

Weak Triggers in Vowel Harmony*

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Abstract

This paper examines vowel harmony initiated by a weak trigger. Height harmony in Veneto Italian dialects, wherein a post-tonic high vowel triggers raising of preceding mid vowels, forms a case study. Veneto presents two variable patterns: stress-targeted harmony, in which harmony propagates to the stressed syllable, and maximal extension harmony, in which raising persists to pretonic vowels. The conditions under which weak vowels trigger and control harmony are examined. It is argued that weak trigger harmony is motivated by perceptual disadvantage: harmony improves exposure of the spreading feature, accomplished either by extending to a stressed position or maximizing duration in the word. The apparent primacy of the vowel quality in weak position in Veneto is accounted for by markedness factors that independently prevent the stressed vowel from overriding it. In regard to positional privilege, it is argued that positional licensing (markedness) drives stress-targeted spreading –positional faithfulness cannot be responsible for strong targets. A weak trigger pattern emerges when licensing constraints operating over perceptually marked structure dominate positional faithfulness. Crosslinguistic applications are also explored.

1. Introduction

The phenomenon of positional privilege in vowel patterns has presented an ongoing challenge for generative phonology. It has stimulated various theoretical proposals and debate, with renewed focus in recent years. An essential testing ground is presented by vowel harmonies that show prosodically based asymmetries. Although many previous studies have centered on harmonies initiated by vowels in privileged positions (e.g. Kaun 1995, Beckman 1997, Majors 1998, Walker 2001a), this paper focuses on the complementary asymmetry-type: harmony controlled by a vowel in a weak position. The two patterns may be contrasted as follows in connection to stress. In Servigliano Italian stressed high vowels trigger regressive raising of preceding mid vowels, as in (1a-b). Observe that the unstressed pretonic high vowel in (1c) does not produce raising (Camilli 1929, Nibert 1998).¹

(1) Servigliano Italian: Stress-triggered harmony

	<u>Nonhigh tonic</u>		<u>High tonic</u>	
a.	verd-ó	‘very green (m sg)’	vird-ú	‘very green (m pl)’
b.	kommonek-á	‘to communicate’	kummunik-ímo	‘we communicate’
c.	predik-á	‘to preach’		

The second pattern is illustrated by the Ascrea dialect spoken in the Lazio region of Italy (Fanti 1938-1940, Maiden 1991). In this harmony, post-tonic high vowels induce raising of a stressed mid vowel, as in (2). Raising propagates only as far as the stressed syllable (2d-e).

(2) Ascrea Italian: Stress-targeted harmony

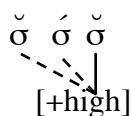
	<u>Nonhigh post-tonic</u>		<u>High post-tonic</u>	
a.	sórda	‘deaf (f sg)’	súrdu	‘deaf (m sg)’
b.	véŕte	‘this (f pl)’	víŕti	‘this (m pl)’
c.	uédóa	‘widow (f sg)’	uíduu	‘widower (m sg)’
d.	metésse	‘reap (1sg impf. subj.)’	metíŕŕi	‘reap (2sg impf. subj.)’
e.	prefónna	‘profound (f sg)’	prefúnnu	‘profound (m sg)’

In awarding the unstressed vowel control of harmony, patterns like that in Ascrea appear to reverse the usual prioritization of strong positions over weak witnessed in asymmetrical systems. As such, they provoke three questions that this paper will address:

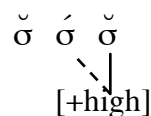
- (3) i. Why do vowels in weak positions trigger harmony?
- ii. Under what circumstances do vowels in weak positions show asymmetrical control?
- iii. In the face of these patterns can previous theoretical approaches to the customary prioritization of strong positions be maintained?

Bearing on these questions is a proposal regarding the functional origins of weak trigger harmony. I argue that vowel harmony like that in (2) has a phonetic motivation: it improves the perceptibility of a height property that is difficult to identify. The difficulty arises from the paucity of cues in an unstressed syllable and the comparative weakness of high vowels. This proposal will be developed here in connection with a case study of height harmony in dialects of Veneto Italian. As Repetti (2000a) points out, the Italian ‘dialects’ are minor Romance language varieties spoken in Italy, standing as sisters to standard Italian. Height harmony in dialects of Veneto Italian is an example of what is traditionally known in Romance as ‘metaphony’, wherein a high post-tonic vowel triggers raising of a stressed mid vowel. In some dialects, lower vowels are also affected. Metaphony patterns occur in many Italian and Spanish dialects (Spanish dialects refer to minor Romance language varieties in Spain). The Ascrea raising in (2) is also a case of metaphony. Veneto, however, presents an intriguing variation. Not only do high post-tonic vowels regularly cause raising of stressed mid vowels, they also may cause raising of pretonic mid vowels. The variable outcomes in Veneto are schematized in (4). In the maximal extension pattern, [+high] spreads from an unstressed vowel to all possible preceding syllables, while in the stress-targeted case [+high] spreading arrests at the stressed syllable.

(4) a. Maximal extension pattern



b. Stress-targeted pattern



The maximal extension pattern mirrors a common result in harmonies controlled by vowels in a

strong position, such as the root-initial syllable: harmony propagates through all possible syllables in the word. Certain – but not all – harmonies of this kind are also suggested to be perceptually motivated. For example, Kaun (1995) argues that round harmony accomplishes the durational extension of a vowel property that is difficult to identify. The upshot is that at least two strategies exist by which perceptually threatened vowel contrasts can be improved in harmony: maximized duration in the word and extension to coincide with a stressed syllable – Veneto calls upon both.

Returning to question (3i) raised above, I argue that vowels in weak positions trigger harmony as motivated by their diminished perceptibility, a perceptual disadvantage that is, at least in part, a positional consequence. In the analysis developed here, I suggest that the grammatical imperative for this kind of harmony consists of formal constraints operating over perceptually weak structure. In the case of stress-targeted harmony, such structure must be licensed by membership in a position of prosodic strength; in the maximal extension result, constraints requiring that weak structure spread throughout the word hold sway.

In Veneto height harmony, the requirement that [+high] in a post-tonic vowel be affiliated with a stressed syllable is resolved by [+high] spreading from the unstressed vowel; however, it could in principle also be satisfied by spreading of [-high] from a stressed syllable to a high unstressed vowel. This is the problem raised by question (3ii). I propose that preservation of the vowel quality in weak position over that of the stressed syllable in Veneto is determined by interactive markedness factors. Specifically, an alternative resolution in which the mid character of the stressed vowel overrides the post-tonic vowel would result in unstressed vowel lowering. This outcome is prevented because it conflicts with a preference for minimized sonority in unstressed syllables in the language. Precedence of the stressed vowel is therefore blocked by avoidance of certain marked structure with control by the weak vowel as the emergent result.

In addition to being triggered by vowels in weak positions, Veneto height harmony is restricted to high vowels, which are inherently perceptually weak. The perceptual disadvantage for unstressed high vowels exists under circumstances of a high/mid contrast. In such cases, there is less opportunity for perception of a distinctive height feature in a high vowel than in a mid one, because

of the high vowel's shorter duration and lower amplitude. Nevertheless, under conditions of neutralization of vowel quality in an unstressed position, high vowels are often unmarked because of their lesser prominence (Crosswhite 1999). As a consequence, other patterns involving unstressed vowels are attested that show resolutions involving neutralization of the mid/high contrast, often accomplished by raising. The broader range of patterns arising from the perceptual difficulty of weak vowels are explored here.

The account is couched in Optimality Theory (Prince and Smolensky 1993). In building upon the notion of ranked and violable constraints, this framework is well-suited to characterize the results for Veneto height harmony and extend them to crosslinguistic considerations. This bears on question (3iii), for which this work arrives at two central findings. First, the role of the stressed syllable in stress-targeted harmony cannot be attributed to positional faithfulness constraints (Beckman 1997, 1998), since the underlying stressed vowel quality is not faithfully preserved. Positional licensing or markedness constraints (Zoll 1996, 1997, 1998), which require the coincidence of marked structure – in this case perceptually marked – with a strong position, are essential to characterize this pattern. Second, despite the lack of activity of positional faithfulness here, this account does not deny the constraints that express the prioritization of strong positions in harmonies issuing from a strong location, such as stressed syllable faithfulness or morphological root faithfulness. Rather such constraints are dominated in the hierarchy with the result that they are not decisive in the patterns under scrutiny.

This paper is organized as follows. In §2 the facts of height harmony in Veneto dialects are laid out. §3 explores the phonetic grounding for such patterns and situates them in the context of other vowel harmonies driven by perceptual weakness. The stress-targeted pattern is shown to expand previous typologies by providing a case where perceptual improvement is accomplished via affiliation with a prosodically strong position rather than maximized extension. §4 centers on the formal analysis of Veneto height harmony. A licensing-based account is developed for the stress-targeted outcome, and a spreading constraint is proposed to be active in cases where maximal extension is observed. The control by the unstressed syllable at the cost of the original stressed

vowel height is also dealt with here. I turn next to matters of empirical breadth: §5 considers metaphony in other Romance dialects, and §6 discusses extensions to other vowel patterns. In §7 I consider two alternative approaches, and §8 presents the conclusion.

2. Metaphony in Central Veneto and Grado

Veneto Italian refers to the group of northern Italian dialects spoken in the Veneto region and the island of Grado. Metaphony is observed only in certain regions of Veneto. It occurs predominantly in the central variety spoken in the contiguous provinces of Padova, Rovigo, and Vicenza and bordering areas of the province of Verona. This is referred to as central Veneto below. In addition, the dialect spoken on the island of Grado, located in the Friuli region, is grouped with the Venetan dialects by many scholars, because it shows close ties with them. The Grado dialect exhibits a robust metaphony like that of central Veneto. Metaphony in Veneto is a phenomenon often associated with “rural” speech; it is not generally found in large cities, such as Venice.

The present study focuses on the aggressive form of metaphony found in the central group and Grado (some speakers show weaker, more variable effects). The data and description for central Veneto are drawn from Rizzi (1989), Belloni (1991), Maiden (1991), Marcato and Ursini (1998) and Brunelli (2000a, b, 2001), as well as the author’s consultation with a native speaker who learned the Venetan dialect near the Vicenza/Verona border. The Grado data are drawn from Ascoli (1898), Battisti (1914), Rohlfs (1966), Cortelazzo (1978), Rosamani (1990), and Maiden (1991). Other work that discusses Veneto metaphony includes Calabrese (1988, 1998) and Kaze (1989).

Venetan dialects have the seven vowel inventory shown in (5), matching that of Standard Italian. Following Calabrese (1988, 1998) I assume that an [ATR] contrast holds within the front and back series of mid vowels and that the three heights notated on the left are determined by combinations of the features [high] and [low]. As in Standard Italian, only five of these vowel qualities surface in unstressed position: /ɛ, ɔ/ raise to [e, o] when unstressed. In final atonic syllables, and other post-tonic inflectional syllables, the inventory is reduced to [i, e, a, o] (Maiden 1991:153).

(5)		<u>Front</u>	<u>Back</u>	
	High	i	u	+ATR
	Mid	e	o	+ATR
		ɛ	ɔ	-ATR
	Low		a	-ATR

The basic metaphony pattern of central Veneto and Grado is as follows: stressed /e, o/ raise to [i, u] when followed by a high vowel. In these dialects, /i/ constitutes the only high suffix vowel; hence it is the only vowel which may trigger alternations. No data were found in which /u/ occurred in a triggering context within a stem, an issue to which I return later in this section.

The data in (6) show raising in central Veneto. As seen here, raising occurs when the trigger is final and the target is in the penultimate syllable or it may take place between a penultimate trigger and antepenultimate target.² Stress typically falls on one of the last three syllables (excluding clitics). In (6k) a final vowel induces raising of a stressed vowel in the antepenult and also an intervening unstressed vowel in the penult, revealing that the initiating trigger and its stressed target are not regularly restricted to adjacent syllables.³ Observe that metaphony does not uniquely affect root vowels; stressed inflectional vowels may also be raised, as in (6b-g). In addition, post-tonic stem vowels in central Veneto are capable of initiating stressed syllable raising (6h, n). Therefore, triggers are not restricted solely to suffix vowels. Forms marked as ‘alternate’ represent alternate pronunciations available for those speakers in the region who show variable metaphony, i.e. speakers who produce both raised and unraised forms.

(6) Central Veneto

	<u>Mid/null post-tonic</u>	<u>High post-tonic</u>	
a.	b[é]v-o	b[í]v-i	‘drink (1sg/2sg)’
b.	g-[é]-va	g-[í]-vi-mo	‘had (3sg/1pl impf. ind)’
	(cf. <i>gavéva</i> , Venezia)	(cf. alternate <i>gévimo</i> , contraction of <i>gavévimo</i>)	
c.	fas-[é]-a	fas-[í]-vi-mo	‘did (1sg/1pl impf. ind)’
		(cf. alternate <i>fasévimo</i>)	
d.		dis-[í]-ino ⁴	‘talked, was talking (1pl impf. ind.)’
		(cf. <i>disévimo</i> occurring elsewhere in the Veneto region,	

Std. Italian: *dicevamo*)

e.	ndas-[í]-i-mo	‘gone, was going (1pl impf. ind.)’	
	(metaphonic raising from <i>ndaséimo</i> ; Rizzi 1989)		
f.	kant-[é]-se	kant-[í]-si-mo	‘sing (1sg/1pl impf. subj.)’
g.	kals-[é]t-o	kals-[í]t-i	‘sock (m sg/pl)’
	(/-et-/ (dim.), lexicalized in this form)		
h.		v[í]ndit-a	‘sale, shop (f sg)’
	(cf. alternate <i>véndita</i>)		
i.	m[ó]v-o	m[ú]v-i	‘move (1sg/2sg)’
j.	sk[ó]lt-o	sk[ú]lt-i	‘listen (1sg/2sg)’
k.	[ó]rden-o	[ú]rdin-i	‘order (1sg/2sg)’
l.	[ó]v-o	[ú]v-i	‘egg (m sg/pl)’
m.	kant[ó]r	kant[ú]r-i	‘choir singer (m sg/pl)’
n.		g[ú]m(b)i-o	‘elbow (m sg)’
	(cf. alternate <i>góm(b)io</i>)		

The data in (7) exemplify stressed vowel raising in Grado. Like central Veneto, raising may affect a stressed penult or antepenult, and an intervening unstressed penult is also raised (7g, o). Raising of an antepenult conditioned by a high penultimate vowel is seen in (7j, p-q). (Compare Grado’s *múniga*, in (7p), vs. central Veneto’s *mónega*.)

(7) Grado

	<u>Mid/null post-tonic</u>	<u>High post-tonic</u>	
a.	m[é]t-o	m[í]t-i	‘put (1sg/2sg)’
b.	r[é]nd-e	r[í]nd-i	‘return (3sg/2sg)’
c.	kr[é]-e	kr[í]-i	‘believe (3sg/2sg)’
d.	v[é]r-o	v[í]r-i	‘true (m sg/pl)’
e.	n[é]gr-o	n[í]gr-i	‘negro (m sg/pl)’
f.	t[é]np-o	t[í]np-i	‘time (m sg/pl)’

g.	[é]nʃen-e	[i]nʃin-i	‘shin (m sg/pl)’
h.	r[ó]mp-o	r[ú]mp-i	‘break (1sg/2sg)’
i.	r[ó]s-o	r[ú]s-i	‘red (m sg/pl)’
j.		s[ú]riʃ-o	‘mouse (m sg)’
			(cf. alternate <i>sòriʃo</i> , Std. Italian: <i>sórcio</i>)
k.	s[ó]rd-o	s[ú]rd-i	‘deaf (m sg/pl)’
l.	t[ó]nd-o	t[ú]nd-i	‘round (m sg/pl)’
m.	fi[ó]r	fi[ú]r-i	‘flower (m sg/pl)’
n.	am[ó]r	am[ú]r-i	‘love (m sg/pl)’
o.	ʃ[ó]ven-e	ʃ[ú]vin-i	‘young man (m sg/pl)’
p.		m[ú]nig-a	‘nun (f sg)’
			(cf. central Veneto: <i>mónega</i> , ⁵ Trieste: <i>mòniga</i> , Std. Italian: <i>mònaca</i>)
q.		t[ú]rbi-o	‘cloudy (m sg)’ ⁶
			(cf. Std. Italian: <i>tórbido</i>)

In the canonical pattern of Romance metaphony, raising extends only as far as the stressed vowel (see, e.g., Maiden 1991), as in the Ascrea dialect in §1. However, in Veneto Italian, it is variable whether pretonic mid vowels raise as well. The variability is observed within and across words and within and across speakers. The data in (8-9) show stress-targeted harmony in which raising terminates at the stressed syllable and mid vowels preceding the stress are unaffected.

