On the nature of vowel harmony: spreading with a purpose

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Abstract

This paper discusses the interaction between constraints governing production of speech and those governing perception of speech, focusing on the issue of vowel harmony. Three different cases of vowel harmony within Romance languages are reviewed to show that configurations of the harmonic domains can be triggered either by demands of articulation or by demands of perception. The former pattern entails improvement of perception as a side effect; the latter may show secondary gains on articulation and typically has the primarily function of preserving a relevant paradigmatic distinction. I present an analysis cast in Optimality Theory (OT) that allows predicting the direction of the spreading from the type of harmony, following previously established patterns based on the notions of Positional Faithfulness and Positional Markedness. Conditions on targets and triggers are derived from general restrictions placed on the harmonic elements. The selection of the harmonic feature is instead derived from specific properties that features have in each system.

1. INTRODUCTION

Harmony has the effect of making segments that are not necessarily adjacent more similar to each other in some domain (typically, the word or the foot), at the cost of changing input properties. One central point in the study of harmonic properties is to find out the reasons for the spreading. There are at least three approaches to answering such a question. One is articulatorily based: harmony results from languages attempting to minimize resetting of articulators (e.g. Smolensky, 1993, Pulleyblank, 2002). Under this view, the general prediction is that the harmonic feature occurs in a strong position and spreads to weak positions to minimize the articulatory effort (within OT, this is an instance of *Positional*

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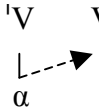
Faithfulness; e.g. Beckman, 1998, Baković, 2000). The figure in (1) illustrates such a pattern with stressed (strong) and unstressed (weak) vocalic positions.

(1) *Positional Faithfulness*: strong → weak pattern

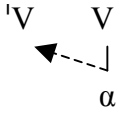


Driving force: Gestural uniformity (articulatory basis)
By-product: Increase the perceptibility of α (functional basis)

In the previous example, strong/weak positions refer to stressed/unstressed positions, but classical harmonies of this type also involve the dependence of affix vowels (morphologically weak positions) —typically suffixes— on the vowels in the root (a morphologically strong position).

The alternative approach is perceptually based: harmony results from languages attempting to license contrasts in maximally perceptible positions (e.g. Steriade, 1995, Zoll, 1997). Under this view, the general prediction is that the harmonic feature appears in a weak structure and is attracted to strong positions to become more perceptible (within OT, this is an instance of *Positional Markedness*; e.g. Walker, 2005, 2006). The figure in (2) illustrates such a pattern with unstressed (weak) and stressed (strong) vocalic positions.

(2) *Positional Markedness*: weak → strong pattern



Driving force: Increase the perceptibility of α (functional basis)
By-product: Gestural uniformity (articulatory basis)

As in the previous case, strong/weak positions may also involve morphological positions. In this case, the assimilation affects root vowels under the influence of affixes.

A further view is that harmony attempts both to maximize perceptibility and to minimize changes in the state of articulators. This approach favors larger spans of features, which are nevertheless protected by faithfulness to preserve certain input contrasts. Unlike the two previous approaches, this view fails to predict the directionality of the spreading, which has to be somehow stipulated (within OT, this is an instance of *Optimal Domains Theory*, Cole and Kisseberth, 1994 or *Span Theory*, McCarthy, 2004). The issue, then, is whether the three types of harmony actually exist. In this paper I review three examples of vowel harmony (VH) within Romance that have been previously discussed in the OT literature (i.e. Ascrea Italian, Valencian Catalan, and Eastern Andalusian Spanish) to show that, although it is true that certain harmonic patterns improve both perception and articulation (e.g. Valencian VH and certain cases of Ascrea and Andalusian VH), others only improve perception in certain contexts (e.g. certain cases of Ascrea and Andalusian VH). It is also shown that in all cases there is a clear initiator, whether articulatory (Valencian VH) or perceptual (Ascrea and Andalusian VH). Hence, only types (1) and (2) exist and directionality of the spreading can be deduced from the harmonic pattern they follow. The examples further show that the perceptual component is favored when the initiator is articulatory (Valencian VH), but articulation can be favored or not as a side effect when the initiator is perceptual (Ascrea and Andalusian VH).

