Deconstructing metaphony

Jennifer Cole

This paper argues that the set of vowel raisings that define metaphony systems in Italian dialects, as in other Romance languages, do not result from a unified operation of height assimilation. Instead, metaphony is claimed to be the product of a restricted assimilation of high-mid vowels, and a subsequent vowel shift that conditions both the vowel raising and fronting. Low-mid and low vowels raise to fill in the gap created by assimilation of /e, o/ to /i, u/. This analysis accounts for striking parallels between the pattern of vowel movement found in diachronic vowel shift systems, as documented by Labov (1994), and the movement of vowels in metaphony systems. The proposed analysis appeals directly to acoustically-defined categories of vowel height, and avoids many problems encountered in existing analyses, which attempt to unify all metaphonic raising through the mechanism of a unified stepwise raising process that operates in terms of abstract phonological height features. The contrast-preserving nature of vowel shift is expressed through two constraints that function to preserve the underlying system of contrast by preserving constrastive height features and the relative height relations between contrastive vowels that undergo metaphonic raising.*

1. The facts

This paper addresses the phonological treatment of metaphony in Romance, focusing mostly on the well-documented patterns of metaphony in Italian dialects. The discussion is based on metaphony systems described in the following sources: Calabrese (this volume, 1985), Kaze (1989), Leonard (1978), Maiden (1991), and Nibert (to appear).

Metaphony refers to the raising of a stressed vowel in forms that bear a certain morphosyntactic feature, such as person, gender or tense. Metaphonic vowel raising is often accompanied by an overt trigger in the form of a high suffixal vowel, /i, u/, but in some dialects, reduction of the atonic suffix vowel has removed its conditioning high feature. Maiden (1991:1) characterizes the situation with the following table:

(1) Variation in the expression of inflectional categories

A	B	C	
korro	korro	korrə	'I run'
korri	kurri	kurrə	'you run'
korre	korre	korrə	'he runs'

Rivista di Linguistica, 10.1 (1998), pp. 69-98 *(ricevuto nel settembre 1997)*

Dialect A employs suffixation alone to mark subject person inflection. In dialect B, suffixation is accompanied by metaphonic raising of the stressed vowel. Dialect C also exhibits metaphony, but in this case the suffix vowels undergo atonic vowel reduction, and the underlying contrast between suffixal /i, o, e/ is neutralized in the single surface variant [ə], with the result that metaphony has no segmental conditioning element in surface form.

Dialects exhibiting metaphony differ significantly in both the input and output to raising. Drawing once again from Maiden's classification of metaphony in Italian dialects (1991:112), the individual vowel alternations that comprise metaphony in its various manifestations are listed as follows:

(2) The set of metaphonic alternations

high mid	/e/	—>	[i]
	/o/	—>	[u]
low mid	/ɛ/	—>	[jɛ], [je], or [e]
	/ɔ/	—>	[wɔ], [wo], or [o]
low	/a/	—>	[ɛ], or [je]

To this list we should add another set of alternations in which metaphony conditions the fronting of back vowels, as in La Valle Anzasca, where the front rounded high vowel /y/ is the metaphonic alternant for /o, u/, or Sonogno, where /ø/ is the metaphonic alternant for /o/, discussed further in section 5.2.

As we shall see below, there are patterns in the way the individual alternations of (2) group together in the metaphony systems of different languages and dialects. Informal observation of the data reported in the literature cited above reveal that the high-mid vowels display metaphonic alternation with the greatest frequency, followed by the low-mid vowels. The low vowel alternates in relatively few of the reported dialects. Furthermore, there is a strong tendency for dialects that display metaphonic raising of the low-mid vowels to also display raising of the high-mid vowels. Maiden claims that there is a descriptive implicational hierarchy, such that if a vowel of height *n* participates, then a vowel of height greater than *n* also participates. Thus, raising of the low vowel would imply raising of the low-mid vowel, which would in turn imply raising of the high-mid vowel.

2. *The problem*

The central problem that Romance metaphony poses for phono-

logical analysis, as viewed from the perspective of non-linear, generative phonology, is how to get a one-step, scalar vowel raising to follow from an assimilation of vowel height triggered by the high vowels /i,u/. Guided by this question, the focus of recent research on metaphony has been on defining the right set of vowel height features and feature geometry that will provide a unified expression of the entire set of metaphonic vowel alternations in (2).[1]

In this paper, I argue that recent proposals for the analysis of metaphony as a unified phenomenon of vowel height assimilation do not fully succeed. The features and mechanisms adopted in these analyses fail on technical or empirical grounds, or confer excessive power to the theory, predicting a wide range of unattested assimilatory phenomena. I claim that the failure of these analyses derives from the assumption that metaphony constitutes a unified phenomenon of assimilation.