(8) Central Veneto

	<u>Mid/null post-tonic</u>	<u>High post-tonic</u>	
a.	b[e]v-é-se	b[e]v-í-si	‘drink (1sg/2sg impf. subj.)’
b.	trasm[é]t-o	trasm[e]t-í-v-i	‘transmit (1sg) / transmitted, was transmitting (2sg impf. ind.)’
c.	b[o]tón	b[o]tún-i	‘button (m sg/pl)’
d.	k[o]ntént-o	k[o]ntént-i	‘contented (m sg/pl)’

(9) Grado

	<u>Mid/null post-tonic</u>	<u>High post-tonic</u>	
a.	b[e]n[e]dét-o	b[e]n[e]dít-i	‘blessed (m sg/pl)’
b.	mist[e]riós-o	mist[e]riús-i	‘mysterious (m sg/pl)’
c.	n[e]vód-o	n[e]vúd-i	‘nephew (m sg/pl)’
d.	p[e]nón	p[e]nún-i	‘trunk of cut tree (m sg/pl)’
e.	t[o]rn-é-v-o	t[o]rn-í-v-i	‘returned, was returning (1sg/2sg impf. ind.)’
f.	m[o]rós-o	m[o]rús-i	‘lover (m sg/pl)’
g.	k[o]ntént-o	k[o]ntínt-i	‘contented (m sg/pl)’
h.	[o]d[o]rós-o	[o]d[o]rús-i	‘odorous (m sg/pl)’
i.	alb[o]r-ét-o	alb[o]r-ít-i	‘tree (m sg/pl dim.)’

By contrast, the data in (10-11) show that the height harmony has the capacity to raise not only the stressed vowel, but also pretonic mid vowels. Observe in (11g) that the raised pretonic mid vowel may be separated from the stressed syllable by an intervening /i/. The pretonic raising is a pattern where maximal extension is operative. Comparison of raised forms in (9f) vs. (11d), which contain the same syllable structure and underlying vowel sequence, suggests that the variable occurrence of pretonic raising does not have a phonological basis. In central Veneto, pretonic /o/ shows a greater tendency to raise than /e/, but variability is nevertheless found with both vowels.

(10) Central Veneto

	<u>Mid/null post-tonic</u>	<u>High post-tonic</u>	
a.	s[e]nt-é-se	s[i]nt-í-si-mo	‘feel, hear (1sg/1pl impf. subj.)’
b.	m[o]v-é-se	m[u]v-í-si	‘move (1sg/2sg impf. subj.)’
c.	k[o]nf[ó]nd-o	k[u]nf[u]nd-í-vi	‘confuse (1sg) / confused, was confusing (2sg impf. ind.)’
d.	t[o]s-ét-o	t[u]s-ít-i	‘kid (m sg/pl dim.)’
e.	arg[o]mént-o	arg[u]mínt-i	‘argument (m sg/pl)’

f.	b[o]tón	b[u]tún-i	‘button (m sg/pl)’
(11)	Grado		
	<u>Mid/null post-tonic</u>	<u>High post-tonic</u>	
a.	d[e]fénd-e	d[i]fínd-i	‘defend (3sg/2sg)’
b.	p[e]ns-é-a	p[i]ns-í-v-i	‘thought, was thinking (3sg/2sg impf. ind.)’
c.	pr[e]sént-e	pr[i]sínt-i	‘present (m sg/pl)’
d.	d[o]lór	d[u]lúr-i	‘sorrow (m sg/pl)’
e.	[o]nór	[u]núr-i	‘honor (m sg/pl)’
f.	m[o]mént-o	m[u]mínt-i	‘moment (m sg/pl)’
g.	g[o]dimént-o	g[u]dimínt-i	‘pleasure (m sg/pl)’

That the variability occurs within individual speakers is confirmed by the author’s consultant on central Venetan and poems by Biagio Marin written in the Grado variety which show both structures, exx: m[u]numínti ‘monument (m pl)’, cf. m[o]numénto (m sg); s[i]ntimínti ‘feeling, sense (m pl)’, cf. s[e]ntiménto (m sg); vs. spl[e]ndúri ‘splendor (m pl)’, cf. Std. Italian *splendori*; rispl[e]ndínti ‘resplendent (m pl)’ cf. Std. Italian *risplendenti* (Marin 1985).

In central Veneto, /a/ blocks metaphony and pretonic raising, as in (12). Ascoli (1898) reports the Grado form: [povaríti] ‘the poor people (dim.)’, in which the absence of pretonic raising is suggestive that /a/ also functions as a blocker in the Grado dialect. No examples were found in the Grado sources where /a/ intervened between post-tonic /i/ and stressed /e, o/.

(12)	Central Veneto		
a.	la(v)ór-a-v-a	la(v)[ó]r-a-v-i	‘worked, was working (1sg/2sg)’
		*la(v)[ú]ravi	
b.	p[o](v)ar-ét-o	p[o](v)ar-ít-i	‘the poor people (dim.)’
		*p[u]varíti	

Although in some Romance dialects, pretonic raising may be initiated by a high stressed vowel (e.g. in Servigliano Italian; see §1), that is not the case in Veneto, as shown in (13-14). Pretonic

vowels are generally affected only under circumstances of raising triggered by a post-tonic unstressed vowel, i.e. in metaphony configurations.⁷

(13) Central Veneto

- | | | | |
|----|--------------|-----------------|-------------------|
| a. | m[o]v-í | ‘move (2pl)’ | cf. m[ú]v-i (2sg) |
| b. | kr[e]d-í | ‘believe (1pl)’ | |
| c. | d[e]slíg-o | ‘untie (1sg)’ | |
| d. | v[o]-í | ‘will (1pl)’ | |
| e. | k[o]lp-ír | ‘to hit’ | |
| f. | [o]b[e]dís-o | ‘I obey (1sg)’ | |

(14) Grado

- | | | |
|----|--------------|-----------------------|
| a. | inv[e]ríd-e | ‘become numb (2pl)’ |
| b. | l[e]vrús-o | ‘young hare (m sg)’ |
| c. | nev[e]rĩ | ‘storm (m sg)’ |
| d. | rev[e]tín | ‘forecourt (m sg)’ |
| e. | sp[o]nt-ít-o | ‘pointed (m sg)’ |
| f. | verd[o]lín | ‘type of bird (m sg)’ |

The data in (15-18) complete the configurations where height harmony does not occur in Veneto. First, as seen in (15-16), the targets are limited to mid [+ATR] vowels only. The [-ATR] vowels /ε, ə, a/ are not affected by a post-tonic high vowel.

(15) Central Veneto

- | | | | |
|----|----------|------------------|---------------------|
| a. | v[é]tʃ-i | ‘old man (m pl)’ | cf. v[é]tʃ-o (m sg) |
| b. | t[ó]k-i | ‘piece (m pl)’ | |
| c. | g[á]t-i | ‘cat (m pl)’ | |

(16) Grado

- | | | | |
|----|----------|-------------------------------|--------------------|
| a. | b[é]l-i | ‘beautiful (m pl)’ | cf. b[é]l-o (m sg) |
| b. | m[ó]rt-i | ‘dead (m pl)’ | |
| c. | st[á]ʒ-i | ‘cellar, storage room (m pl)’ | |

The data in (17-18) confirm that height harmony in Veneto is strictly raising triggered by a high vowel. Nonhigh post-tonic vowels do not affect the height of the stressed vowel:

(17) Central Veneto

- a. fin-[í]-s-o ‘end (1sg)’
- b. sc[ú]r-o ‘dark (m sg)’
- c. fin-[í]-s-a ‘end (3sg pres. subj.)’
- d. b[ú]x-a ‘hole (f sg)’
- e. b[é]v-a ‘drink (1sg pres. subj.)’
- f. g[á]t-o ‘cat (m sg)’

(18) Grado

- a. f[í]dʒ-o ‘child (m sg)’
- b. r[ú]l-o ‘roller (m sg)’
- c. mant[í]n-a ‘morning (f sg)’
- d. man-[ú]s-a ‘hand (f sg dim.)’
- e. mor[ó]s-a ‘lover (f sg)’
- f. gr[á]m-o ‘poor (m sg)’

To summarize, in central Veneto and Grado, post-tonic high vowels cause raising of stressed /e, o/ to [i, u]: this is the stress-targeted harmony pattern. In addition, there is a pattern of maximal extension, i.e. raising of stressed and pretonic [e, o], which occurs only variably.

The above description states that high post-tonic vowels trigger raising. All of the examples show the trigger /i/. As mentioned above, /u/ does not occur in the post-tonic inflectional vowel inventory in Grado and central Veneto. The distribution of /u/ therefore prevents it from triggering metaphonic alternations. While nonfinal post-tonic /u/ might occur in a context to cause metaphony within a stem – absent alternations, no forms with the relevant vocalic configuration were found. Dictionaries containing central Veneto and Grado dialect forms (Rosamani 1990, Brunelli 2000b) were searched for a number of words that are pronounced in Standard Italian with unstressed /u/ situated between a final inflectional vowel and a stressed mid vowel. Since these words are not

common and the [\pm ATR] quality of mid vowels differs for some words in Standard Italian versus the dialects in question, words with mid vowels of either [ATR] quality were checked (e.g. *s[é]rqua*, *tr[é]gua*, *incr[é]dulo*, *m[ó]dulo*). However, no corresponding forms were listed (with raised or unraised stressed vowels). In a database for Venetan dialect forms, El Galepìn (www.veneto.org/language/galepin/galepin.html), there was either no entry for the words in question or they were translated to forms lacking the environment for metaphony (e.g. Std. Italian *[ó]vulo*/cent. Veneto *buíyo*, Std. Italian *s[é]rqua*/cent. Veneto *doxína*, Std. Italian *ing[é]nuo*/cent. Veneto *m[ó]nega*). The generalization that raising is triggered by post-tonic high vowels in general thus appears to hold true, i.e. it is not necessary to stipulate that metaphony is triggered by front high vowels only. Nevertheless, given the relative infrequency in central Veneto and Grado of words that contain post-tonic /i, u/ within the stem preceded by a stressed [+ATR] vowel, it might be the case that some speakers have not fully generalized raising for all words in this nonalternating context. In this eventuality, words without raising could be treated as lexical exceptions, on which see Itô & Mester (1995), Inkelas *et al.* (1997), and Pater (2000).

Before closing this section, let us consider the possible role of morphology in Veneto metaphony. By way of perspective, Dyck (1995:10) observes the label ‘metaphony’ has been applied to various phenomena, including ‘a) an incipient phonetic process, b) historic residue, and c) a productive, synchronic process’. It is the latter with which we are concerned here. In many Italian dialects, such productive metaphonic processes are restricted to specific morphological categories. Maiden (1991) addresses this issue, arguing that phonetic/phonological and morphological conditioning are simultaneously operative in metaphonic patterns which occur with only certain morphological structures containing post-tonic high vowels. With respect to phonological conditioning, a substantial base of theoretical work agrees that productive, synchronic metaphony phenomena in Italian dialects are assimilatory in nature (see, e.g., crosslinguistic studies by Calabrese 1988, 1998, Kaze 1989, 1991 and Dyck 1995).

Maiden (1991) observes that for dialects in which /i/ is the only post-tonic high vowel, metaphony is most commonly witnessed within the verbal conjugation in the second person

inflectional forms that contain /i/. In the declensional system, metaphony occurs in the structures marked with an /-i/ suffix: these are the masculine plural and the plural of ‘class 2’ forms that do not formally distinguish gender marking. (Such forms have the suffix [-e] in the singular and [-i] in the plural.) In Veneto, metaphony is clearly productive across these structures, i.e. in the plural nominal and adjectival inflections and the second person verbal inflections when the suffix contains an unstressed high vowel. There are no other number/gender suffixes in the declensional system of Veneto that contain a high vowel. However, Grado and central Veneto nominal forms show that a stem vowel is capable of producing raising (see 6h, n, 7j, p-q). Furthermore, as seen in the central Veneto forms in (6b-f, 10a), the one additional suffix group within the regular verbal conjugation that presents a potential environment for metaphony – the first person plural inflections that contain post-tonic high vowels – is also capable of triggering raising. This indicates that aggressive Veneto metaphony is not limited solely to inflections with which metaphony is traditionally associated. Indeed, it may apply regardless of the trigger’s stem/suffix status. Nevertheless, Maiden (1991) and others have argued that a treatment in sound structure is also warranted for those dialects in which metaphony is productive in certain categories only. See Maiden (1991) for discussion of the additional morphological conditioning for those varieties that display such restrictions. I return to the issue of morphological conditioning in the context of Lena Spanish metaphony in §5.

3. Situating Veneto Height Harmony in the Typology of Vowel Harmony

3.1 Phonetic Grounding

A central claim of this work is that the functional origins of Veneto metaphony lie in improving the perceptibility of a distinctive height property which is perceptually difficult. The nature of the perceptual disadvantage is detailed below in this section. Metaphony accomplishes improved perceptibility by extending the height feature to overlap multiple syllables, including the stressed syllable. In the proposal developed here, the phonetic motivation does not represent an intention on the speaker’s part but rather it exerts influence on language change and shapes certain synchronic phonological processes through phonetically-grounded constraints. The notion that metaphony has

a perceptual grounding connects to research on certain vowel harmonies involving maximal extension for which it is argued that perceptual difficulty of the spreading feature drives harmony. Kaun (1995, to appear) elaborates this approach for round harmony. Additional work includes Suomi (1983) on palatal harmony, Steriade (1994, 1995) on nonperipheral harmony, and Jiménez (1998) on RTR dependent color systems in Valencian Catalan (note also Flemming 1995). Stress-targeted height harmony, such as that in Veneto, augments previous typologies of vowel harmony driven by perceptual weakness in two ways: it provides a case where (i) the trigger must asymmetrically belong to a prosodically weak position, and (ii) the improvement is achieved by membership in a prosodically strong syllable rather than maximal duration.

Let us turn to the evidence that metaphonic height assimilation is grounded in improving perceptual weakness. Consider first the character of the triggers. These are unstressed high vowels, which present a perceptibility problem inherent to their featural composition. High vowels are well known to be lower in amplitude than other vowels. In addition, they tend to be shorter in duration than nonhigh vowels (e.g. Meyer 1903, House and Fairbanks 1953, Wells 1962), although most experimental studies on this point thus far have centered on English. Metaphonic triggers are also disadvantaged prosodically. (See Majors 1998 for some related observations.) They reside in an unstressed syllable, a site of diminished prominence. It has been established that unstressed vowels in Italian are shorter than their stressed counterparts (D'Imperio and Rosenthal 1999). Furthermore, unstressed syllables tend to be reduced in amplitude, and they lack a salient pitch contour. Post-tonic syllables also show evidence of phonological weakness which exceeds that of pretonic syllables in Italian dialects, as will be discussed in §4.1.1.

The comparative weakness of unstressed vowels in general gave rise to various neutralizing processes that occurred in Italian's historical development. For example, the contrast between /ɛ, ɔ/ vs. /e, o/ in Latin (often described as a length contrast) was one of several diachronic neutralizations that took place in unstressed position in Italian (Grandgent 1927). In the present day language, this neutralization produces alternations under stress shift. In addition, deletion of medial unstressed vowels was common (see §6). In cases where intertonic unstressed vowels were retained, their

quality was often neutralized via reduction to [i] (but [e] before [r]; Grandgent 1927:55). These historical changes serve to minimize the occurrence of vocalic contrasts when expressed solely in unstressed position. It falls to the grammar to determine which particular changes or alternations that accomplish this take place. Metaphony also achieves this outcome, but with the effect of favoring the contrast that originated in the unstressed syllable. It improves exposure for the unstressed vowel height feature as follows. In extending to the stressed syllable, the feature becomes affiliated with a vocalic position that has increased duration and increased amplitude. Duration of the feature is also increased by its continuation across more than one syllable.

A crosslinguistic implicational hierarchy lends support to a perceptual motivation. Maiden (1987, 1991) observes that if closed stressed syllables are targeted in metaphony, open syllables are too. Italian vowels are documented to be longer in open syllables than in closed ones (Maiden 1991, D'Imperio and Rosenthal 1999, D'Imperio 2000). I interpret the implicational hierarchy as signaling that metaphony phenomena are sensitive to the relative degrees of perceptual exposure that different structures will accomplish. In some metaphony patterns, the range of prosodic targets may be narrowed to seek only those that achieve exposure above a minimum threshold.⁸

Another consideration concerns the contrastiveness of the spreading feature. In her study of round harmony, Kaun (1995:vii) points out that 'harmony serves to extend the duration of phonetic information which is phonologically important (i.e. distinctive), but which is transmitted by means of relatively subtle acoustic cues'. The singular activity of distinctive properties in harmony is demonstrated in certain cases of metaphony. Vowels for which [+high] is a distinctive feature are seen to asymmetrically trigger harmony, while high vowels that are not contrastively so may remain inactive. Dyck (1995) makes this point. A key finding of her crossdialectal and crosslinguistic study of metaphony is that phonetically high vowels trigger metaphony only under circumstances of a high/mid contrast in suffixes.

Consider the vowel inventory in (19) for inflections (desinences) in the metaphonizing Lena and Aller dialects of the central Asturias region of Spain (Dyck 1995:50-52). The underlying inventory in (19a) contains a mid front vowel phoneme but lacks a robust high front counterpart. As depicted

in (19b), the phoneme /e/ is resultingly realized with a range of vowel qualities from [i] to [e]. On the other hand, a genuine contrast exists between the high and mid back vowels /u/ and /o/. The present-day inventory structure resulted from a neutralization of a weak contrast between /i/ and /e/. (Dyck 1995:50 notes that archaic /i/ desinences exist, which are of marginal status.) On a comparative note, Ibero-Romance presented fewer instances of final unstressed /i/ than Italo-Romance, because it utilized different formations for nominal plurals and verbal 2sg forms. On the other hand, Asturian maintained the contrast between final unstressed /u/ vs /o/, which was lost in Standard Spanish and Standard Italian (Neira 1991).