A related issue discussed in this paper that is not always properly addressed in the study of harmony is the selection of the harmonic feature. The examples analyzed here support Archangeli and Pulleyblank's (2007: 357) viewpoint according to which "evidence suggests that there is no a priori list [of harmonic features], but rather that the differential behavior of features vis-à-vis harmony is an artifact of other properties of those features and

their interactions, not specific to harmony itself." In contrast, limitations to the characteristics of targets and triggers are derived from general restrictions placed on harmonic elements.

The paper is organized as follows. Section 2 shows asymmetries encountered in the effects of VH, section 3 analyzes three cases of VH within Romance languages to illustrate different harmonic patterns, and section 4 brings the results together and presents the conclusions.

2. ASYMMETRIES INVOLVING THE FINAL EFFECT

Positional Faithfulness and Positional Markedness are two complementary approaches independently necessary to account for other types of phonological processes that can be used to explain harmonic patterns with distinct motivations. The Positional Faithfulness VH pattern is characterized by predominance of the faithfulness constraints that preserve the features (F) that occur in strong positions (i.e. the IDENT(F)-StrongPosition constraint family; cf. (3a)) (4a). The Positional Markedness VH pattern is instead characterized by predominance of the markedness constraints that favor the association of features to strong positions (i.e. the LICENSE(F)-StrongPosition constraint family; cf. (3b)) (4b).

(3) a. IDENT(F)-StrongPosition: A segment in a strong position in the output and its correspondent in the input must have identical specification for a feature [F] (cf. Beckman, 1998).
b. LICENSE(F)-StrongPosition: Feature [F] is licensed by association to a strong position (cf. Walker, 2005).[1]

(4) a. Positional Faithfulness VH pattern:
IDENT(F)-StrongPosition >> IDENT(F), LICENSE(F)
b. Positional Markedness VH pattern:
LICENSE(F)-StrongPosition >> LICENSE(F), IDENT(F)

As said, a well-known asymmetry between the two views concerns the predicted directionality of the spreading: under Positional Faithfulness, the spread takes place from strong to weak positions; under Positional Markedness, the spread takes place from weak to strong positions. A less noticed and interesting asymmetry concerns the final effects of the change. Under Positional Faithfulness, the harmonic process reinforces a feature that already appeared in a strong position by spreading it over other positions. Hence, the weak gets weaker by assimilating to the strong and the strong gets stronger by spreading its features. It thus follows the prototypical pattern according to which strong elements are attracted to strong positions, with the overall effect of turning stronger strong elements. Under Positional Markedness, though, the harmonic process reinforces a feature that appeared in a weak position by spreading it over strong positions. Hence, not only a weak element becomes stronger through the spread, but also a strong element becomes weaker because it is altered through the assimilation and acquires the weak feature. This is a striking effect that merits taking a closer look at the reasons for such spreads, which in my view depend on the properties of the trigger.

[1] Walker (2006), upon Rose and Walker (2004), reformulates LICENSE in terms of correspondence relations (Generalized Licensing). Here, I follow the formulation in Walker (2005) for simplicity, although nothing hinges on this.

Walker (2005, 2006) states the phonetic conditions that features have to satisfy to be characterized as perceptually weak and instigate a spread through licensing. According to her, they have to satisfy one or more of the restrictions mentioned in (5).

(5) Featural conditions on triggers (*f* is an occurrence of a [F] in an output):
- a. *f* is a specification that is perceptually difficult
- b. *f* belongs to a prosodically weak position
- c. *f* occurs in a perceptually difficult combination

The idea I will put forth here is that features have to satisfy a further condition to initiate the spread through licensing: the perceptually threatened trigger (under conditions in (5)) has to convey a relevant *paradigmatic* distinction, whether underlyingly contrastive or not, that harmony improves or preserves. As we shall see, Ascrea VH and Andalusian VH illustrate this situation. Valencian VH shows instead that harmonies initiated from strong positions do not have this functional restriction. Both types of harmonies, though, can share other type of limitations placed on targets and triggers.

