels, we obtain the sequence vowel + nasal. Notice now that the rendition of the nasal vowel as a sequence nasal + vowel would require a drastic reshuffling of syllable structure. One could propose that the application of simplification procedures cannot lead to a major syllabic restructuring.

6 I will use the feature [ATR] to distinguish between the higher and lower mid vowels of the Italian dialects discussed here. In Calabrese (1985), I used the more traditional feature [tense]. The feature [ATR] has been used to describe the vowel systems of African languages (Stewart, 1972; Archangeli & Pulleyblank, 1994), and recently to describe the vowel systems of many Altaic languages and of an Indo-European language such as Armenian (cf. Vaux, 1993). It makes sense

to use this feature in the case of Italian dialects as well, given the central role that the configuration [+high, -ATR] will play in the analysis. Evidence for the existence of a marking statement blocking the configuration [+high, -ATR] is provided by the African and Altaic languages where vowels characterized by that configuration are often eliminated in historical changes (cf. Stewart, 1972; Vaux, 1991). Future phonetic research should investigate the use of the feature [ATR] to account for height distinctions in vowels in Italian and more generally in Romance.

7 I do not intend to provide an exhaustive analysis of nominal and verbal morphology of Arpinate, but only a sketch of the morphological categories where metaphony is relevant.

8 A quite interesting phenomenon is found in the verbs in Arpinate. In this case, metaphony not only affects the mid vowels, but also the vowel /a/, as we can see in (f):

(f) *1sg. párla pjérla 'speak'*

The best way of treating this phenomenon is not clear to me at this point. One could account for the alternations in (f) by assuming a double application of metaphony: first a special rule raising /a/ to /e/ in metaphonic context and then regular application of metaphony. Or one could propose that /je/ is the direct outcome of the metaphony of /a/. In this last case a direct account of the surface form of the outcome is not some and some adjustments are needed. I will not investigate this phenomenon further here. See Maiden (1991) for discussion of the special metaphony patterns found in verbal morphology, what he calls hypermetaphony (see also section 5).

9 I use Halle and Idsardi's theory of prosodic structure to represent stress (cf. Halle & Idsardi, 1992; Idsardi, 1992). In this theory the stress pattern of the Arpinate word /ausedkava/:

line 2 * (primary stress)
 line 1 * (head of feet)
 line 0 (* * * * * (stress positions projected from syllables)
 (f) at . tsə . ka . va

Asterisks on the line 0 represent stress position in a word, whereas asterisks on the higher lines represent heads of prosodic constituents. Parentheses representing metaphony must carry the primary stress of the word. Observe that given condition (27a), we have to assume that the rules assigning prosodic structures must apply before the readjustment rule in (27). This indicates that we cannot assume that all morphological readjustment rules apply before the phonological rules. But we have to admit as in Lexical Phonology that phonological rules can be intermingled among the Readjustment Rules so that certain phonological processes can apply before certain given readjustment rules. This important issue goes beyond the goals of this article and will not be discussed here.

10 The mid vowels of the metaphonic diphthongs are reported to be higher than the usual mid [-ATR] vowels, although there is no clear discussion of this issue in Parodi. Let assume that they are actually [+ATR]. If this is correct, we have to assume that after application of fission, a further rule applies which assigns the feature [+ATR] to the mid [-ATR] vowels which are in the second subcomponent of the diphthong produced in (32)-(33). This feature may be spread from the preceding adjacent high vowel. Another possibility suggested to me by Jennifer Cole (p.c.) is to assume that in this case two repair strategies operated simultaneously: fission produces diphthongization, while negation derives (e) from the disallowed

configuration [+high, -ATR]. Further research will determine the correct ATR status of the mid vowels in the metaphonic diphthongs and decide on their proper treatment.

11 As shown by Maiden (1991), in some dialects the only suffixal high vowel was the front high vowel /i/, in others both the vowels /i/ and /u/. This was due to a historical change that lowered word-final /u/. This sound change occurred in the former dialects before the arrival of metaphony.

12 In some southern dialects, metaphony also affects low vowels. This is an innovative extension of the metaphony rule which originally applied only to mid vowels. Many interesting outcomes are found when /a/ undergoes metaphony. Unfortunately, limits on the length of this article prevent me from studying this phenomenon. See Calabrese (1985) for a tentative analysis.

13 The condition in (36a) states that the vowel target of the rule must have primary stress and that the vowel trigger must be contained in the same prosodic constituent. The issue of metaphony in words with antepenultimate stress will not be discussed here. Observe, however, that if we assume that the last syllable of words with antepenultimate stress is extrametrical, then we should not find metaphony in the case of these words, unless the penultimate vowel is high. And this is exactly what we observe in the case of these words (see Calabrese, 1985 and Maiden, 1991 for some discussion of metaphony in words with antepenultimate stress).

14 Notice that in the autosegmental representation obtained after the application of metaphony, the feature [+high] should be associated with the root node of the trigger and the root node of the target of the metaphony rule. However, fission repairs only the disallowed configuration [+high, -ATR] dominated by the root of the target. This is expected if we assume a principle like (i):

(i) A simplification procedure operates only inside the feature bundle that contains a configuration of features disallowed by an active marking statement.