(19)	a. Underlying desinential vowels	b. Phonetic realization												
	<table style="border: none;"> <tr> <td style="padding-right: 20px;">e</td> <td style="text-align: center;">u</td> </tr> <tr> <td></td> <td style="text-align: center;">o</td> </tr> <tr> <td style="padding-left: 20px;">a</td> <td></td> </tr> </table>	e	u		o	a		<table style="border: none;"> <tr> <td style="border: 1px solid black; padding: 2px 5px;">i/e</td> <td style="text-align: center;">u</td> </tr> <tr> <td></td> <td style="text-align: center;">o</td> </tr> <tr> <td style="padding-left: 20px;">a</td> <td></td> </tr> </table>	i/e	u		o	a	
e	u													
	o													
a														
i/e	u													
	o													
a														

Significantly, only the high back vowel triggers metaphony in the Lena and Aller dialects. Even when realized as high, the front vowel remains strictly inert with respect to initiating raising. Interpreted in the light of Kaun’s observation, the perceptibility of [+high] in /u/ is uniquely promoted because it is distinctive in this segment. Critical to this insight is Dyck’s (1995) treatment of contrasts relativized to their position, i.e. the dialects in question have a phoneme inventory for stems and a reduced one for inflections.⁹

Dyck (1995) argues that a mirror-image example occurs in Calvello Italian, a Lucanian dialect. Dyck posits an underlying desinential inventory of /i, e, a, (o), (u)/, where the u/o contrast is obsolete (cf. Kaze 1989). Word-final unstressed vowels are reduced to schwa; however, alternations support an underlying inventory consisting of four full vowels. Dyck argues that while /i/ triggers phonological metaphony, the underlying vowel that is sometimes phonetically realized as [u] does not. Again, the contrastive [+high] specification is the one that instigates raising.¹⁰

In sum, the evidence surveyed above supports a functional basis for metaphony in improving perceptibility of height features. Under this view, in Veneto, part of the burden for recognizing the quality of a post-tonic high vowel is extended to the stressed vowel. This shows some parallels to cases of displacement of a phonological contrast. A vowel length alternation in Friulian, a Romance

variety of northeastern Italy, presents an example. As discussed by Hualde (1990), a vowel length distinction that appears in final stressed syllables closed by an obstruent corresponds to an underlying voicing contrast in obstruents, which is neutralized in final position. (See also Baroni and Vanelli 2000.) The data in (20a) show that vowels which are long before a final devoiced obstruent are short in other contexts. As seen in (20b), stressed vowels before final obstruents that are underlyingly voiceless do not show a length alternation with their counterparts in other contexts.

(20) Friulian

a.	ló:f	lóve	‘wolf (m/f)’
	rú:t	rúde	‘pure (m/f)’
	bonorí:f	bonoríve	‘early-rising (m/f)’
	skorsá:t	skorsáde	‘chased away (m/f)’
	lá:k	lagúne	‘lake/lagoon’
	ná:f	navigá	‘ship/to navigate’
b.	skrít	skríte	‘written (m/f)’
	zgardúf	sgardufá:	‘bun/to roll up’
	pák	pakút	‘package/small package’

In addition, in the context of voicing neutralization, vowel length has the capacity to distinguish words: exx. [ká:s] ‘case (m)’ vs. [kás] ‘bodice (m)’.

In historical terms, Hualde argues that the following evolution took place in Friulian: [CV́T] vs. [CV́D] > [CV́T] vs. [CV́:D] > [CV́T] vs. [CV́:T], i.e. lengthening of a stressed vowel before a final voiced obstruent occurred then devoicing of word-final obstruents. Hence, the voicing contrast that existed between final obstruents shifted to vowel length. As the synchronic alternations show, the contrast shift is also active in the present day language, analyzed by Hualde as a kind of compensatory lengthening process triggered by devoicing (cf. Baroni and Vanelli 2000, Lubowicz 2003). Like Veneto metaphony, this process results in the expression of a contrast in a site other than where it originated. In Veneto the contrast remains in its original location as well, where it is weakly perceptible, while in Friulian, the contrast is neutralized in its originating position.

The Francavilla Fontana Italian dialect that Calabrese (1985, 1988) calls northern Salentino presents a case where metaphony has developed into a synchronic shift of height contrast from one site to another. In this dialect, underlying high vowels trigger metaphony but mid vowels that are regularly raised to high in unstressed syllables do not (Calabrese 1985), exx. /pareti/ → [paríti], but /parete/ → [paréti] ‘wall (pl/sg)’; /creti/ → [críti], but /crete/ → [créti] ‘believe (2sg/3sg)’. This interaction between metaphony and vowel reduction could be analyzed as a case of phonological opacity, as Calabrese proposes.¹¹ A treatment of this kind is likewise applicable for cases of phonological metaphony in dialects that neutralize unstressed vowels to schwa but show stressed vowel raising before the schwas deriving from high vowels (Maiden 1991). For serial approaches to surface [ə] patterns in which metaphony is triggered by an underlying high vowel with subsequent reduction, see Calabrese (1985), Kaze (1989, 1991), and Dyck (1995).

3.2 The Typology of Harmony Driven by Perceptually Weak Triggers

Metaphony adds a new category to the typology of vowel harmony motivated by perceptual weakness of the trigger. Consider the typological breakdown in (21).

(21) Vowel harmony motivated by perceptual weakness of trigger

i. Maximal extension patterns

- a. Round harmony, e.g. in Altaic languages (Kaun 1995).
- b. Palatal harmony, e.g. in Uralic and Altaic languages (Suomi 1983).
- c. Color harmony (RTR dependent) in Valencian Catalan (Jiménez 1998).¹²
- d. Centralizing harmony in Pasiego Spanish (Penny 1969, McCarthy 1984,

Hualde 1989)

- e. Nonperipheral harmony, e.g. in Lamba (Steriade 1995).¹³

- f. Height harmony in Veneto (variable pattern).

ii. Stress-targeted patterns

- a. Canonical pattern of metaphony (height harmony) in Romance, e.g. in Ascrea Italian (Fanti 1938-1940), Pasiego Spanish (Penny 1969, Hualde 1989, cf. McCarthy

1984).

b. Height harmony in Veneto (variable pattern).

The Veneto pattern of pretonic raising adds a height-raising harmony to the other well-established cases of maximal extension harmony. Among the examples in this category, Veneto is the only one for which the position of the trigger vowel is regularly weak, namely, an unstressed syllable (usually an affix). The typical cases of round and palatal harmony are controlled by a root syllable, usually root-initial, a position widely recognized as privileged (Steriade 1994, Kaun 1995, Beckman 1997). Often, but not always, these syllables are stressed in such languages. The trigger in Valencian Catalan is a stressed vowel, and in Lamba, it is a root or stem vowel.

A raising harmony in Pasiego Spanish shows some apparent similarities to the Veneto maximal extension pattern. Metaphony raises stressed mid vowels in the context of a final high vowel, ex. /kesu/ → [kÍsU] ‘cheese’ (capital letters symbolize centralized vowels).¹⁴ Of interest is that raising persists to mid vowels that precede the stress, as in /el korderu/ → [Il kUrdÍrU] ‘the lamb’ (Penny 1969, Hualde 1989). However, Hualde argues that the process of pretonic vowel raising is independent from metaphony in the language; it is triggered by stressed vowels. This is supported by the occurrence of pretonic vowel raising in the absence of metaphony, ex. [koxeré] / [kuxiría] ‘I will/would take’ (contrast Veneto examples in (13-14)).¹⁵

The stress-targeted cases in (21) constitute a second, new category in the typology. Ascrea Italian and Pasiego Spanish are examples of the canonical Romance metaphony pattern, and the Veneto raising that terminates at the stressed syllable also falls under this classification. Nevertheless, the range of vocalic patterns involving a weak trigger and strong target are not limited to metaphony alone; some further cases are outlined in §6. The maximal extension patterns and the stress-targeted patterns share a common result: they improve exposure of a perceptually threatened property. However, they differ in their emphasis of resolution. The former pattern-type maximizes duration of the property in the word, without singling out a positional target, while the latter extends the property to a position that is particularly favorable for augmenting perceptibility.

Vowel harmony motivated by perceptual weakness of the trigger does not exhaust the range of

patterns. The larger typology of vowel harmony encompasses cases whose origin, historically or synchronically, is suggested to lie in coarticulation, i.e. the aim of maximizing vowel-to-vowel coarticulation in the word and/or the perceptual result of vowel-to-vowel coarticulatory overlap (Majors 1998, Beddor *et al.* 2001, Beddor *et al.* 2002; note also Boyce 1988, Ohala 1994, Steriade 1994, Manuel 1999, Kaun to appear). Patterns rooted in perceptual weakness of the trigger will be identifiable by an asymmetry: perceptually difficult vowels will initiate harmony but not perceptually strong ones. On the other hand, harmonies that are asymmetrically triggered by vowels in a position of prosodic strength – i.e. where the relevant feature(s) are contrastive in both prosodically strong and prosodically weak positions, but only the prosodically strong vowels initiate harmony – cannot be attributed to a perceptual threat. Majors (1998) argues that coarticulatory influence from the stressed syllable is the operative factor in such cases.

Still other harmonies show no trigger asymmetry or sensitivity to prosody: both principles of coarticulation and perceptual extension may be active here. In this regard, it is important to note that improvements along the lines of coarticulation or perceptibility are by no means mutually exclusive (for related observations see Cole and Kisseberth 1994, Steriade 1994). Coarticulatory motivated harmony also accomplishes durational extension, and harmony motivated by perceptual weakness of the trigger also achieves vowel-to-vowel coarticulation across a sequence of syllables. The chief motivation in many instances can nevertheless be distinguished.

In Romance metaphony, coarticulatory effects might play a minor role. A study of Italian /VtV/ sequences by Farnetani *et al.* (1985:97-98) finds that from among [i, a, u], the vowel [i] has the strongest vowel-to-vowel coarticulatory influence. Crosslinguistically [i] also tends to show the weakest coarticulatory effects from other vowels (Beddor *et al.* 2001, Beddor *et al.* 2002, and citations therein). These special coarticulatory properties of [i] might be a contributing factor in its tendency to participate in triggering metaphony; however, they cannot be the principal motivation for metaphony patterns. First, in numerous dialects [u] also triggers metaphony (e.g. Ascrea in (2)), and in the Lena and Aller dialects, [u] is the only trigger (see (19)). Second, a hallmark of metaphony is that the trigger is unstressed. It has been shown that unstressed vowels undergo more

vowel-to-vowel coarticulation than stressed ones, and this has been demonstrated to hold of the vowel /i/ (see Majors 1998 and references therein). Hence a coarticulatory driven harmony should not single out unstressed (high) vowels as triggers. On the other hand, a perceptually driven view of metaphony predicts there will not be a harmony triggered by unstressed vowels in which low /a/, a vowel with comparatively strong perceptual cues, initiates harmony, while /i, u/ do not.¹⁶ This is true of Romance and also appears consistent with the wider range of weak-trigger patterns across languages, as discussed in §5 and §6.

4. Analysis of Veneto Metaphony

I interpret the phonetic factors described in the previous section as supplying the functional origins and motivation for the formal phonological constraints that drive vowel harmony. I assume a model of phonology that includes constraints informed by phonetic factors but that stands apart from phonetics as an autonomous grammatical component. This model corresponds to that described by Howe and Pulleyblank (2001), and it is implicit in a range of research on phonetically grounded phonology building upon proposals by Archangeli and Pulleyblank (1994). I turn now to developing a formal analysis of height harmony in Veneto, incorporating its basis in perceptual difficulty. The account is formalized in the framework of Optimality Theory (OT; Prince and Smolensky 1993). (On modeling functional grounding within CON, the set of universal constraints, see Hayes 1999 and Smith 2002). In this section, I focus chiefly on height harmony that terminates at the stressed syllable. This pattern receives attention since it is new within the typology of harmony driven by perceptual weakness of the trigger. The maximal extension pattern is addressed subsequently, but in less detail, along with the variation that exists between these patterns.

4.1 The Stress-targeted Pattern

4.1.1 The Imperative for Stress-targeted Harmony

I propose that the grammatical need for perceptually marked structure to have membership in a prosodically strong position is instantiated in terms of positional licensing constraints, also known

as positional markedness constraints. I begin by introducing the statement of licensing and then go on to motivate this particular approach for stress-targeted harmony in Veneto.

The general schema for prosodic licensing constraints grounded in perceptual weakness is given in (22) (adapted from Zoll 1996, 1998, Walker 2001b):¹⁷

(22) LICENSE(F, S-Pos): ‘Feature [F] is licensed by association to strong position S.’

- Let:
- i. f be an occurrence of feature [F] in an output O (optional restrictions: (a) f is limited to a specification that is perceptually difficult, (b) f belongs to a prosodically weak position, (c) f occurs in a perceptually difficult feature combination),
 - ii. s be a structural element (e.g. σ , μ , segment root) belonging to perceptually strong position S in O,
 - iii. and $s\delta f$ mean that s dominates f .

Then $(\forall f) (\exists s)[s\delta f]$.

Simply put, LICENSE(F, S-Pos) requires that a feature be affiliated with a perceptually strong position. Licensing constraints of this type may specifically operate over features that are inherently perceptually difficult (e.g. [+high]), that belong to prosodically weak positions (e.g. unstressed), or that occur in combination with another feature that renders it perceptually subtle. An example of the latter is [Round] in [-high] vowels, which requires licensing by association to the strong root-initial syllable in Classical Mongolian (Walker 2001a, see also Kaun 1995). Also, in some Romance dialects certain features in high vowels besides [+high] alone require licensing by association with a stressed syllable, as discussed in later sections. The increased salience of a stressed syllable qualifies it as a perceptually strong position, and hence as a potential licensor (for wider ranging discussion of the basis for linguistic positional privilege, see Steriade 1994, 1995, Beckman 1997, 1998, Zoll 1996, 1997, Alber 2001, Smith 2002, among others).

The particular constraint needed for stress-targeted height harmony in Veneto is as follows:

(23) LICENSE([+high]_{post-tonic}, $\acute{\sigma}$):

[+high] in a post-tonic syllable must be associated with a stressed syllable.

A licensing constraint operating over [+high] only will serve our purposes for Veneto. A unified

treatment encompassing Veneto together with those Italian and Spanish dialects which require licensing of additional height features is outlined in §5. Although we have seen that the contrastive status of the feature can impact its need to be licensed, this will not be crucial in the case of Veneto. I return to the the issue of contrastivity in §8.

The assessment of the licensing constraint in relation to two structures is considered in (24). It is obeyed in (24a), because [+high] in a post-tonic syllable also has an association to a stressed syllable. On the other hand, licensing for [+high] is violated in (24b). Observe that under this formulation of licensing, the feature [+high] must actually be multiply linked across the trigger and target syllables.

- | | |
|--|---|
| (24) a. Licensing: satisfied | b. Licensing: violated |
| $\begin{array}{c} b \acute{i} v i \\ \swarrow \searrow \\ [+high] \end{array}$ | $\begin{array}{c} b \acute{e} v i \\ \quad \\ [-high][+high] \end{array}$ |

The post-tonic condition in (23) is plausibly a restriction of type (b) in (22i). Its underpinnings lie in work by Maiden (1995), who argues that post-tonic syllables compose a prosodic domain in Italian dialects. Evidence points to post-tonic syllables being the phonologically weakest positions in this group. Significantly, post-tonic vowels participate in various neutralizing and/or effacing phenomena to the exclusion of stressed and pretonic syllables. Examples of processes which affect post-tonic vowels only include vowel reduction in Southern Lucanian, vowel neutralization in the Lazio dialect of Sant’ Oreste, vowel (and consonant) deletion in central Italian vocatives, and vowel copy harmony in Servigliano Italian. Furthermore, in northern Salentino, rounding and backness harmony operates strictly among post-tonic vowels (Sluyters 1988). It is conceivable that the separate patterning of post-tonic syllables in Italian has a basis in phonetic weakness that stands in contrast to pretonic syllables. This kind of correlation has been identified elsewhere in Romance. Crosswhite (1999, to appear) discusses a relation between ‘extreme’ vowel reduction in post-tonic syllables of Brazilian Portuguese and shorter syllable duration in this context. (Crosswhite analyzes the post-tonic syllables in phonological terms as containing nonmoraic vowels.) Whether asymmetries in post-tonic vs. pretonic syllables in Italian dialects have a similar grounding or are

rooted in more abstract constructs remains for further research.

An alternative imaginable restriction to consider for [+high] in the licensing constraint is that it belong to a suffix. A suffix restriction is simply not tenable for Veneto, in which stem vowels are capable of triggering metaphony (exx. central Veneto: [gúmbio] ‘elbow, (m sg)’, Grado: [múniga] ‘nun (f sg)’). Even apart from these data, it is not a satisfactory substitute for the post-tonic domain in Italian dialects on both explanatory grounds and crossdialectal considerations. The first point of comparison goes to the licensing constraint’s phonetic motivation. Post-tonic syllables are unstressed; hence, vowels in these positions show a regular paucity of perceptual cues. By way of contrast, suffix syllables in Italian dialects may be either unstressed or stressed, and thereby lack a uniform prosodic weakness (exx. central Veneto: [mov-í] ‘move (2pl)’ vs. [gát-i] ‘cat (m pl)’). Although suffixes as a class qualify as morphologically weak, it does not generalize that morphological dependents fail to license [+high]. Stressed vowels – whether they belong to a root or an affix – serve as the target of height harmony (exx. Grado: /met-i/ → [míti] ‘put (2sg)’, /albor-et-i/ → [alboríti] ‘tree (m pl dim.)’). Furthermore, from a crossdialectal viewpoint, the post-tonic domain cannot be equated with suffix material for the phenomena that Maiden (1995) discusses. In Servigliano some suffixes are stressed and some post-tonic syllables contain stem vowels (Nibert 1998). Nevertheless, vowel copy harmony operates strictly in post-tonic syllables, regardless of their morphological affiliation. Another approach in which the post-tonic restriction is replaced by a condition limiting harmony to a metrical foot also presents drawbacks, as will be discussed in §7.