3. HARMONIC PATTERNS

3.1. Ascrea Italian

Walker (2005) analyzes different cases of vowel harmony in varieties of Italy in light of the Positional Markedness view, on which I heavily draw the example presented in this section. One of the dialects Walker studies is Ascrea, which has a seven-vowel stressed system (/i, u, e, ɛ, o, ɔ, a/) but a reduced five-vowel unstressed system (/i, u, e, o, a/). Height characteristics of the vowels in Ascrea are presented in (6). (I follow Walker's binary feature characterization, with the height binary features [high], [low], and [ATR].)

(6)

	i		u	High
[+ATR]	e		o	
[–ATR]		ɛ ɔ		
		a		Low

Ascrea illustrates a typical case of perceptually grounded harmony, triggered by a contrastive low-perceptible value of a feature ([+high]) that appears in a weak prosodic position (word-final unstressed vowels) and targets strong positions (stressed vowels) to become more perceptible. The examples in (7) show how a final high vowel triggers assimilation in a stressed mid vowel to its left.

(7)

	víʃti	'this (m pl)'	cf.	véʃte	'this (f pl)'
	súrdu	'deaf (m sg)'	cf.	sórda	'deaf (f sg)'

Walker's primarily concern is to show that in this kind of harmonies perceptually threatened phonological contrasts are improved through harmony. The pattern is analyzed as an instance of the markedness constraint LICENSE(+high)-ǵ ranked above the faithfulness constraint IDENT(high). The tableau in (8), adapted from Walker (2005), illustrates the basic ranking at work.

(8)

/véʃti/	LIC(+high)-σ́	ID(high)
a. véʃti	*!	
☞ b. víʃti		*

Markedness constraints such as LICENSE(+high)-σ́ only evaluate outputs. Hence, there exists the possibility that the spread takes place from strong to weak positions (with the result [véʃte]), as a means to satisfy gestural uniformity and avoid crucial evaluation of the markedness constraint. In Walker's analysis, this ungrammatical candidate is ruled out by the action of a high-ranked local constraint conjunction of the markedness constraint *σ̆/Son≥e,o and the faithfulness constraint IDENT(high) (9). The constraint *σ̆/Son≥e,o penalizes mid vowels in unstressed syllables, where corner vowels (i.e. [i, u, a]) are favored (cf. Crosswhite, 2004). The constraint IDENT(high) penalizes discrepancies between inputs and outputs with respect to the specifications of the feature [high]. A local constraint conjunction is violated only when both constraints are violated in a given domain (the segment in the case under study) and it is obligatorily ordered before the constraints that conform the conjunction.

(9) *σ̆/Son≥e,o $\&_{seg}$ IDENT(high): If a segment violates *σ̆/Son≥e,o it must not violate IDENT(high), and vice versa.

The local conjunction *σ̆/Son≥e,o $\&_{seg}$ IDENT(high) ensures that [e, o] only occur as instances of /e, o/ inputs (i.e. as instances of faithfulness relations); they can never be derived from other input segments as a result of a change (i.e. they cannot arise as an effect of markedness constraints penalizing mid vowels). The effects of this local constraint conjunction are shown in (10).

(10)

/véʃti/	*σ̆/Son≥e,o & ID(high)	LIC(+high)-σ́	*σ̆/Son≥e,o	ID(high)
a. véʃti		*!		
☞ b. víʃti				*
c. véʃte	*!		*	*

Association of the relevant feature to a strong position minimally satisfies licensing conditions. It is possible, then, that pre-stressed vowels (11a) as well as non-final post-stressed vowels (11b) remain unaffected by harmony, as is the case in Ascrea. Note that the latter, (11b), gives rise to a gapped, discontinuous configuration (i.e. [túrewu]: [… $ú_{[+high]}$ … $e_{[–high]}$ … $u_{[+high]}$], which does not benefit gestural uniformity as far as articulation is concerned.