An alternative analysis is proposed here, in which metaphony is decomposed into two aspects: (i) the assimilation of the high-mid vowels /e, o/ to the high vowels /i, u/, within the stress foot; and (ii) vowel shift, a typically non-neutralizing phenomenon by which /a, ɛ, ɔ/ are raised one step. This analysis avoids the pitfalls of the "unified assimilation" analyses, and accounts for the many similarities between the properties of diachronic vowel shifts and synchronic metaphony systems. The proposed analysis does not impose any special requirements on a theory of vowel height features, or their place in a feature hierarchy, drawing instead on the functionally-based principle of vowel shift, augmented by a very restricted and unremarkable operation of height assimilation.

We begin in section 3 with a review of several contemporary analyses of metaphony as assimilation. Section 4 examines more closely, and critically, the assumption that metaphony constitutes a unified phenomenon of assimilation. Section 5 compares vowel raising in metaphony to similar vowel shifts in diachronic sound change, setting the stage for section 6, where the details of the proposed analysis are worked out, drawing on Labov's (1994) principles of vowel shift systems. Finally, section 7 outlines a role for assimilation in the proposed analysis, and puts forth an account of the unique behavior of the high-mid vowels in metaphony systems. Section 7 summarizes, and spells out several questions for future research.

3. *Metaphony as assimilation*

Recent analyses of metaphony can be divided into two groups. The direct assimilation analyses derive raising from the autosegmen-

tal spreading of a unique vowel height feature from the triggering suffix vowel, while the indirect assimilation analyses employ rules other than spreading to directly manipulate vowel height features on the stressed vowel target. The latter type of analysis is assimilatory in only the loosest sense of the term, since assimilation results as a byproduct of the raising rules, which are formulated independently of the vowel height features of the 'trigger', and which may affect different vowel height features for different input vowels. Both groups of analyses have in common the property that all the metaphonic alternations result from a unified rule that operates on all stressed vowels by spreading, inserting, or deleting vowel height features. In the next three sections, we review the primary features of several direct and indirect assimilation analyses.

3.1. Spreading analyses with binary features

Calabrese (this volume, 1985) and Kaze (1989) analyze metaphony as the leftward spread of the feature [+high] from the suffix vowel onto a [-low] stressed vowel. For both Calabrese and Kaze, the low-mid and low vowels suffer feature clash upon assimilation of the feature [+high]. We focus on Calabrese's analysis here, but the discussion holds equally for Kaze's analysis, which differs from Calabrese's primarily in the specification the low-mid vowels.[2]

Calabrese recognizes three contrastive vowel height categories, specified with the binary features [high] and [low]. The low-mid vowels /ɛ, ɔ/ are treated as mid vowels, with the additional specification of [-tense], as follows:

(3) Vowel height specification with binary features

	i	u	e	o	ɛ	ɔ	a
high	+	+	-	-	-	-	-
low	-	-	-	-	-	-	+
tense	+	+	+	+	-	-	-

Furthermore, Calabrese assumes that metaphony applies to representations which are underspecified, as in (4).

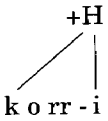
(4) Underspecified representations

	i	u	e	o	ɛ	ɔ	a
high	+	+					
low	-	-	-	-	-	-	+
tense					-	-	

With these underspecified representations, the vowels that undergo metaphonic [+high] assimilation are unspecified for the feature [high]. In addition, only the low-mid vowels bear a specification for [-tense]. It's easy to see that assimilation of the feature [+high] renders the underlying vowels /e, o/ non-distinct from their high counterparts /i, u/. For the low-mid vowels, assimilation of [+high] derives the features combination [+high, -tense]. Calabrese argues for a filter, or constraint, that bans this combination of features, observing that such a constraint accounts for the absence of high, lax vowels in the segment inventory of these Romance languages.[3] The illicit feature combination is subject to one of three repair strategies: fission, delinking, or negation. Fission splits the offending features into two distinct bundles, deriving the diphthongal elements [jɛ, wɔ] with a [+high] segment followed by a [-tense] segment. Delinking removes one of the offending features, deriving a [+high] element [i, u], or a [-tense] element [ɛ, ɔ]. In the latter case, the output of the repair procedure is non-distinct from the input to metaphonic assimilation. Negation is a repair that affects both of the offending features, which are converted to the opposite value: [+high, -tense] becomes [-high, +tense], or /e, o/.