A pivotal claim of this research is that the licensing approach is not only successful but also crucial to characterize strong targets in harmony. An alternative positional faithfulness analysis proves an inadequate substitute (see also Majors 1998, Zoll 1998, Walker 2001b). The kind of positional faithfulness constraint that would be expected for harmony sensitive to a stressed syllable is given in (25) (Beckman 1998, Majors 1998):

(25) IDENT- $\acute{\sigma}$ -IO(high)

A segment in a stressed syllable in the output and its correspondent in the input must have identical specifications for [high].

The constraint in (25) cannot characterize stressed syllables as the target of spreading because stressed syllables in this role are potentially unfaithful. In order to illustrate this point, let us suppose that a spreading constraint for [+high] were driving height harmony, and it were ranked in between IDENT- \acute{o} -IO(high) and its nonpositional counterpart, as in (26). The input considered here is /bev-i/. Candidate (a) is the attested form, but it is not selected by this constraint hierarchy because the stressed vowel is unfaithful. The faithful candidate, in (b), or the candidate with spreading from the stressed vowel to the affix, in (c), are both more harmonic with respect to positional faith. With this particular ranking, candidate (c) is predicted to be optimal – the wrong result for Veneto. Importantly, no re-ranking of this constraint set will select (a). This is indicative that positional faith cannot be what underlies the special status of stressed syllables in metaphony.

(26) Positional faithfulness is inadequate for strong target positions

‘☞’ marks attested form, ‘☹’ marks form wrongly selected by tableau.

/bev-i/	IDENT- \acute{o} (high)	SPREAD(+high)	IDENT(high)
a. ☞ bívi	*!		*
b. bévi		*!	
c. ☹ béve			*

Although positional faithfulness does not assist in characterizing stressed syllable targets, this does not stand as evidence against a role for prosodically determined positional faithfulness within phonological theory. The activity of positional faithfulness sensitive to prosodic prominence is well-documented (e.g. Beckman 1998, Féry 1998, Majors 1998, Lombardi 1999, Curtin 2001). In vowel harmony initiated by a position of prosodic advantage, positional faithfulness constraints are often essential to characterize the trigger. Furthermore, several analyses that utilize positional licensing/markedness constraints also call upon some kind of positional faith, either prosodically determined (Walker 2001c) or morphologically sensitive (Ringen and Vago 1998, Zoll 1998, Balassa 2000). The metaphony case contributes to defining the scope of phenomena whose roots lie in positional markedness in contrast to positional faithfulness.


4.1.2 The Licensing Account

I turn now to the rankings for stress-targeted harmony in Veneto. Recall the principal

phenomenon: post-tonic high vowels cause raising of /e, o/ to [i, u] in stressed syllables, exx. central Veneto: /bev-i/ → [bívi] ‘drink (2sg)’, Grado: /moros-i/ → [morúsi] ‘lover (m pl)’.


The first aspect of the harmony to be addressed is that licensing for [+high] produces alternations in the stressed syllable. This is indicative that the licensing constraint outranks the stressed syllable faithfulness constraint in (25), and also nonpositional IDENT-IO(high), which demands that correspondent segments (in any position) have identical specifications for [high] (McCarthy and Prince 1995). The ranking is exemplified in (27). Candidate (a), which licenses [+high] of the final vowel is selected over the faithful candidate in (b), in which there is no height harmony. (The sub-optimality of another candidate [béve] is addressed presently below.)

(27) LIC(+high) >> IDENT-ó-IO(high), IDENT-IO(high)

/bev-i/	LIC(+high)	IDENT-ó(high)	IDENT(high)
a.  bívi		*	*
b. bévi	*!		

The next point for the analysis is that harmony terminates at the stressed syllable. This follows from the licensing approach, as shown in (28). The optimal output, in (a), spreads [+high] only as far as the stressed syllable, satisfying the licensing constraint. The alternative in (b), which spreads to the pretonic syllable as well, also satisfies licensing, but it incurs a gratuitous faithfulness violation. Candidate (c), in which [+high] fails to spread at all, is ruled out by a licensing violation.

(28) Pretonic vowels are not affected

/moros-i/	LIC(+high)	IDENT-ó(high)	IDENT(high)
a.  morúsi		*	*
b. murúsi		*	**!
c. morósi	*!		

Next let us focus on the problem of why stressed vowel raising occurs rather than unstressed vowel lowering. As will be spelled out below, I propose that this is a consequence of avoidance of the marked structure that would result from unstressed vowel lowering.

The ranking thus far is silent on which vowel controls assimilation, i.e. whether satisfaction of licensing is accomplished by spreading from the stressed vowel or the unstressed one. If the decision were to fall to morphologically based faithfulness, lowering of an unstressed affix vowel

would generally be predicted more harmonic, given the plausibly universal ranking of root faith over affix faith (McCarthy and Prince 1994). This is illustrated in (29). Candidates (a) and (b) both obey licensing but differ in the vowel that controls spreading. If IDENT-IO(high)_{root} >> IDENT-IO(high)_{affix} were decisive in the Veneto forms, then (b) would incorrectly be predicted optimal.

(29) LIC(+high) >> IDENT-IO(high)_{Rt} >> IDENT-IO(high)_{Af}

/bev-i/	LIC(+high)	IDENT(high) _{Rt}	IDENT(high) _{Af}
a. ☞ bívi		*!	
b. ☹ béve			*
c. bévi	*!		

This problem could conceivably be resolved by ranking affix faithfulness over root faithfulness for [high] in Veneto. However, since affix-to-affix metaphony also occurs as well as stem vowel-to-stem vowel metaphony, this move would not regularly restrict control to the unstressed vowel. In addition, the implications of ranking affix faith over root faith are undesirable on crosslinguistic and functional grounds. Extensive crosslinguistic evidence supports the universal prioritization of root faith (McCarthy and Prince 1994, Urbanczyk 1996, Beckman 1997, Alderete 2001, among others). Furthermore, from a functional perspective, the fixed ranking expresses the widely accepted generalization that lexical content is more essential than inflection.¹⁸

From the wider consideration of lexical recoverability, it is worth questioning whether metaphony in Veneto truly has the capacity to override distinctions between roots. The central Veneto verbs in (30), distinguished exclusively by a mid/high contrast in the stressed vowel, verify this is indeed the case: metaphony neutralizes the lexical contrast.

- (30) a. ségar ‘to mow (wheat)’
 ség-o / te seg-i → [sígi] ‘mow (1sg/2sg)’
 b. sígar ‘to shout, to cry out’
 síg-o / te síg-i ‘shout, cry out (1sg/2sg)’

Another possibility to consider is whether the cases of affix control could be achieved by avoidance of inflectional merger, i.e. whether affix vowel lowering would regularly neutralize with another inflection. This conjecture is not borne out: metaphony occurs even in those cases for

which suffix lowering would not produce neutralization in the paradigm, as shown by the central Veneto forms in (31).

- (31) a. /mov-e-v-i/ → [muvívi] ‘moved, was moving (2sg impf. ind.)’ *movéve
 (No -e-v-e imperfective structure)
- b. /fas-i-vi-mo/ → [fasívimo] ‘did (1pl impf. ind.)’ *fasévemo
 (No -e-ve-mo imperfective structure)

Two other imaginable approaches can also be dismissed. First, positional faithfulness constraints have been effectively employed to characterize vowel harmony triggers that regularly occur in strong positions; however, that approach is not applicable here. While word-final syllables might be attributed a special status by virtue of their edge status (see §4.2), nonfinal post-tonic syllables are not a privileged position. Nevertheless, vowels in both positions are capable of triggering harmony (exx. central Veneto: [bívi] ‘drink (2sg)’, [gívimo] ‘had (1pl impf. ind.)’). An alternative that stipulates regressive spreading of [+high] also fails. A constraint such as SPREAD(+high)-Left evaluates output configurations only. Hence it will fail to discriminate between candidates (29a) [bívi] and (29b) [béve]. In (29a), left-spreading is satisfied via [+high] linking to all vowels, while in (29b) it is vacuously obeyed.

The proposal I will advocate employs a rather different strategy: unstressed high vowels control harmony as an epiphenomenon of general constraints on phonological well-formedness in the system. The specific well-formedness constraints relevant here are those mandating prominence reduction, i.e. ‘the weak get weaker’ (Prince and Smolensky 1993, Kenstowicz 1996, Crosswhite 1999). Crosswhite suggests a scale of constraints for vowels belonging to unstressed syllables, given in (32). These constraints are stated as *Unstressed/V by Crosswhite; inclusion of ≥ follows de Lacy (2001a) and Prince (2001).¹⁹ ‘Son’ stands for sonority.

- (32) *ǃ/Son_{≥a} >> *ǃ/Son_{≥ε,ɔ} >> *ǃ/Son_{≥e,o} >> *ǃ/Son_{≥i,u}

Crosswhite’s hierarchy crosses two phonetically grounded scales: an accentual prominence scale that rates stressed syllables as more prominent than unstressed and a vocalic prominence scale for which sonority positively correlates with prominence. Hence, *ǃ/Son_{≥a}, which forbids low vowels

in unstressed syllables, will be active in a grammar that weakly minimizes vocalic prominence in unstressed contexts, while $*\check{\sigma}/\text{Son} \geq i, u$, which forbids even the least sonorous full vowels in unstressed syllables, will be active in grammars with extreme prominence minimization.

The prominence reduction constraint scale in (32) performs two important functions in Veneto: it drives unstressed vowel raising and it blocks unstressed vowel lowering. First, with regard to the former, recall that unstressed / $\varepsilon, \text{ɔ}$ / raise to [e, o]. This is illustrated by the alternations in (33) (Zamboni 1977).

- (33) a. $\text{s}\check{\text{e}}\text{ra}$ ‘shut, close (1sg pres. subj.)’ $\text{se}\check{\text{r}}\acute{\text{a}}\text{r}$ ‘to shut, close’
 b. $\text{m}\check{\text{o}}\text{g}\acute{\text{e}}\text{a}$ ‘let go (3sg pres.)’ $\text{mo}\check{\text{g}}\acute{\text{e}}\text{ár}$ ‘to let go’

Crosswhite (to appear) observes that this form of reduction arises from situating IDENT-IO(ATR) below $*\check{\sigma}/\text{Son} \geq \varepsilon, \text{ɔ}$: the raising occurs to better satisfy the prominence reduction scale within the limits of altering an [ATR] specification only.²⁰

The prominence reduction scale is applicable to the problem of preventing unstressed vowel lowering in Veneto height harmony, because it reveals that in prominence based terms, mid vowels are more marked than high ones in unstressed syllables. Nevertheless, from the viewpoint of perceptibility of a distinctive height feature, high vowels are more marked in an unstressed syllable (as expressed in the licensing constraint). Both of these considerations are best resolved with respect to the unstressed syllable by spreading [+high] from an unstressed vowel. This ameliorates perceptibility of the distinctive [+high] feature and minimizes prominence in the unstressed syllable at the cost of stressed syllable faithfulness. Other possible resolutions without spreading from the unstressed syllable sacrifice on one front or the other. For example, the mid/high contrast in unstressed position could be neutralized. Means of achieving this include across-the-board raising of unstressed mid vowels, which minimizes unstressed syllable prominence, or spread of height features from the stressed syllable, which fails to minimize unstressed syllable prominence but helps to maximize coarticulation across syllables. Alternatively, the mid/high contrast could be preserved despite weak perceptibility, in which case high and mid vowels would remain in unstressed syllables without spreading or reduction.

Veneto displays spreading from a high unstressed syllable, revealing both a need to satisfy licensing for [+high] and a dispreference for unstressed nonhigh vowels. Although unstressed nonhigh vowels are tolerated in Veneto when their mid quality is underlying, structures that contain unstressed mid vowels derived from high vowels are avoided. Building on Lubowicz (2002), I posit that the avoidance of derived marked structure is an effect of local conjunction of markedness and faithfulness constraints (local conjunction is after Smolensky 1993, 1997; on local conjunction of markedness and faith see also Baković 2000, Itô and Mester 2003).²¹ The relevant local conjunction is given in (34).


(34) * \check{O} /Son \geq e,o &_l IDENT-IO(high):

If a segment violates * \check{O} /Son \geq e,o, it must not violate IDENT-IO(high), and vice versa.

The local conjunction will be violated by nonhigh vowels in the output whose correspondents were [+high] in the input: such segments will incur violations of both IDENT(high) and * \check{O} /Son \geq e,o. The local conjunction will, however, be satisfied by nonhigh vowels that are underlyingly [-high]. Hence, mappings such as /i/ → [e] and /u/ → [o] in unstressed syllables will incur a mark with respect to the conjunction, but mappings such as /e, o/ → [e, o] and /e, o/ → [i, u] will obey it.

In order to achieve the metaphonic pattern of raising, the local conjunction and licensing constraint must together dominate stressed syllable faithfulness and root faithfulness. The ranking is illustrated in (35), which presents the same candidates as in (29). Candidate (c) is ruled out by a violation of licensing. The local conjunction now eliminates the formerly problematic candidate in (b), which spreads [-high] from the stressed syllable to the unstressed one. The optimal output is (a), which spreads [+high] from the unstressed vowel at the cost of positional faithfulness.

(35) * \check{O} /Son \geq e,o &_l IDENT-IO(high), LIC(+high) >> IDENT- \acute{O} -IO(high), IDENT-IO(high)_{Root}

/bev-i/	* \check{O} /Son \geq e,o & _l IDENT(hi)	LIC (+high)	IDENT- \acute{O} (high)	IDENT (high) _{Rt}	IDENT (high) _{Af}
a.  bívi			*	*	
b. béve	*!				*
c. bévi		*!			


The principal claims of the account of Veneto stress-targeted height harmony are encapsulated

in (35). Spreading in this system is driven by licensing sensitive to perceptual markedness, specifically, perceptually difficult height features in a weak position require membership in a stressed syllable. The capitulation of the stressed vowel in favor of the unstressed one is determined by prominence based markedness, i.e. an alternative resolution of licensing in which the stressed vowel height prevails is blocked by sonority minimization in unstressed syllables. Finally, positional faithfulness, prosodic and morphological, does not determine the pattern. This is a consequence of the domination of positional faith by licensing and the local conjunction.

The ranked and violable nature of optimality-theoretic constraints makes available the reconciliation of harmonies whose trigger is regulated by markedness factors, such as Veneto metaphony, versus other harmonies in which faithfulness to a strong position determines the trigger. In Veneto, positional faithfulness is dominated in the hierarchy, leaving control to well-formedness constraints. The universal generalizations expressed by positional faithfulness constraints thus remain intact but are not decisive in this language.

Before closing this section, I briefly address some additional details of the Veneto stress-targeted height harmony. First, metaphony affects only [+ATR] vowels: the [-ATR] vowels /ɛ, ɔ, a/ do not raise. I attribute this to the combined effect of faithfulness to [ATR] specifications, i.e. IDENT-IO(ATR), and avoidance of high [-ATR] vowels, expressed by the constraint *[+high, -ATR] (Calabrese 1988, Archangeli and Pulleyblank 1994). These constraints together outrank licensing to prevent [-ATR] vowels from being targeted in metaphony, as shown in (36).

(36) IDENT-IO(ATR), *[+high, -ATR] >> LIC(+high)

/bɛl-i/	IDENT(ATR)	*[+high, -ATR]	LIC(+high)
a.  béli			*
b. bíli		*!	
c. bíli	*!		


Since the licensing constraint cannot be satisfied by [+high] linking to a stressed [-ATR] vowel, and it dominates IDENT-IO(high), something further is needed to prevent post-tonic /i/ from lowering to [e] in these configurations (i.e. /bɛli/ → [béli], *[bele]). This is resolved by ranking the local conjunction over the licensing constraint, i.e. *ǝ/Son≥e,o &_l IDENT-IO(high) >> LIC(+high),

which blocks lowering of the high vowel.

It has been established that /a/ functions as a blocker for metaphony and pretonic raising in central Veneto. This can be handled straightforwardly by strict enforcement of a NO-GAP constraint on feature linkage (e.g. Archangeli and Pulleyblank 1994, Pulleyblank 1996, Walker 1998, Ní Chiosáin and Padgett 2001). It has been suggested by Ní Chiosáin and Padgett (2001) that gapped structures are universally ill-formed, i.e. they are not included among the set of structures produced by Gen. (Possible approaches to transparent segments under a theory that uniformly respects NO-GAP are mentioned in §5.)