Therefore, when the simplification procedure applies, the feature value [+high] of the trigger of the rule must be distinct from that of the target. I thus hypothesize that (i) triggers a rule, a sort of mitosis operation, which splits a feature value that simultaneously belongs to two different feature bundles, when this feature value will be affected by a simplification procedure in only one of these feature bundles. I propose the following convention:

(ii) Given a node n_1 that is linked to two root nodes: if n_1 , together with other nodes n_2, \dots, n_3 which are linked to only one of these root nodes, is included in the structural description of a simplification procedure, then n_1 is split into two identical copies, each one linked to only one of the root nodes.

15 It is this non optimal behavior of tongue root retraction in high vowels that characterizes the feature [-ATR] as being marked in that context.

16 See Calabrese (1995, section 8) for discussion of how this option may come about historically (see also note 15).

17 We obviously expect that in the dialects where there is such blocking, the contrast between [-ATR] and [+ATR] mid vowels is neutralized. Further research should show that there are no [+ATR] mid vowels in closed syllables in these dialects.

18 The metaphony pattern of the dialects of Lesina and Torremaggiore reported by Maiden (1991) is a possible counterexample to this generalization. In these dialects, metaphony applies to [+ATR] midvowels in all types of syllabic positions, but applies to mid [-ATR] vowels only in open syllables. The data from these dialects, however, are quite unclear. The absence of metaphony of mid [-ATR] vowels

in closed syllables could be due to a special treatment of diphthongs in closed syllables. More research on these dialects is needed.

¹⁹ It appears that the stressed open syllables of words with antepenultimate stress were treated as closed syllables in not undergoing metaphony in dialects of this type. See Maiden (1991:127) for some discussion of this fact. See also note 13.

²⁰ As observed by Jennifer Cole (p.c.), this analysis seems to predict that the opposite sort of system should exist, where the marking statement is deactivated for metaphony, but not for laxing in closed syllables, where simplification takes place. This would be a system where raising derives the [+high, -ATR] vowels [i, u], but such vowels cannot be derived from underlying /i, u/ by closed syllable laxing. This pattern is not found in Italian dialects. It is unclear to me whether or not this pattern should be considered impossible. Further research should determine that.

²¹ The process of high vowel laxing we observe in these dialects is quite peculiar in not having an apparent phonetic or phonological motivation. It may be related to a quite interesting reversal in ATR values of mid vowels observed in some of these dialects. Thus in these dialects, underlying mid [+ATR] vowels [e, o] became [-ATR] [ɛ, ɔ] in surface representations, whereas underlying mid [-ATR] vowels became [+ATR] [e, o] (cf. Loporcaro, 1988 for the dialect of Alkamura). I will not investigate this process further here. Loporcaro (1991), adopting natural phonology, argues that this process is due to the relaxation of the natural phonetic process assigning the feature [-ATR] to high vowels. He, however, fails to recognize that in terms of Natural Phonology such relaxation should automatically lead to a contrast between [+ATR] and [-ATR] high vowels. The best account for the lax realization of high vowels in southern Italian dialects involves assuming that they are underlying [+ATR], so that we have underlyingly a standard system with extremely peripheral high vowels. A late phonetic rule should then account for their lax pronunciation, as proposed in the text.

²² In addition to fission, negation, and delinking of [-ATR], the framework proposed here allows yet another possibility: the delinking of [+high]. In a dialect choosing the latter option it looks as though metaphony affects only [+ATR] mid vowels, i.e., in such a dialect 'walls' would be *pariti*, but 'teeth' would be *denfi*, i.e., the metaphony pattern we find in Veneto in (41-42). Under this option, a disallowed configuration created by the application of a phonological rule is repaired by delinking the very feature assigned by that rule – i.e., a structure-preserving application of the simplification procedures. In Calabrese (1995, section 7), it is argued that this option is to be excluded. The reason is that the same output form can be obtained by simply not applying the rule. Thus we have two possible derivations of the same output form. One involves two steps: 1) the generation of a disallowed form by the rule; and 2) the repair of the disallowed form by a simplification procedure. The other derivation is simply null: the rule does not apply. I propose that when we have a situation in which the same form can be derived through application of a phonological rule and subsequent application of a simplification procedure, or through the non-application of a phonological rule, a general principle of Economy of Derivation imposes selection of the latter alternative since in this case it produces the shortest derivation. This is the analysis I proposed in the case of Veneto (See Calabrese, 1995 for more discussion).

²³ After morphologization, the alignment constraint in (67) is reanalyzed as a constraint disallowing mid vowels in stressed position in certain morphological categories, i.e. the constraint in (i):

- (i) *[-high]/
 I * N
 | X
 |
 -cons
 |
 -low
- in the masc. sg. and plur. of II nominal class.
 in the plural of the III nominal class, etc.

²⁴ The prosodic structures in (70) are simplified by representing the left edge of the foot directly in the segment sequence. In (70), the constraints are listed across the top in their rank order. Candidates, or potential outcomes, are listed in the first column. A violation of a constraint by a particular candidate is marked by an asterisk in the appropriate cell. A crucial violation (which eliminates the candidate from consideration) is marked by an exclamation point. The dollar sign indicates the winning candidate output.

²⁵ The idea of using Linearity to account for the positioning of the fissioned elements was given to me by Jennifer Cole (p.c.).

²⁶ Observe that the constraint on linearity must be *inviolable* in the case of diphthongization since a process of discontinuous breaking is totally unattested across languages. Thus, linearity must be universally undominated. But this would exclude all processes of metathesis which, although rare, are actually attested. (see McCarthy, 1995 for some examples).

²⁷ Here again, I follow another suggestion given to me by Jennifer Cole (p.c.).

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