I find two problems with this sort of "spread and repair" analysis. [4] First, applying any one of the three repair strategies to the output of assimilation completely undermines the autosegmental analysis of assimilation adopted by Calabrese, because it requires deconstruction of the autosegmental linked structure configuration. The autosegmental theory of assimilation (together with its sister theory of underspecification) is built around the idea that assimilation occurs when a single feature token becomes associated to multiple segments, through the insertion of association lines, as in (5).

(5) Assimilation as multiple association

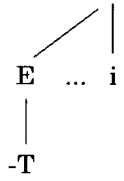


Furthermore, autosegmental theory maintains that in such a multiply-linked configuration, all the elements linked to [+high] must be equally affected by any subsequent rules that target [+high] segments – either all the elements will undergo the rule, or none will

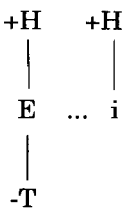
(the "Inalterability Effect" of Hayes 1986, Schein & Steriade 1984). Yet, as Calabrese (this volume) concedes, in cases where a low-mid or low vowel assimilates [+high] and then undergoes one of the repair strategies, only the target vowel, and not the trigger, is affected. For example, consider the application of the Negation repair strategy to an underlying /ɛ/ after [+high] assimilation has taken place. Negation yields the output configuration [-high, +tense], [e], without affecting the height of the triggering suffixal vowel. The only way to achieve this result is to delink the multiply-linked feature, cloning it onto each element individually prior to applying Negation, as in (6).

(6) Spread, Delink, Repair

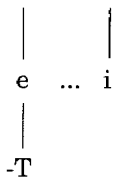
a. Spread



b. Delink and Clone



c. Negation



These steps yield the correct output, but the analysis amounts to an admission that a fundamental prediction of autosegmental theory is false. The linked structure that is the hallmark of the autosegmental analysis is in fact a hindrance to the successful analysis of this system. If linked structures can be deconstructed when the facts dictate, then autosegmental theory makes no predictions at all about the behavior of elements in an assimilation dependency. Facts like these raise questions about the appropriateness of the autosegmental treatment of assimilation (for further discussion see Cole & Kisseberth 1994).

A second problem with the 'spread and repair' analysis concerns the repair strategy of Fission. Under this operation, two conflicting feature specifications, such as [+high] and [-tense], are sequenced over two segments. I question the viability of Fission as a general strategy to overcome feature co-occurrence constraints in systems of assimilation. Feature co-occurrence constraints play an important role in accounting for opaque and transparent segments in harmony systems, as demonstrated in Archangeli & Pulleyblank's (1994) work on Grounded Phonology. For instance, the constraint [+low, +ATR] is responsible for the opacity of low vowels in the ATR harmony systems of many languages, such as Akan (Clements 1981, Archangeli & Pulleyblank 1994). Yet there are no ATR harmony systems in which a low vowel participates in harmony, but then throws off its [+ATR] feature onto an adjacent vocalic segment, through an application of fission to the offending feature structure [+low,+ATR]. That is, there are no reported cases where underlying /a/ undergoes ATR harmony and surfaces as [ia], [æa], or any other diphthongal element with an initial (or final) [+ATR] element.

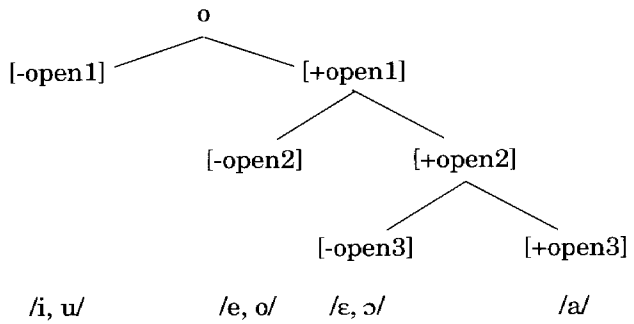
Similarly, although low vowels are opaque in many round harmony systems (eg., Turkish), there are no systems in which low vowels undergo round harmony, only to throw off their [+round] feature onto an adjacent vowel, producing diphthongal [ua], [oa] or even [ɔa]. Under Calabrese's axiomatic approach to repair operations, this striking difference between metaphony and other assimilation systems remains unexplained. We return to the treatment of diphthongization in section 6.3.