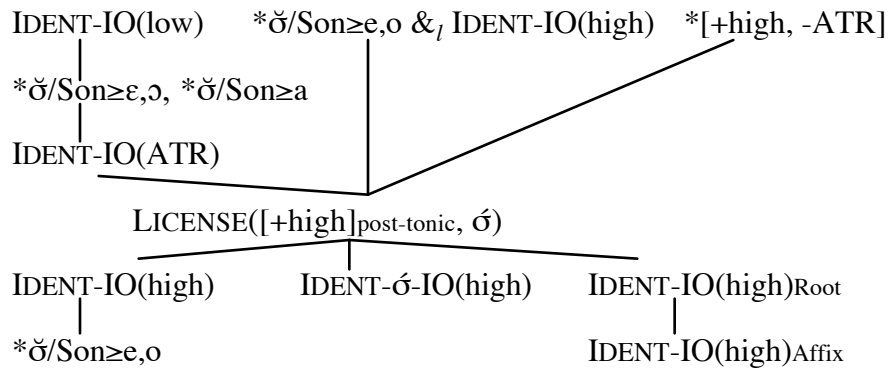
Finally, let us return to the issue of vowel reduction. It was established above that in order to obtain the raising of /ε, ɔ/ to [e, o] in unstressed syllables, *ǫ/Son≥ε,ɔ dominates IDENT-IO(ATR) in Veneto. Since IDENT(ATR) in turn dominates LIC(+high), which in turn dominates IDENT(high), it follows from transitivity that *ǫ/Son≥ε,ɔ also outranks IDENT(high). This raises the twofold question of what prevents /ε, ɔ/ from raising all the way to [i, u] in unstressed syllables and what prevents /a/ from raising at all. The former is accomplished by locating *ǫ/Son≥e,o below IDENT(high). By interleaving IDENT(high) and IDENT(ATR) between *ǫ/Son≥ε,ɔ and *ǫ/Son≥e,o, mid [-ATR] vowels will only raise to mid [+ATR], as illustrated in (37).

(37) *ǫ/Son≥ε,ɔ >> IDENT(ATR), IDENT(high) >> *ǫ/Son≥e,o

/serar/	*ǫ/Son≥ε,ɔ	IDENT(ATR)	IDENT(high)	*ǫ/Son≥e,o
a.  serár		*		*
b. sirár		*	*!	
c. serár	*!			*

The lack of reduction-induced raising of /a/ is achieved by ranking IDENT-IO(low) over *ǫ/Son≥a, *ǫ/Son≥ε,ɔ. A ranking diagram for Veneto stress-targeted harmony is given in (38).

(38) Ranking summary for stress-targeted harmony in Veneto



4.2 The Maximal Extension Pattern

I now address the additional rankings needed to obtain the maximal extension pattern that occurs as a variable alternative. This is needed for cases in which a post-tonic high vowel causes raising not only of a stressed vowel but of pretonic mid vowels too, exx. central Veneto: /sent-e-si-mo/ → [sintísimo] ‘feel, hear (1pl impf. subj.)’, /mov-e-si/ → [muvísi] ‘move (2sg impf. subj.)’; Grado: /defend-i/ → [difíndi] ‘defend (2sg)’, /godiment-i/ → [gudimínt-i] ‘pleasure (m pl)’.

As discussed in §3, phonological strategies to improve perceptibility may be prosodically centered, as in the stress-targeted pattern, or focused on maximized duration, as in the maximal extension pattern. Following Kaun (1995), I assume that trigger conditions on spreading constraints may single out perceptually marked properties. As she discusses, constraints extending the domain of a perceptually marked feature in the word are geared towards improving the likelihood that the listener will perceive a subtle featural contrast. The constraint that drives maximal spreading in Veneto is given in (39). Like licensing, the spreading constraint singles out as triggers vowels that are high and unstressed. Moreover, they occur in the weakest of unstressed domains in the language, i.e. they are post-tonic. In contrast to licensing, the spreading constraint seeks to take full advantage of the vocalic positions in the word by requiring affiliation with all of them rather than with a particular site of prosodic strength (Kaun 1995, among others).²²


(39) SPREAD(+high)-if-post-tonic:

[+high] associated with a post-tonic vowel must be associated with every vowel in the word.

A constraint requiring initial syllable licensing for [+high] could not be substituted, since pretonic mid vowels are raised even if spreading does not extend to the initial syllable, under circumstances of a low initial vowel, ex. central Veneto: /argument-i/ → [argumínti] ‘argument (m pl)’. Furthermore, a constraint without the post-tonic restriction would not be adequate, because it erroneously predicts that high vowels outside of post-tonic syllables could trigger raising, which is not the case, exx. central Veneto: [obedíso] ‘I obey (1sg)’, Grado: [godiménto] ‘pleasure (m sg)’.

In order for the spreading constraint to be visibly active, it must dominate IDENT-IO(high), as shown in (40). In this example, the input contains a mid vowel in the syllable that will receive stress and a mid vowel in the preceding syllable as well. The optimal output, in (a), raises both mid vowels, satisfying SPREAD(+high) and violating IDENT(high) twice. A competing candidate in (b), which raises only the stressed vowel, is ruled out by its violation of spreading, and candidate (c), in which no raising takes place, is likewise eliminated by its failure to obey spreading.

(40) SPREAD(+high)-if-post-tonic >> IDENT-IO(high)

/dolori/	SPREAD(+hi)-if-post-tonic	IDENT(high)
a.  dulúri		* *
b. dolúri	*!	*
c. dolóri	*!*	

The general parallels between the spreading and stress-targeted patterns are indicative that for cases of maximal spreading, SPREAD(+high) is dominated by the same constraints as licensing, i.e. it is situated below *ǝ/Son≥e,o &_l IDENT-IO(high), IDENT-IO(ATR) and *[+high, -ATR] (see (38)). This ensures the post-tonic high vowel does not undergo lowering and guarantees the lack of participation of [-ATR] vowels.

The increased tendency for pretonic /o/ (versus /e/) to raise in central Veneto might have a basis in articulatory difficulty. Kaun’s (1995) survey of rounding harmony finds support for a constraint

*ROLO, which prohibits round nonhigh vowels. Kaun argues that the avoidance of such vowels stems from an antagonism between a lower jaw position and a lip rounding gesture. *ROLO will penalize [o] but not [e], and it plausibly interacts with the maximal spreading phenomena of central Veneto to favor raising of the former. However, for reasons of space, the present analysis focuses on the undifferentiated raising of both mid vowels, as in Grado.

The maximal spreading pattern is strictly regressive, ex. central Veneto: [sintísimo] ‘feel, hear (1pl impf. subj.)’. This is also true of the stress-targeted harmony, but in that case, regressivity follows from the licensing constraint operating over vowels in the post-tonic domain. The spreading constraint in (39) is stated without directionality. A conceivable means of obtaining the regressivity would be to impose a left-directional restriction on spreading. However, given several researchers’ finding that directionality in vowel harmony follows from other properties of the system, such as positional prominence and morphological structure (e.g. Kaun 1995, Steriade 1995, Beckman 1997, Baković 2000, Walker 2001a; note also Padgett 1995), I speculate that faithfulness to the word-final syllable might instead be what prevents spreading from the penult to the final vowel.²³

Although asymmetries in edge-based faithfulness often favor word beginnings (Beckman 1997, Casali 1997, Nelson 2003), evidence for faithfulness to word endings has recently accrued (Hyman 1998, Petrova *et al.* 2000, Curtin 2001, Krämer 2001; note also Steriade 1993, Barnes 2003). The special phonological status of final syllables is seen in various ways across languages, such as showing more contrasts, resisting neutralization and resisting deletion. Its origins are suggested to be psycholinguistic and/or phonetic in nature (e.g. Petrova *et al.* 2000, Smith 2002, Steriade 1993). Although phonological final privilege often correlates with enhanced phonetic prominence, this is not always so (Barnes 2001, 2003). Barnes (2001) cites Gidabal, a Bandjlang dialect (Australian), which shows evidence of phonological strength in its final vowels together with reduced prominence in final position. Likewise, in Veneto, the phonological strength of the final syllable stands despite its lack of metrical prominence. This suggests a possible source in this position’s psycholinguistic importance. It is noteworthy that evidence for privileged faithfulness for the final syllable is also seen in the history of Italian, which systematically retained vowels of final syllables

in its evolution from Latin (Grandgent 1927:46).

Returning to issues of constraint ranking, the assumption of a word-final faithfulness constraint will not obviate the need for the local conjunction, $*\check{\sigma}/\text{Son} \geq e, o \ \&_l \ \text{IDENT-IO}(\text{high})$, to dominate the licensing and spreading constraints. This will still be required to prevent vowel lowering as a solution to licensing or spreading for triggers in the penult, ex. /sentesimo/ \rightarrow [sintísimo], *[sentésemo].

Moving on to the variability in harmony patterns witnessed in Veneto dialects, the critical analytical generalizations are as follows. First, within the dialects showing height harmony, spreading is regularly in accordance with the requirements of the stress-targeted pattern – it sometimes exceeds these requirements, but it never undershoots. This suggests that the ranking of the licensing constraint depicted in (38), which drives the stress-targeted pattern, holds constant. By contrast, the maximal extension pattern is variably obeyed. As shown in (40) above, maximal extension harmony results from ranking SPREAD(+high) over IDENT(high), more specifically, from ranking SPREAD(+high) at the same location as LIC(+high). The maximal extension harmony produced by this ranking is consistent with the sustained precedence of licensing over faithfulness for [high], though it does not necessitate it. If the ranking of SPREAD(+high) and IDENT(high) were reversed, and the hierarchy remained otherwise unaltered, then the stress-targeted pattern alone would emerge. (Although in principle the licensing constraint could be regarded as wholly inactive in the maximal extension pattern, I assume only the minimal ranking difference needed to distinguish the licensing and maximal extension harmonies within Veneto dialects.) Accordingly, I posit that the pattern variability arises solely through different ranking outcomes for SPREAD(+high) and IDENT(high), as sketched in (41).

- (41) a. Stress-targeted harmony: IDENT(high) \gg SPREAD(+high)
b. Maximal extension harmony: SPREAD(+high) \gg IDENT(high)

Such variable ranking can be accomplished via constraints that are probabilistically ranked according to assigned ranking values (Boersma 1998, Hayes and MacEachern 1998, Zuraw 2000, Curtin 2001).²⁴ When one constraint has a considerably higher ranking value than another, it will

effectively always dominate: this is the case for the stress-targeted rankings. However, when two constraints have relatively close ranking values, their ranking with respect to each other will vary. I propose that this represents the situation for SPREAD(+high) and IDENT(high). The different outcomes under the two rankings are demonstrated in (42). As shown here, the licensing constraint is assumed to regularly dominate IDENT(high) to enforce stress-targeted harmony.

(42i) Maximal extension harmony: SPREAD(+high) >> IDENT(high)

/botoni/	LIC(+high)	SPREAD(+hi)-if-post-tonic	IDENT(high)
a. ^u butúni			**
b. botúni		*!	*
c. botóni	*(!)	*(!)*	

(42ii) Stress-targeted harmony: IDENT(high) >> SPREAD(+high)

/botoni/	LIC(+high)	IDENT(high)	SPREAD(+hi)-if-post-tonic
a. butúni		**!	
b. ^u botúni		*	*
c. botóni	*!		**

5. Stress-sensitive Harmony in Other Romance Dialects

5.1 Metaphony Across Dialects

A wider typological perspective must encompass other metaphony patterns attested in western Romance. I focus first on Italian dialects. Veneto metaphony raises only /e, o/; however, many cases of metaphony also affect stressed mid [-ATR] vowels. The outcome for these vowels varies by dialect, as illustrated in (43). In the southern Umbro dialect, mid [-ATR] vowels are raised to mid [+ATR] in metaphonic configurations, in the Pugliese dialect, all mid vowels raise to high, and in Calvello, diphthongization occurs (data in (43a-b) from Calabrese 1988, (43c) from Kaze 1991). The targeting of mid [-ATR] vowels also occurred historically in central Veneto, for example, sixteenth century Padovano presented forms such as *bello/bieggi*, *morto/muorti* (Zamboni 1977:40).

(43) a. Southern Umbro

<u>Unraised</u>	<u>Raised</u>	
vérde	vírđi	‘green (sg/pl)’
róssa	rússu	‘red (f/m)’
tʃéka	tʃéku	‘blind (f/m)’
nóva	nóvu	‘new (f/m)’

b. Pugliese

<u>Unraised</u>	<u>Raised</u>	
kjéna	kjínu	‘full (f/m)’
móʃʃa	múʃʃu	‘soft (f/m)’
péte	píti	‘foot (sg/pl)’
gróssa	grússu	‘big (f/m)’ ²⁵

c. Calvello

<u>Unraised</u>	<u>Raised</u>	
mése	mísi	‘month (sg/pl)’
kavróne	kavrúni	‘carbon (sg/pl)’
pére	pjéri	‘foot (sg/pl)’
móvo	m ^w óvi	‘move (1sg/2sg)’

In a few Italian dialects, [-ATR] /a/ is also raised, most commonly becoming [ɛ] or something close to it. This occurs in southern Romagna (Maiden 1991:131). The Teramo dialect of the Abruzzo region shows an extreme case wherein all vowels become high in metaphony: among the [-ATR] vowels /ɛ, a/ raise to [i] and /ɔ/ raises to [u] (Maiden 1991:167).

Most analysts agree that the effects on [-ATR] vowels involve height assimilation (cf. Cole 1998). Let us consider how the licensing approach extends to these cases. I hypothesize that in such systems, all height features of post-tonic high vowels ([+high], [±ATR], [-low]) require licensing. I express the constraint here as LICENSE(height). For the sake of uniformity, the same constraint could also be deemed active in Veneto, but higher ranking IDENT(ATR) and IDENT(low)

prevent [-ATR] vowels from being affected in metaphony. At the same time, *[+high, -ATR] is strictly enforced across patterns to block [ɪ, ʊ]. Each of the above varieties ranks LICENSE(height) over IDENT(high). In Pugliese, where /ɛ, ɔ/ raise to [i, u], licensing for all height features is also capable of overriding IDENT(ATR). Hence, in contrast to Veneto, LICENSE(height) dominates IDENT(ATR) in Pugliese.


Like Pugliese, metaphony in southern Umbro has the capacity to violate IDENT(ATR), but it shows gradual raising. After Kirchner (1996), this is accomplished by local conjunction of faith constraints for height features, which moderates satisfaction of height licensing. The approach is briefly sketched here.²⁶ The relevant local conjunction is in (44). This constraint will be violated by any vowel that changes its specifications for both [high] and [ATR] in the input-output mapping.

(44) IDENT-IO(high) &_l IDENT-IO(ATR)

If a segment violates IDENT(high), it must not violate IDENT(ATR), and vice versa.

The conjunction dominates LICENSE(height), which in turn outranks the nonconjoined height faithfulness constraints, as shown in (45). The local conjunction rules out candidate (c), in which /ɔ/ → [u]. This constraint is obeyed, however, in (a), in which /ɔ/ → [o], and in (b), which is fully faithful. Candidate (a) wins over (b), because it better obeys LICENSE(height), for which a violation mark is shown for each unlicensed height feature: (a) violates licensing for [+high] and (b) for both [+high] and [+ATR]. An alternative [núvu] will be eliminated by *[+high, -ATR].

(45) IDENT(high) &_l IDENT(ATR) >> LIC(height) >> IDENT-IO(ATR), IDENT-IO(high)

/noʋ-u/	IDENT(high)& _l IDENT(ATR)	LIC(height)	IDENT(ATR)	IDENT(high)
a.  nóvu		*	*	
b. nóvu		**!		
c. núvu	*!		*	*

As in Veneto, the lack of effect on /a/ results from IDENT(low) >> LICENSE(height). In dialects showing /a/ → [i], the reverse ranking holds. This is likewise true for /a/ → [ɛ], but satisfaction of licensing is restricted by a dominating conjunction, IDENT(low) &_l IDENT(ATR), which produces gradual raising.

In Calvello, [ɛ, ɔ] become diphthongs. As Calabrese (1988) suggests, diphthongization may be regarded as driven by the constraint *[+high, -ATR] in collusion with other factors operative in the system. In Calvello, the faithfulness conjunction, IDENT(high) &_l IDENT(ATR), is strictly enforced, as in southern Umbro. Licensing of all height features is nevertheless accomplished by affiliation of [+high] with the glide portion of a diphthong when full occupation of the nucleus is prevented. Recall that the licensing constraint requires perceptually marked structure to be dominated by an element in a strong position. One element of a diphthong in a strong syllable is sufficient. Patterns where a weak vowel metathesizes into a stressed syllable to form a diphthong with the original stressed vowel are plausibly driven by licensing too, as discussed in §6. Assuming that diphthongs are bisegmental, diphthongization in Calvello will violate DEP-IO for the inserted root node (McCarthy & Prince 1995). Diphthongization patterns for [-ATR] mid vowels will thus be distinguished from ones with step-wise raising, as in southern Umbro, by the relative ranking of DEP-IO and LICENSE(height).²⁷

On a related matter, diphthongization in metaphony appears to be nonlocal. In a theory assuming strict locality of feature linkage (Ní Chiosáin and Padgett 2001), this could be handled using an analysis to transparent segments that involves phonological opacity or a treatment that derives the effect of seeming phonological opacity. Possible approaches are discussed by Walker (1998), Baković and Wilson (2000) and Sanders (2003). Determining which particular treatment is suitable will depend on closer examination of the dialects in which diphthongization occurs. Such approaches will also be applicable to metaphonies in which a stressed antepenult is raised by a final vowel across a neutral penult, as in Lena and Pasiego, discussed below.²⁸

To summarize, metaphony patterns in Italian dialects regularly raise /e, o/ to [i, u] but vary in their influence on lower vowels. In Pugliese, southern Umbro and Calvello, where [-ATR] vowels are affected, a licensing constraint for height features dominates IDENT(ATR). In the latter two dialects, a local conjunction of faithfulness for height features dominates licensing, with the effect in southern Umbro of gradual raising and in Calvello of gradual raising with diphthongization.²⁹

In contrast to Italian, Spanish dialects lack [ATR] in their phonemic system, yielding the tonic

vowel inventory /i, e, a, o, u/. As discussed by Hualde (1989), mid vowels regularly undergo metaphonic raising, but participation of /a/ varies across dialects. Metaphony in Pasiego raises mid vowels only, as seen in (46a) vs. (46b). The data compare forms ending in /-u/ (m sg) with counterparts ending in /-o/ (mass) or /-os/ (pl). Final unstressed /u/ is realized as centralized [U] and /o/ as [ʊ] (Hualde describes the latter as open [u] or closed [o]). A separate centralization harmony operates regressively in words. In contrast to Pasiego, metaphony in Lena additionally raises /a/ to [e], as in (47). A further detail is that raising can operate across a transparent penult: exx. Pasiego [gwɪrfAnU] ‘orphan’, Lena [trwɪbanu] ‘beehive (m sg)’, cf. [trwébanos] (m pl).

(46) Pasiego

	<u>Unraised</u>	<u>Raised</u>	
a.	nwéstru	nwɪstrU	‘our (mass/m sg count)’
	babérus	bAbɪrU	‘bib (m pl/m sg count)’
	górdʊ	gʊrdU	‘thick (mass/m sg count)’
	r̄apósus	r̄ApʊsU	‘fox (m pl/m sg count)’
b.	/blanku/ → blÁnkU		‘white’
	/gatu/ → gÁtU		‘cat’

(47) Lena

	<u>Unraised</u>	<u>Raised</u>	
	nénos	nínu	‘child (m pl/sg)’
	kordéros	kordíru	‘lamb (m pl/sg)’
	tsóbos	tsúbu	‘wolf (m pl/sg)’
	kókos	kúku	‘worm (m pl/sg)’
	gátos	gétu	‘cat (m pl/sg)’
	tsamárgos	tsamérgu	‘muddy lake (m pl/sg)’

These patterns result from rankings already motivated for certain Italian dialects above. Licensing dominates IDENT(high) to produce raising of /e, o/. In Pasiego, where only mid vowels undergo raising, IDENT(low) outranks LICENSE(height), as in Veneto. The reverse ranking occurs in

Lena, which, like southern Romagna and Teramo, shows raising of /a/ too.³⁰ Gradual raising in Lena is accomplished by IDENT(high) & IDENT(low) dominating LICENSE(height).

The Tudanca Montañes dialect shows a further variation, namely, a centralizing metaphony. Like Pasiego, final unstressed high vowels are regularly centralized, analyzed by Hualde (1989) as insertion of [-ATR]. As Hualde discusses, centralizing metaphony propagates [-ATR] to the stressed syllable, a process which I posit assists in signaling the final high vowel. All stressed vowels participate in this harmony (48a). In instances of antepenultimate stress, intervening vowels are also centralized (48b).

(48) Tudanca

	<u>Noncentralized</u>	<u>Centralized</u>	
a.	pínta	pÍntU	‘calf (f/m)’
	thúrdos	thÚrdU	‘left-handed (m pl/sg)’
	séka	sÉkU	‘dry (f/m)’
	óhos	ÓhU	‘eye (m pl/sg)’
	sekálo	sekÁIU	‘to dry it (mass)/to dry him’
b.		antigwÍsImU	‘very old’
		pÓrtIkU	‘hall’
		orÉgAnU	‘oregano’

Tudanca metaphony presents a case in which licensing dominates IDENT(ATR) but not IDENT(high) or IDENT(low). As mentioned above, Pasiego also shows a centralizing harmony, but it operates throughout the entire word. This is the centralizing counterpart of the maximal extension harmony for [+high] in Veneto.

The Italian and Spanish dialect patterns exemplify many of those predicted in a factorial typology involving LICENSE(height) and its corresponding faithfulness constraints, IDENT(high)/(low)/(ATR), as shown in (49). In addition to these rankings, a local conjunction of faithfulness and DEP-IO are involved in some dialects to produce gradual raising and/or diphthongization, as discussed above.

- (49) Attested metaphonic patterns: Different rankings of LICENSE and IDENT
- a. Mid vowels /e, o/ raised only: IDENT(high) dominated by licensing
 Veneto: IDENT(ATR), IDENT(low) >> LIC(height) >> IDENT(high)
 Pasiego: IDENT(low) >> LIC(height) >> IDENT(high)
 - b. Centralizing metaphony: IDENT(ATR) dominated by licensing
 Tudanca: IDENT(high), IDENT(low) >> LIC(height) >> IDENT(ATR)
 - c. Mid vowels /e, o, ε, ɔ/ raised: IDENT(high)/(ATR) dominated by licensing
 S. Umbro, Pugliese, Calvello: IDENT(low) >> LIC(height) >> IDENT(high),
 IDENT(ATR)
 - d. All vowels raised: IDENT(high)/(low) (and IDENT(ATR)) dominated by licensing
 S. Romagna, Teramo: LIC(height) >> IDENT(high), IDENT(ATR), IDENT(low)
 Lena: LIC(height) >> IDENT(high), IDENT(low)

A factorial typology of these constraints also predicts a ranking in which all IDENT constraints dominate licensing. This would be a pattern in which there is no metaphony, attested in languages without height harmony. Absent here are rankings in which IDENT(low) is dominated by licensing but not IDENT(high) (or IDENT(ATR) in dialects for which this feature is relevant). This correlates with Maiden's observation that metaphony of lower vowels nearly always implies metaphony of higher vowels (1991:115).³¹ The nature of the theoretical issue here depends on whether this implication extends beyond western Romance to height harmonies in general. This is a matter requiring further investigation.

As mentioned in §2, morphological conditioning plays a role in the phonological metaphony patterns of some Romance varieties. As demonstrated by Hualde (1989), this is the case in Lena's metaphony, where suffixal unstressed high vowels trigger metaphony but not post-tonic high vowels in the stem. This is evident in the comparison of *silikótikos* 'suffering from silicosis (m. pl)', where post-tonic /i/ in the stem /silikotik-/ does not trigger raising of the stressed vowel, versus the masculine singular form, *silikútiku*, with raising triggered by a suffixed high vowel. A similar point is made by Sluyters (1988) for the northern Salentino Italian dialect. Cases of this kind could

be handled under a licensing account as motivated by properties of perceptual weakness, as spelled out in (22), together with morphological weakness, that is, height features belonging to an affix. (Some metaphony patterns might further restrict licensing to specific weak affixes; see Maiden 1991.) This points to the potential for certain licensing constraints to be shaped by weakness in terms of morphological structure. Licensing would be accomplished by a strong position – here a prosodically strong, stressed syllable. Additional patterns in other languages involving licensing of features belonging to morphologically weak structure are discussed in §6.

5.2 Stress-triggered Harmonies in Romance

In addition to metaphonies, where stressed vowel height is determined by an unstressed vowel, there are harmonies in Romance where the stressed vowel is in control. Certain of these are driven chiefly by improving perceptibility and others are driven primarily by coarticulation (although some patterns' motivation might be ambiguous). The Canals variety of Valencian Catalan exemplifies the former type. Unstressed /a/ becomes [ɛ] or [ɔ] following stressed [ɛ] or [ɔ], respectively, as shown in (50a) (Jiménez 1998). Other stressed vowels do not affect /a/ (50b). Corresponding forms from València, which lacks harmony, are given for comparison. Like Italian, Valencian varieties have a seven vowel inventory (some dialects also have [ə]), and /ɛ, ɔ/ occur in stressed syllables only.

(50)	<u>Canals</u>	<u>València</u>	
a. /tera/	té <u>ɛ</u>	téra	‘land’
/afekta/	afé <u>ɛ</u> kte	afékta	‘it affects’
/kɔza/	kó <u>ɔ</u> zɔ	kóza	‘thing’
/apɔrta/	apó <u>ɔ</u> rta	apórta	‘s/he brings’
b. /mira/	mí <u>ɾ</u> a	míra	‘s/he looks’
/luna/	lú <u>ɾ</u> na	lúna	‘moon’
/kapa/	ká <u>ɾ</u> pa	kápa	‘cape’
/pera/	pé <u>ɾ</u> a		‘pear’
/tota/	tó <u>ɾ</u> a		‘all (f sg)’

Jiménez (1998) analyzes this as spreading of color features from mid [-ATR] vowels to [-ATR] vowels ([-ATR] is [RTR] for Jiménez). He argues the harmony improves perceptibility of marked [ɛ, ɔ]. Thus, like metaphony, this harmony has perceptually weak triggers. Here, the weakness lies strictly in featural content, not prosodic position. Because weak [ɛ, ɔ] occur contrastively only under stress, it is stressed vowels that trigger harmony. This is a case where feature combinations with weak perceptibility are licensed by affiliation to stressed syllables and an imperative to maximize extension of perceptually difficult features (i.e. a SPREAD constraint) drives harmony. In contrast to stress-targeted metaphony, the post-tonic vowel capitulates in this system.

Certain other Romance dialects show stress-triggered harmony that appears rooted primarily in this position's strength. As mentioned earlier, stressed high vowels in Servigliano cause raising of pretonic mid vowels, ex. [kummunikímo] 'we communicate', cf. [kommoneká] 'to communicate'. The trigger's asymmetric strength is evident in the failure of pretonic high vowels to cause raising, ex. [prediká] 'to preach'. Pasiego shows a similar harmony, discussed in §3.2. In these cases, the operative constraint requires spreading of features that belong to the stressed syllable, motivated by this position's strong coarticulatory influence (Majors 1998, see also Ringen and Heinämäki 1999).

We have seen that height harmonies in Romance can also affect tenseness. Canadian French presents a laxing harmony triggered by stressed vowels. As shown in (51), pretonic high vowels in open syllables (optionally) become lax preceding a lax vowel in a final syllable, which is stressed (Walker 1984, Dumas 1987, Baronian 2001; cf. Déchaine 1990). The final vowels in these data have undergone an obligatory laxing process affecting high vowels in final syllables closed by certain consonants.

(51) Canadian French

/tribyn/	trɪbɪ́n	'tribune'
/skrypyl/	skrɪpɪ́l	'scruples'
/myzik/	mɪzɪ́k	'music'
/sukup/	sukúp	'saucer'

/kutym/ kut^sým ‘tradition’

The Canadian French vowel inventory is much richer than that of Italian or Spanish dialects, consisting of [i, i:, y, e, e:, ē:, ø:, ø:, ε, œ, a, a:, ã:, ə, ɜ:, ɑ:, ɔ, o:, õ: u, u:] (Baronian 2001). Nevertheless, like Tudaanca centralization, the laxing harmony can be treated as involving spreading of [-ATR]. However, in contrast to Tudaanca’s stress-targeted metaphony, laxing harmony in Canadian French is not licensing driven, but rather it is amenable to treatment in terms of a constraint requiring that [-ATR] spread from a stressed syllable (subject to certain conditions).

To sum up, this section has provided an overview of height harmonies in western Romance involving licensing and/or stress. In metaphony patterns, where the stressed syllable is targeted, perceptually based licensing in the stressed position is the harmony imperative. On the other hand, in certain stress-triggered patterns a coarticulatorily based spreading constraint from stressed position causes harmony. Still other harmonies involve maximal extension of features from a perceptually weak vowel, which might be in stressed or unstressed position, depending on the system. Further applications of licensing in vowel patterns, in Romance and elsewhere, are dealt with in the next section.

6. Extensions to Other Vowel Patterns

The larger theoretical issue with which this paper is concerned is the characterization of weak triggers in harmony, beyond metaphonic patterns alone. On the matter of empirical breadth, I turn to some crosslinguistic extensions of the perceptual markedness approach to harmony. I focus on applications of licensing constraints operating over perceptually weak structure, since as discussed in §3, stress-targeted patterns are novel within the weak-trigger typology. The vowel patterns I examine in this section fall into two main categories: (i) ones in which a weak vowel triggers a change in a strong position, and (ii) ones that alter unstressed vowels. In many cases high vowels are the sole ones that initiate a process.

Veneto metaphony presents a case where the stressed syllable serves as the target of height harmony. The core ranking that drives this result is given in (52): a constraint demanding that

certain weak structure be licensed by affiliation with a prosodically strong syllable supercedes stressed syllable faithfulness.

(52) LICENSE(Weak-structure, \acute{o}) >> IDENT-IO- \acute{o}

The ranking in (52) extends to other vowel patterns with strong prosodic targets. The case of umlaut in Old High German, shown in (53), may be amenable to a licensing treatment (Ellis 1953). This process has been analyzed as a vowel harmony wherein stressed back /a/ fronts to [e] preceding an unstressed high front vowel or glide (e.g. Robinson 1976, Flemming 1993).³² As Robinson (1976) points out, the vowel which triggers umlaut must be unstressed, ex. [kráftl̩h] ‘strong’ * [kréftl̩h].³³

(53) Old High German

	<u>Unfronted</u>		<u>Fronted</u>	
a.	fáran	‘to go’	férit	‘goes’
b.	kálb	‘calf’	kélbir	‘calves’
c.	gást	‘guest’	gésti	‘guests’

A perceptual markedness account suggests itself, paralleling that proposed for metaphony. The feature [-back] must be licensed by membership in a stressed syllable when affiliated with a high unstressed vocoid. The perceptual difficulty suffered in unstressed contexts and by high vowels were discussed in §3. While the restriction to front vowels might be arbitrary, it is possible that certain factors underlie this condition. Pulleyblank (1998) assumes that front vowels are less sonorous than back ones in Yoruba. If this generalization carries over to Old High German, then [i] would be the most perceptually vulnerable high vowel. The special coarticulatory status of [i] mentioned in §3.2 might also play a role. These properties would favor high, front vocalic triggers in weak positions over triggers that are back.

The Jaqaru dialect of Aimara shows a related effect. In this variety, a final unstressed vowel triggers harmony for all features in the stressed vowel (Cerrón-Palomino López 2003). The vowel inventory consists of /i, a, u/ and stress is penultimate in native words. Examples include /palu-ri/ → [palíri] ‘eater’, /nuni-ja/ → [nunája] ‘to cause to rinse’, /ima-ka-ʃu/ → [imkúʃu] ‘sewing’ (last

example shows deletion of the root final vowel). Here again vowels in a perceptually weak (unstressed) position produce harmony in a prosodically strong syllable.³⁴

In circumstances where licensing supercedes the stressed syllable faithfulness constraint that regulates the linear order of segments (LINEARITY; McCarthy and Prince 1995), metathesis of a weak vowel to the stressed syllable occurs. Maiden (1987:70, n. 24) points out that metathesis of final unstressed /i/ and a stem-final consonant occurs in certain Italian dialects to form a diphthong in the previous syllable. The consonant that most commonly participates with /i/ in the metathesis is a nasal, and in some cases where [ai] is the resulting diphthong, there is monophthongization of the resulting diphthong to [ɛ] or [e]. Examples from northern Italian dialects where [i] has metathesized into a stressed syllable containing a back vowel (where metathesis is visibly apparent) are given in (54-55) (data from Rohlfs 1966:43-44, 95). Additional Ligurian examples from Forner (1975a) are as follows: /buŋ-i/ → [bwíŋ] ‘good (m pl)’, cf. [buŋ] ‘good (m sg)’, /kaŋsuŋ-i/ → [kaŋswíŋ] ‘song (pl)’, cf. [kaŋsúŋ] ‘song (sg)’. Forner’s (1975b) study of the resulting structures in the Ligurian dialects has established that they truly arise through metathesis together with monophthongization of certain diphthongs rather than through metaphonic raising. Maiden (1987) also confirms the independence of the effects of metathesis of final /i/ and metaphony.

(54) Liguria

- | | | | |
|----|---------|-----------------|-----------------------------------|
| a. | karbuíŋ | ‘carbon (m pl)’ | cf. Std. Italian, <i>carbóni</i> |
| b. | keŋ | ‘dog (m pl)’ | cf. Std. Italian, <i>cáni</i> |
| c. | meŋ | ‘hand (m pl)’ | cf. Std. Italian, <i>máni</i> |
| d. | skriveŋ | ‘clerk (m pl)’ | cf. Std. Italian, <i>scriváni</i> |
| e. | toskeŋ | ‘Tuscan (m pl)’ | cf. Std. Italian, <i>toscáni</i> |

(55) Piedmont

- | | | | |
|----|----------|-----------------|-----------------------------------|
| a. | larroin | ‘thief (m pl)’ | cf. Std. Italian, <i>ladróni</i> |
| b. | krastoin | ‘wether (m pl)’ | cf. Std. Italian, <i>castróni</i> |
| c. | kain | ‘dog (m pl)’ | cf. Std. Italian, <i>cáni</i> |
| d. | draip | ‘cloth (m pl)’ | cf. Std. Italian, <i>dráppi</i> |

This prosodically sensitive metathesis satisfies licensing by shifting weak structure into the stressed syllable. Patterns of this kind in several other languages are discussed by Blevins and Garrett (1998), under the label ‘compensatory metathesis’. They too argue for a motivation grounded in weakness of the vowel that undergoes metathesis, characterizing the phenomenon as follows: ‘a vowel at the edge of a phonological domain undergoes phonetic weakening in quality and duration, with compensation for this weakening by anticipatory or perseverative coarticulation of the original vowel quality in stressed position’ (p. 527).