We have seen in this section that a theory with binary height features is genuinely challenged to identify a unique assimilating feature as the source for a multi-level, one-step raising of the sort found in some metaphony systems. Additional rules are needed to repair the structures that result from assimilation, which are otherwise predicted to be uniformly [+high]. A possible way out of this dilemma is to abandon the standard analysis of vowel height in terms of the binary features [high], [low], and [tense], adopting instead a feature set which will allow for a more direct expression of one-step raising. The next section reviews one such proposal.

3.2. *Spreading analysis with recursive height features*

Clements (1989) proposes an alternative to the analysis of vowel height in terms of the binary features [high] and [low]. He argues that the vowel space is divided into height categories by a succession of binary divisions. Clements employs a single binary height feature [open], which can appear in a recursive structure such as (7), where each [α open] branch of the feature tree can be further subdivided into [+open] and [-open] branches.

(7) Recursive expansion of [open]



Nibert (to appear) applies Clements' model to the analysis of metaphony in the Servigliano dialect of Italian. Servigliano has the 7-vowel inventory /i, e, ɛ, u, o, ɔ, a/. Metaphony induces a one-step raising of both the high-mid vowels /e, o/ and the low-mid vowels /ɛ, ɔ/. Nibert specifies vowel height features for Servigliano as in (8). Note that this is a center-embedding structure, as opposed to the right-branching structure in (7). The choice between the center-embedding and right-branching analysis of a four-height system depends on the behavior of the mid vowels in an individual language. (7) best represents a system in which the low-mid vowels pattern with the low vowel with respect to vowel height, while (8) is an appropriate specification for languages like Servigliano, in which the low-mid and high-mid vowels pattern together.

(8) A 7-vowel system

	i	u	e	o	ɛ	ɔ	a
open1	-	-	-	-	-	-	+
open2	-	-	+	+	+	+	+
open3	-	-	-	-	+	+	+

Nibert shows that under this analysis of vowel height, the raising of /e, o/ requires assimilation of [-open2] from the triggering vowels. But spreading [-open2] onto /ɛ,ɔ/ yields the feature bundle [-open1, -open2, +open3], which doesn't correspond to any of the available vowel qualities. In order to raise /ɛ, ɔ/ one step to /e, o/ it is the feature [-open3] that must be assimilated. Nibert argues that metaphony can spread either feature, [-open2] or [-open3], subject to structure preservation, which bans the spread of [-open2] onto /ɛ, ɔ/. In fact, a stricter formulation is required to guarantee that [-open2] and not [-open3] spreads onto /e,o/, since spread of [-open3] would be vacuous, and would not accomplish raising. Nibert's rule must be modified to apply disjunctively, spreading [-open2] 'unless' spreading is blocked, in which case [-open3] will spread.

Nibert's approach fares even worse when applied to the analysis of metaphony systems in which the low vowel also participates, undergoing a one-step raising to [ɛ]. In such a system, a different [open] feature would have to assimilate for each of the low, low-mid, and high-mid vowels. Under an assignment of height features as in (8), raising /a/ one step would require the assimilation of [-open1], in addition to the assimilation of the features [-open2] and [-open3] required for the raising of /e, o/ and /ɛ, ɔ/, respectively. Similar results obtain even if the vowel height features are assigned as in (7).

Nibert's application of Clements' model to the analysis of Servigliano metaphony succeeds in generating the correct output. But it does not succeed in delivering a unified analysis of high-mid vowel metaphony and low-mid vowel metaphony. Strictly speaking, the raising of these two sets of vowels is accomplished by distinct rules. The rules may be collapsed into a single rule format through the use of disjunctive notation, but they are nonetheless distinct, since they spread two distinct vowel height features. In fact, Nibert's analysis is formally equivalent to an analysis formulated in terms of the binary features [high] and [tense] (or perhaps [high] and [low]), spreading [+high] onto /e, o/ and [+tense] onto /ɛ, ɔ/. I further note that Nibert's appeal to structure preservation relies on a lexical constraint banning the feature bundle [-open2, +open3] to block spread of [+high] onto the low-mid vowels, which is parallel to Calabrese's reliance on the feature co-occurence constraint [+high,-tense] in his treatment of the low-mid vowels.

Viewed in this light, Nibert's analysis adopting Clements model of vowel height fares no better than Calabrese's analysis, discussed above (or Kaze's, see footnote 2). In both types of analysis, metaphony