Thus far, we have focused on cases of licensing by strong prosodic structure which improves perceptibility. However, psycholinguistically salient positions, such as the root-initial or word-initial syllable also show positional privilege effects (Beckman 1997, 1998, Casali 1997), and morphological roots in general can be prioritized (e.g. McCarthy and Prince 1994). In principal, strong morphological positions could function as licensing positions for weak structure too, i.e. as strong targets in harmony. The relevant ranking structure is given in (56).

(56) LICENSE(Weak-structure, Root/Stem constituent) >> IDENT-IO-Root/Stem

Harmony in the Bantu language, Nzebi, is a possible case. In Nzebi, a latent suffix vowel /-i/, which marks certain verb tenses, induces raising in the root vowel (Guthrie 1968, Clements 1991). The suffix vowel is ‘latent’ in the sense that it is pronounced only in deliberate speech or when followed by an enclitic. The other possible suffix vowel, [ə], does not affect root vowel height. Nzebi has a seven vowel inventory like that of Veneto. In addition, [ə], which is possibly derived from /a/, occurs in contexts where contrast is reduced (Clements 1991:35, see also Guthrie 1968:118). As seen in (57), suffix /-i/ causes step-wise raising: /a/ → [ɛ], /ɛ, ɔ/ → [e, o], /e, o/ → [i, u]. Stems in the language are composed of a CVC radical plus a possible extension from among [əl], [ən], [əs], [əx]. (Vowels in extensions may also be high [i] or [u] when occurring in combination with certain radical vowels.) Height harmony targets the vowel in the CVC radical – this vowel may be short, long, or a diphthong beginning in a high vowel. If an intervening extension occurs, its reduced vowel is realized as [i]. The harmony thereby affects a contiguous string of syllables.

(57) Nzɛbi

- a. -bet-/bit(-i) 'to carry'
- b. -kolən-/kulin(-i) 'to go down'
- c. -βɛɛd-/βeed(-i) 'to give'
- d. -niɔd-/niod(-i) 'to drink'
- e. -sal-/sɛl(-i) 'to work'
- f. -kasəl-/kɛsil(-i) 'to tear'

The weak nature of the trigger in this case is two-fold: the vowel is high and it belongs to an affix. The harmony is plausibly driven by a demand that the height features of this segment be licensed by association to a morphologically strong position, i.e. the CVC radical. For an optimality-theoretic treatment of the gradual raising effect in Nzɛbi, see Kirchner (1996).

Other cases of vowel harmony exist that show properties suggesting they are driven by root or stem licensing. In Vata (Eastern Kru), a plural suffixal [-i] causes optional raising of stem /e, o/ to [i, u]: exx. [jɛ̀lé] / [jɪ́lí ~ jɛ̀lí] 'lizard (sg/pl)', [bōvλ] / [būvì ~ bōvì] 'crab (sg/pl)' (diacritics mark tones; mid-high and high tones are transcribed here with IPA symbols for high and extra high, respectively) (Kaye 1982). Determiner suffixes in Somali (Cushitic) induce noniterative copy harmony in a short final vowel of a noun stem: exx. *meelo* 'places' / *meeláha* 'the places', *fúre* 'key' / *furáha* 'the key', *báre* 'teacher' / *baríhii* 'the teacher (remote)' (accent marks high tone) (Saeed 1993, Borowsky 2000). Finally, in Hungarian round harmony, discussed by Ringen and Vago (1998), the feature [round] in a mid short front suffix vowel must be licensed by association with a root vowel or with a rounded vowel other than a short mid vowel: exx. [fül] 'ear' / [fül-höz] 'ear (allative)', [víz] 'water' / [víz-héz] 'water (all.)' / [viz-ünk-höz] 'water (1pl poss.-all.). Kaun (1995) has pointed out that rounding contrasts are perceptually subtle in front and nonhigh vowels. This rounding harmony thus improves perceptibility of a weakly discernible contrast in a short vowel via extension to a root vowel or less perceptually-marked suffix vowel.

The source of control by the weak positions in the above-mentioned harmonies is an area for further study in the context of each of their linguistic systems. Its foundation may lie in well-

formedness constraints that prevent the weak position from capitulating. Morphological factors may also play a role. In each case, the relevant constraint that blocks dominance by the strong position will outrank positional faithfulness.

It is not always the case that content in the weak position wins out over positional faithfulness. There are patterns in which the weak position gives way. This can result in spreading from strong to weak or neutralization of contrast in the weak position under the following generalized ranking:

(58) LICENSE(Weak-structure, Strong position), IDENT-IO-Strong-position >> IDENT-IO

Vowel harmony in the Dravidian language, Koya (Tyler 1969), is a candidate for treatment under this ranking structure (cf. Majors 1998). In Koya, all long vowels are strong, not only by virtue of their inherent duration, but according to Tyler (1969:32) they are also stressed. The comparatively weak unstressed short /i, u, a/ show a pattern of featural dependency on the prosodically strong positions. These vowels fully harmonize with a long vowel in the following syllable, i.e. in this context they do not independently support vowel features. In contrast to the strong target harmonies discussed above, the stressed position remains faithful. Examples affecting /u/ and /a/ are given in (59) (Tyler explicitly states that [i] is also affected in the same context). Koya has a ten vowel inventory /i, i:, e, e:, a, a:, o, o:, u, u:/. Among the short vowels, /i, u/ are weak by virtue of being high. The tendency of short /a/ to be realized as [ə] in the majority of nonfinal contexts might be the reason that it is the only nonhigh vowel affected. Following Tyler, capital letters are used as allomorphic cover symbols in underlying representations. The diacritic [.] marks prepalatal segments.

(59) Koya

- | | | | | |
|----|-------------------|---|--------------------------|----------------|
| a. | /a:ru-+va:y#e:ɖu/ | → | [á:r <u>á</u> vá:yyé:ɖu] | ‘sixty-seven’ |
| b. | /ira+vu:ru/ | → | [ir <u>u</u> vú:ru] | ‘both’ |
| c. | /vaŋak+IT+e/ | → | [vaŋ <u>í</u> kí:te] | ‘it will bend’ |

The hierarchy in (58) can effect the neutralization of a mid/high contrast in weak position. A case involving vowel height is found in the Native American language, Luiseño, in which mid vowels raise to high in unstressed syllables (Munro and Benson 1973, Crosswhite 1999).

(60) Luiseño

<u>Unraised</u>		<u>Raised</u>	
a. hédí-	‘to open’	hídíki-	‘to uncover’
b. tʃóka-	‘to limp, be crippled’	tʃukátʃkaʃ	‘limping’
c. tʃapómkat	‘liar’	tʃáʃpumkatum	‘liars’
d. puló·v	‘good’	pópluvum	‘good (pl)’

For our purposes the key observation is that unstressed syllables are incapable of licensing a mid/high contrast (cf. Crosswhite 1999, to appear). The highly ranked IDENT-ó prevents satisfaction of licensing via spreading to the stressed syllable, and the result is loss of height contrast. The sensitivity of formal licensing constraints to contrastive properties is an issue to which I return in §8. Under conditions of neutralization, it falls to markedness constraints to determine vowel height quality. In Luiseño, the neutralized height optimizes with respect to the prominence reduction hierarchy, resulting in across-the-board raising in unstressed syllables.

Patterns of high vowel syncope, e.g. in certain Arabic dialects (Brame 1974, Hayes 1995), are additional examples where high unstressed vowels undergo effacement. From a historical perspective, syncope also occurred in incipient form in late Latin, producing changes like those shown in (61) in the development of Italian (Grandgent 1927). Syncope in an unstressed penultimate syllable in words with antepenultimate stress was also manifested in the development of certain other Romance languages, including Catalan, French and Spanish.

(61)	<u>Latin</u>	>	<u>Italian</u>	
a.	cŏmĭtem	>	cónte	‘count’
b.	nĭtĭdus	>	nétto	‘clean’
c.	vĭrĭdis	>	vérde	‘green’
d.	calĭdus	>	caldo	‘heat’
e.	cŏmpŭtus	>	cónto	‘account’
f.	spĭnŭla	>	spilla	‘pin’
g.	spathŭla	>	spalla	‘shoulder’

h. altera > altra 'other (f)'

To summarize, the various phenomena reviewed here suggest that weak vowels, such as those in unstressed or affixal position, are avoided as the locus of certain contrastive featural information. Many patterns show an asymmetry, centering specifically on high vowels within these positions. If the low vowel /a/ is involved in weak contexts, as in Somali and Koya, then high vowels are too, as expected given their weaker perceptibility. The problem may be resolved by some form of augmentation, for example, spreading from weak to strong position or metathesis of a weak element into a strong position. Alternatively, the weakly perceptible contrast may be eliminated, for example, through spreading from strong to weak position, deletion of weak structure, or neutralization via vowel reduction, which in the case of a mid/high contrast may be accomplished through raising to minimize the unstressed syllable's prominence. Given the variety of possible repairs, an approach to Veneto metaphony which calls upon a licensing constraint for weak structure appears promising in its potential for crosslinguistic application. A licensing approach reveals a shared motivation operating across these seemingly diverse vowel patterns.

A further imaginable resolution of licensing would shift stress to the site of weak structure, for example, a pattern in a language presenting the same segmental and prosodic configuration as Veneto but with shift of stress to a high vowel that would otherwise be post-tonic. To the best of my knowledge, no such pattern occurs. While we may speculate that the disruption to metrical structure arising from a stress shift would render this outcome unlikely, the question remains as to why certain kinds of prosodic augmentation are unattested. This points up an issue for phonological theory in general: the site of a strong position appears to never be altered in order to preserve weak structure. Hence, stress never shifts to a syllable containing weak structure to render it more audible. In counterpoint, prominent or augmentative material can influence the locus of stress (Prince and Smolensky 1993, Kenstowicz 1996, Hayes 1995, Walker 1997, Zoll 1997, de Lacy 2001b, Smith 2002). The pervasive trend is for prioritization of metrical considerations: a stress shift may occur to increase the prominence profile, but a shift to rescue weak content which would diminish stress prominence or interfere with rhythm structure is avoided. The consequence is that

prosodic licensing of weak structure must be parasitic on metrical structure that is independently determined.

Within OT, a stress shift to a syllable containing weak structure could be attained under a ranking where the licensing constraint and IDENT-IO(high) supercede the constraints responsible for locating stress. Nevertheless, the problem of theoretically excluding such a pattern is not specific to the OT framework. It would likewise confront a rule-based approach to the range of patterns examined in this section. Something must exist in the theory to prevent a rule or constraint ranking that will shift stress under these circumstances. How this generalization is to be captured, in an OT framework or otherwise, remains an open question for further investigation. Wilson (2000) directs recent research towards the problem of ‘too many solutions’, stimulating his proposal of targeted constraints. This approach might prove fruitful in addressing this issue.

7. Alternatives

I now consider two alternative approaches to metaphony: one treating the spreading imperative and its domain and the other treating control by weak triggers. Both are argued to be problematic.

First, this paper develops an approach under which metaphony (and other weak trigger patterns) are driven by licensing of weak structure. Let us consider a different view of the harmony imperative, posited by Flemming (1993), in which the height feature spreads blindly, absent licensing and its proposed phonetic motivation. Under the analysis in question, metaphony is driven by a rule that spreads [+high] leftward in the metrical foot. No reference to stress is made.

Such an approach is confronted with typological and explanatory issues. Because blind spreading lacks a perceptual grounding, it predicts no restrictions on the nature of the trigger and target. Parallel processes that spread height features from nonhigh vowels only are predicted to be equally attested. However, metaphonies favor high vowel triggers. Other harmonies discussed in §6 that are controlled by a weak position and initiated by only a subset of vowel qualities also show a preference for [+high] triggers or other weak qualities. These asymmetries are predicted by the licensing account.

In addition, the within-foot spreading analysis treats the targeting of the foot head as purely epiphenomenal. It posits that the termination of spreading at the foot boundary arises from a condition prohibiting [+high] from being associated to two positions that do not belong to the same foot. This misses the perceptual advantage explanation that the stress-licensing account incorporates: it is the phonetic correlates of stress that make this position the target of spreading from a weak trigger. Moreover, blind spreading overlooks the connection between metaphony and other phenomena discussed in §6 which conspire to avoid the expression of a vocalic contrast within a weak position, i.e. which show effects of licensing driven by perceptual markedness. In metaphony the contrast is extended to a stressed syllable, while other phenomena that fall under licensing include metathesis of weak vowels to stressed syllables and vocalic neutralization and deletion in unstressed syllables.

A further consideration concerns the operation of metaphony in words with antepenultimate stress (proparoxytones). In many dialect groups, including Veneto, a final high syllable is capable of producing raising in the antepenultimate syllable (ex. Grado: /enʃen-i/ → [ínʃini] ‘shin (m pl)’). The problem raised by proparoxytones is how the trigger and target can belong to the same foot under the well-motivated assumption of binary foot structure (e.g. Prince 1985). Italian is regarded by many scholars as having trochees which are binary in composition (see D’Imperio and Rosenthal 1999, among others). In order to account for metaphony in proparoxytones, the foot-delimited spreading account requires an assumption that the final syllable is extrametrical and then stray-adjoined to form a foot composed of the stressed syllable and all following unstressed syllables (Flemming 1993:11-12). This particular view of the foot structure is otherwise debatable (cf. Burzio 1993, Nespor 1993, note also Thornton 1996). In contrast, an approach in which the stressed syllable is licenser is compatible with a foot structure that does not exceed two syllables and eliminates any need for ad hoc ternary (or larger) foot structures in Italian.³⁵

In large part, similar issues confront other non-licensing approaches in which a metrical constituent delimits the metaphony domain (Zubizarreta 1979, Hualde 1989, Calabrese 1998). Most significantly, such analyses fail to incorporate the perceptual motivation. They thereby miss the

insight that not only prosodically weak vowels trigger harmony, but also vowels that are perceptually weak by virtue of their featural make-up, e.g. high vowels, and these weak qualities together promote the stressed syllable's assimilation. Moreover, even if the licensing account were modified so that the post-tonic restriction on triggers were replaced by a condition requiring that metaphony operate within a metrical constituent, the approach would miss contact with the various processes across dialects that attest to the asymmetric phonological weakness of post-tonic vowels (see §4). It would therefore overlook the motivation for licensing features that belong to post-tonic syllables in particular.

A second proposal of this paper is that the control of harmony by unstressed syllables is an epiphenomenon of prominence based markedness. A possible alternative would be to instead attribute unstressed vowel control to prioritization of faithfulness specific to [+high]. The alternative under consideration would require that IDENT-IO(high) be split into separate constraints for IDENT(+high), as in (62), and IDENT(-high), formulated likewise for [-high].

(62) IDENT-IO(+high)

Let α be a segment in the input and β be any correspondent of α in the output. If α is [+high], then β is [+high].

The IDENT(+high) constraint would then be ranked together with licensing over IDENT(-high), stressed syllable faith and root faithfulness. This would compel the preservation of [+high] in the unstressed syllable, as illustrated in (63).

(63) IDENT(+high), LIC(+high) >> IDENT- \acute{o} -IO(high), IDENT-IO(high)_{Rt}, IDENT-IO(-high)

/bev-i/	IDENT(+high)	LIC(+high)	IDENT(high) _{Rt} IDENT- \acute{o} -(high)	IDENT(-high)
a. $\text{b}^{\text{v}}\text{b}^{\text{v}}\text{i}$			* *	*
b. béve	*!			
c. bévi		*!		

An issue such an approach faces concerns the split of IDENT(high). Although previous studies of certain monovalent features have found support for distinguishing their deletion or insertion – for example, [Nasal] (Pater 1999) and [Round] (Walker 2001a) – firm support has not been

accrued for faithfulness constraints singling out binary height feature specifications. Indeed, two previous studies of vowel height harmony suggest such a move is not warranted (Beckman 1997, Baković 2000; the latter focuses chiefly on [ATR]). In that research, as well as the present work, asymmetrical patterning of height specifications is accomplished through markedness statements referencing particular height values or feature cooccurrences, which render a split treatment of faith for [high] superfluous. Moreover, retaining a unitary faithfulness constraint for [high] is desirable from the viewpoint of minimizing the universal constraint set, and hence, the factorial typology.

There is an approach that proposes a type of value-sensitive faithfulness for vowel features including height. Based on his study of Yoruba, Pulleyblank (1998) suggests a harmonic scale wherein the ranking of faithfulness to tongue height and advancement features increases with sonority as follows: nonhigh back > nonhigh front > high back > high front. This scale prioritizes faith to more open (nonhigh) values, which stands in direct conflict to the ranking needed for the split IDENT(high) approach shown in (63). Thus, to the extent that a value-specific view of faithfulness has found utility, it does not concur with asymmetric precedence for faith to [+high].

A final drawback of the approach depicted in (63) is that it misses a connection to the activity of prominence reduction in Veneto and numerous other Italian dialects: the widespread generalization is that unstressed vowels may raise but they resist lowering. This holds true even when [high] is not the particular height feature involved, for example, in raising of mid [-ATR] vowels to [+ATR]. The prominence based account developed in this work directly integrates this property of the phonological system.

8. Conclusion

This paper began with three central questions: (i) why do vowels in weak positions trigger harmony? (ii) under what circumstances do they show asymmetrical control? and (iii) in the face of these patterns can previous theoretical approaches to the customary prioritization of strong positions be maintained? In answer to the first question, this study has argued that vowels in weak positions trigger harmony because of their perceptual markedness. Two phonetically grounded

strategies for improving weak perceptibility are witnessed in Veneto. In the stress-targeted case, featural spreading propagates to the stressed syllable. This prosodic based exposure is driven by prosodic licensing constraints that mandate the coincidence of perceptually difficult structure with a prominent position. Alternatively, spreading extends beyond the stressed syllable, achieving exposure via maximized duration. This pattern is determined by constraints that require full spreading of perceptually weak structure.

The apparent prioritization of the weak vowel quality is argued to result from the activity of markedness factors in the form of prominence reduction constraints. This answers the second question. Grammatical constraints do not specify weak vowel control, rather this emerges as an epiphenomenon of constraint interaction within a language. The avoidance of vowel lowering in unstressed syllables working together with a high-ranking spreading/licensing imperative overrides faithfulness in the stressed syllable.

The domination of positional faithfulness in these patterns relates to the third question. Positional licensing (markedness) constraints prove essential in driving stress-targeted harmony – such patterns cannot be attributed to constraints that require faithfulness in stressed position. This research thus accrues support for the inclusion of positional markedness in the characterization of certain position sensitive phenomena (Zoll 1996, 1997, 1998). A pivotal feature in the account of strong target harmonies is the precedence of positional markedness over positional faithfulness. In Veneto, not only is stressed syllable faith dominated, but also the Root-Faith >> Affix-Faith ranking, suppressing trigger control of harmony by positions of prosodic and/or morphological strength. On the other hand, in those vowel harmonies that issue from a strong position, positional faithfulness plays an important role in characterizing the trigger (e.g. Kaun 1995, Beckman 1997, Majors 1998, Baković 2000, Krämer 2001, Walker 2001a). These are distinguished from strong target patterns by the rise of positional faithfulness constraints in the hierarchy.

A more general consequence is that markedness is a complex issue in vowel patterns. Prosodic position, perceptibility, articulatory difficulty, and contrastive status are among the various interactive factors that may contribute to what is known as featural ‘markedness’. Which factors are

emphasized may vary according to the process. The nature of vowel height markedness in unstressed syllables serves to illustrate. In the literature, high vowels are typically viewed as unmarked (see Beckman 1997 for a review). This is supported by the observation that the occurrence of mid vowels in an inventory usually implies the occurrence of high vowels and the fact that high vowels have a default character in many languages. Yet, evidence gathered in the present work points to a conceptualization where markedness is assessed in the context of the phenomenon at hand and relativized to the linguistic system under scrutiny. If the focus is prominence reduction and avoidance of the articulatory effort needed to maintain a contrast, then the ‘unmarked’ vowel quality is often high. However, if the aim is perceptibility of a mid/high contrast in an unstressed syllable, then the ‘unmarked’ vowel quality can be mid: it has the advantages of greater duration and amplitude.

The role played by contrast in influencing perceptual markedness brings us back to the observation in §3 that licensing constraints may be sensitive to improving exposure of contrastive features. This suggests that some languages may warrant an extension of the licensing account proposed for Veneto, one that incorporates access – whether direct or otherwise – to the contrastive function of features. The problem of accessing such information is a matter in the theory that requires further investigation beyond the scope of this paper, but I briefly consider some framing aspects of the phenomena to be addressed. The generalization is that licensing preferentially operates over [+high] in circumstances where it carries distinctive information, i.e. it stands in opposition to [-high]. This is apparent from the findings of Dyck’s (1995) survey, which reveals a correlation between nonlow vowels that do not show a mid/high contrast in the affix inventory and their failure to trigger metaphony. Moreover, in conditions where neutralization of a mid/high contrast takes place in an unstressed syllable, specifications for [high] are no longer distinctive. Under a view that such neutralizing contexts may be exempt from licensing, rendered either through a revised formulation of the licensing constraint or the nature of the phonological structure itself (or both), then it falls to markedness constraints to determine the quality of the unstressed vowel, as discussed in §6. Phenomena of this kind are suggestive that exploring and developing formal

connections between licensing and contrast would be a fruitful area for future research.

On the flipside of contrast, the findings of this study have the potential to integrate with explanation of the character of epenthetic vowels. Although crosslinguistically [i] is frequently the default vowel quality, for example in Palestinian Arabic (Brame 1974) and Nupe (Hyman 1970), a wide range of other epenthetic vowel qualities exist (see, e.g., Rice 1999). A nonexhaustive list includes front nonhigh vowels, [e] in Modern Hebrew (Kenstowicz and Kisseberth 1979:311) and [ɛ] in Spanish (Hyman 1975), central vowels [ɨ] and [ə] in Lenakel (Lynch 1974, Blevins 1995, Kager 1999), back high vowel qualities [u/ʊ] in Japanese, with [o] and [i] occurring in certain consonantal contexts (Lovins 1973, Hyman 1975), and the low vowel [a] in Serbo-Croatian (Kenstowicz 1994). In addition, part or all of an epenthetic vowel's quality may be conditioned by vowel harmony, as in the case of the epenthetic high vowel in Turkish, which undergoes back and round harmony (Clements and Sezer 1982), and copy epenthesis, occurring in Selayarese (Kitto and de Lacy 1999). Clearly numerous interactive factors, both context-sensitive and context-free, can impact (un)markedness as manifested in epenthetic structure. Continued elaboration of the elements at play in vowel markedness relations will inevitably shed further light on the connections operating between a particular epenthetic vowel quality and the linguistic system in which it occurs. The findings of the present work suggest that efforts could productively be directed towards further fleshing out the effects of perceptual markedness, for instance, provoking feature extension from neighboring vowels or favoring a vowel quality that optimizes perception of an adjacent consonant (see also, e.g., Flemming 1995, Ní Chiosáin and Padgett 2001). Exploring the points of coincidence or conflict between perceptual markedness and articulatory based or prominence based markedness holds promise for future progress in this area.

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¹ In addition to stress-triggered raising, Servigliano has two separate harmonies involving post-tonic vowels: post-tonic vowel copy and metaphony (Nibert 1998).

² For some speakers the pattern shows more variability if the trigger is in the penult.

³ Among those speakers in the central region for whom metaphony is less robust, raising in the antepenult in forms like /orden-i/ → [úrđini] is less regular. This suggests that for these speakers metaphony is obligatory only if the trigger and target belong to adjacent syllables. However, Cortelazzo (1978) does not indicate variability for comparable structures in (7g, o) from Grado.

⁴ The suffixation *-ino* is an alternate form of *-imo*, but less common (Rizzi 1989).

⁵ The example of *mónega* is drawn from El Galepìn (www.veneto.org/language/galepin/galepin.html), a database of Venetan dialect forms.

⁶ This example is drawn from Marin (1981).

⁷ Apart from the phonological patterns described here, some speakers show occasional instances of raised mid vowels in the context of a high stressed vowel, a phenomenon that is reportedly

sporadic and irregular, *exx.* /dorm-i/ → [durmí] / [dormí] ‘sleep (2pl imp.)’, but [vendí] ‘sell (2pl imp.)’, [vejní] ‘come (2pl imp.)’ (Marcato and Ursini 1998).

⁸ Maiden (1991:127) discusses an additional possible factor influencing the preference for open syllable targets. He points out that the length difference conditioned by closed versus open syllable structure may correlate with a height differential: shorter (mid) vowels tend to be lower than longer ones in Romance. Maiden observes that higher vowels are favored targets in metaphony. For example, Italian dialects in which lower mid vowels are affected in metaphony will also target higher mid vowels. He speculates that a lower vowel height might be an inhibiting factor for metaphony in closed syllables. See Calabrese (1998) for discussion in terms of an [ATR] contrast in these vowels. As Calabrese notes (1998:63-64, n. 17-18), more research on vowel quality in closed versus open syllables is needed in the relevant dialects to fully assess height as a factor.

⁹ In eastern Asturian dialects, the high/mid contrast is weak in both the front and back vowels. Dyck (1995:67) argues that the irregular ‘metaphony’ in this region is a historical residue, and Penny (2000:100) confirms that metaphony in eastern Asturias is only ‘vestigially present’. According to Penny (2000), phonologically-active metaphony triggered by /i/ persists in certain areas of the central Asturias region where a contrast between i/e remains, although as Neira (1983) notes, its extent is limited. Penny (2000:100) observes the existence of some varieties in which /i/ and /e/ have merged where a morphologized metaphony is witnessed. The implication nevertheless holds that phonological metaphony favors propagation of distinctive features. Even if certain cases were to be analyzed as involving phonological metaphony triggered by weakly contrastive or noncontrastive high vowels, these segments are not singled out as triggers to the exclusion of contrastively high vowels (if they occur in the language). As Dyck has shown, the reverse implication does not hold, i.e. triggering of metaphony by contrastively high vowels may occur while noncontrastive high vowels remain inert.

¹⁰ Dyck (1995) argues that a ‘metaphony’ occurring in Calvello prenominal forms containing a vowel sometimes realized as [u] is morphologized and not a regular phonological process.

¹¹ This points stands independent of the particular mechanism or approach used to obtain ‘counterbleeding’ interactions, on which this work remains neutral. See McCarthy (1999), among others, for discussion.

¹² Some of the patterns that Jiménez discusses show maximal spreading in one direction only.

¹³ High and mid vowels might each present perceptual challenges that can provoke harmony. The perceptual difficulties of high vowels are noted herein. On the other hand, Steriade (1995) suggests that mid vowels are disadvantaged by their nonperipherality (see also Crosswhite 1999). In Bantu height harmony wherein suffixal high vowels become mid after mid vowels, Steriade suggests that the marked property [nonperipheral] spreads. But see Hyman (1998, 1999) for a different analysis of this phenomenon in terms of ‘plateauing’ in some languages.

¹⁴ As discussed in §5, final unstressed /u/ is regularly centralized in Pasiego, as characterized by Hualde (1989). A centralization harmony is also evident in these data. (Compare McCarthy 1984 for characterization of the alternations in terms of tense/lax.)

¹⁵ Andalusian Spanish laxing harmony also shows some similarities to the Veneto maximal extension pattern. A lax final vowel spreads laxness to preceding mid vowels up to and including the stressed syllable, exx: [ljévre] / [ljévre^(h)] ‘hare’ (sg/pl) (Zubizarreta 1979). Laxing may persist to pretonic vowels, although this is less systematic, exx: [monótono] / [mɔnótɔno^(h)] ‘monotonous (sg/pl)’, [moménto] / [mɔméntɔ^(h)] ‘moment (sg/pl)’. Nevertheless, unlike Veneto, pretonic laxing may also occur when the initiating final vowel is stressed: [koséh] → [kɔséh] ‘sew’ (the word-final consonant in the last example may be realized as either [h] or a lax fricative lateral).

¹⁶ Kaze (1989) suggests that metaphony in the Muccia dialect involves lowering before /a/. However, the data also appear consistent with raising before nonlow vowels. In fact, with the exception of one example, the data could be analyzed in terms of raising before /i, u/. Furthermore, certain cognates in other dialects are suggestive that raising rather than lowering is at play.

¹⁷ Majors (1998) and Crosswhite (1999) formulate prosodic licensing constraints in a similar spirit. In utilizing the positional markedness mode of licensing, this analysis has parallels to other

applications and extensions of Zoll's proposal, including Walker (1997), Ringen and Vago (1998), Balassa (2000), Alber (2001), and Kager (2001), among others; and note Goldsmith (1990), Flemming (1993) and Steriade (1995) on indirect feature licensing. Compare Dyck (1995), who also proposes that metaphonic spreading is provoked by an asymmetry between a vowel in a dependent (weak) position and a vowel in the prosodic head. Under her account, the weak vowel is posited to have greater structural complexity than the stressed vowel, creating an ill-formed contour that is resolved by spreading.

¹⁸ Compare Majors (1998), who proposes that affix-specific faithfulness constraints determine that unstressed vowels do not give way to the stressed vowel in the metaphony of northern Salentino. Compare also Krämer (2001), who proposes that INTEGRITYAffix may be prioritized, but within his framework of syntagmatic correspondence this achieves harmony that propagates from stem to affix.

¹⁹ Given the superset nature of successively lower ranked constraints (as formulated here), a stipulated ranking will not be necessary. Crosswhite (1999) adds a further constraint, *Unstressed/ə, at the bottom of the hierarchy. Since the data under scrutiny here contain only full vowels, this constraint will not be relevant.

²⁰ The constraints in (32) are also responsible for the more aggressive reduction in northern Salentino, wherein mid vowels /ɛ, e, ɔ, o/ raise to [i, u] in unstressed syllables (see §3.1).

²¹ Comparative markedness (McCarthy 2002) is also capable of capturing the avoidance of derived marked structure. The particular choice of approach for Veneto is not pivotal here.

²² An alternative harmony constraint AGREE[F] has been proposed, which requires adjacent segments to have the same value for feature [F] (Baković 2000). AGREE[F] drives 'iterative' spreading through avoidance of local contours in specification for a given feature. However, it is not clear how this formulation could obtain Veneto's harmony, because spreading of [+high] only issues from a post-tonic vowel. Hence, in configurations where a high stressed vowel is preceded by a pretonic mid vowel, it is necessary to reference whether the [+high] feature is also associated

with a post-tonic position nonadjacent to the pretonic vowel. This motivates the formalism in (39) requiring spreading of [+high] from a post-tonic vowel to all vowels.

²³ A typological overview by Hyman (2002) identifies a preference for vowel harmony to be regressive in cases where morphological root control is not at play. (Note also Koya vowel copy harmony discussed in §6.) This apparent asymmetry awaits further study; however, word-final faithfulness plausibly plays a role in determining the regressive directionality in many cases.

²⁴ Compare Ringen and Heinämäki (1999) and references therein on an alternative approach to variation using unranked constraints.

²⁵ Valente (1975) reports that unstressed vowels in Pugliese are phonetically reduced to schwa. As mentioned in §3, this is also true of post-tonic vowels in Calvello. Hence, metaphony in these dialects is opaque.

²⁶ An alternative approach using a scalar-valued height feature is discussed by Clements (1991) and Nibert (1998).

²⁷ Although a rare outcome, /a/ diphthongizes in some dialects to [je] (Maiden 1991:112) or [ia] (Calabrese 1985:49; but cf. Maiden 1991:146 n. 27). Yet in Ischia, where mid [-ATR] vowels diphthongize, metaphony of /a/ produces a monophthong: /a/ → [ɛ], /ɛ/ → [je], /ɔ/ → [wo] (Maiden 1991:112-113). Contrast preservation and avoidance of (derived) diphthongs containing lax vowels (i.e. [je, wo]) might play a role in preventing diphthongization of /a/ here.

²⁸ See Walker (to appear) for an alternative approach under which the licensing constraint is satisfied by both multiple linkage of features and correspondence between features in separate vowels. The latter configuration accommodates licensing at a distance.

²⁹ It is noteworthy that diphthongization of [-ATR] mid vowels in western Romance metaphony typically produces diphthongs that rise in sonority, such as [je] or [wo], rather than falling diphthongs. This might simply result from similarities existing within related languages in the development of metaphony processes. It is conceivable that contrast dispersion factors might also

play a role. Whether these represent gaps in possible scenarios across the world's languages remains to be seen.

³⁰ In Lena, /a/ raises to front [e], whereas in the neighboring Nalón Valley variety, /a/ raises to back [ɔ] (Hualde 1989, 1998). Hualde attributes this to differences in /a/'s specification for [±back] in these dialects. Further study of this issue is merited.

³¹ See Maiden (1991:128-130) on exceptions to this implication. A few dialects show metaphony affecting only [-ATR] mid vowels. Maiden suggests a possible source in the non-neutralizing diphthong outcome for these vowels. There may have been resistance to /e, o/ → [i, u] alternations, because it neutralized a phonemic opposition.

³² This case is not a counter-example to Maiden's claim that metaphony of lower vowels generally implies metaphony of higher vowels. His use of the term 'metaphony' refers to raising height assimilation processes (1991:112), whereas umlaut in Old High German involves fronting, i.e. assimilation involving [-back] (Flemming 1993).

³³ Many scholars agree that umlaut in Old High German (OHG) was a phonologically conditioned process, possibly with some morphological restrictions (e.g. Robinson 1976, Flemming 1993, Salmons 1994, Iverson and Salmons 1996, Wiese 1996). Evidence for its phonological status stems from phonological restrictions on its context. Compare Janda (1998), who supposes that the process was phonological in pre-OHG but fully morphologized in OHG and later, despite its phonological restrictions. However, as Klein (2000:27) points out, Janda's approach leaves undetermined how the phonological characteristics of umlaut phenomena are to be explained.

³⁴ Harmony in Älvdalska and Elverum (Scandinavian) might also fall into this category (Riad 1998). In these dialects, a root vowel in a light syllable is affected by the following vowel when both belong to the same bimoraic trochaic foot (Älvdalska shows total harmony, Elverum height harmony). However, as Riad points out, the nature of the prosodic conditioning needs further

investigation, as there appears to be sensitivity to accent and controversy exists regarding which syllables bear stress.

³⁵ See Beckman (1998:163-164) and Majors (1998:92-94) for discussion of drawbacks for an analysis of stress-triggered harmony as spreading within the foot.

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