(11) a. prefúnnu 'profound (m sg)' cf. prefónna 'profound (f sg)'
b. túrewu 'cloudy (m sg)' cf. tórewa 'cloudy (f sg)'

In addition to the limits placed on the trigger, Walker (2005) discusses and analyzes other restrictions placed on targets (i.e. only mid vowels are affected) as well as on the resulting change (i.e. it is a stepwise raising). In other words, mid-close vowels /e, o/ are

raised to [i, u] (cf. (7)) and mid-open vowels /ɛ, ɔ/ are raised to [e, o] (12a), but the low vowel, /a/, does not change (12b).

(12) a. méti ‘reap (2sg pres ind)’ cf. méto ‘reap (1sg pres ind)’
kapóti ‘overturn (2sg pres ind)’ cf. kapɔ́to ‘overturn (1sg pres ind)’
b. mánni ‘send (2sg pres ind)’ cf. mánno ‘send (1sg pres ind)’

This is an interesting result, since both perceptibility and gestural uniformity favor the change to [i, u] in all cases. There exist, however, input-preserving limitations that control the effects of harmony: sharp raisings are prevented to partially maintain the input properties of the vowels. In Walker’s analysis, this is captured through the local constraint conjunction of two faithfulness constraints: IDENT(high) $\&_{seg}$ IDENT(ATR). This combined constraint prevents that a segment changes the feature [high] (a violation of IDENT(high)) and the feature [ATR] (a violation of IDENT(ATR)) at the same time (13).

(13) IDENT(high) $\&_{seg}$ IDENT(ATR): If a segment violates IDENT(high) it must not violate IDENT(ATR), and vice versa.

Additional licensing constraints involving the other height properties (i.e. Low and ATR) are further needed to get the proper stepwise change. For expositional convenience, the cover constraint LICENSE(height)-ó is used instead of appealing to the individual licensing constraints with respect to the height features [high], [ATR], and [low], with the result of spreading to the targets as many height features as possible from the low-perceptible high vowels.[2] The tableau in (14) illustrates these constraints and ranking at work with the case of a mid-open vowel target.

(14)

/mɛ́ti/	ID(high) & ID(ATR)	LIC(height)-ó	ID(high)	ID(ATR)
a. mɛ́ti		**!		
☞ b. méti		*		*
c. míti	*!		*	*

The fact that the low vowel, /a/, never raises impelled by a high vowel (e.g. /mánni/ [mánni] in (12b)) is not due to a restriction on feature incompatibility, since the stepwise raising could turn /a/ into [ɛ] (we shall see a case of feature co-occurrence restriction in §3.3 with respect to Andalusian VH). This limitation is comparable to many other cases of harmony that require certain degree of similarity between the trigger and the target to apply: Archangeli and Pulleyblank (2007) cite several languages with vowel or consonant harmonies that show such restrictions and the case of Valencian VH presented below also fits this pattern. In Ascrea, vowels of contradictory height (i.e. low and high vowels) are too dissimilar to interact, and the height harmony only applies between non-low ([–low]) vowels. In Walker’s analysis, this is interpreted as a consequence of high ranking the faithfulness constraint IDENT(low), as illustrated in (15).

[2] Note that ‘height’ is not an arbitrary set of individual features but rather has phonetic basis, an assumption carried over from traditional feature theory (cf., among others, Clements, 1985, Clements and Hume, 1995). Padgett (2002) recasts this view within Feature Class Theory, where ‘Height’ and ‘Color’ are considered feature classes for vowels.

(15)

/mánni/	ID(low)	LIC(height)-ó	ID(high)
☞ a. mánni		*	
b. ménni	*!	*	
c. ménni	*!	*	
d. mínni	*!		

As Maiden (1991) points out, an additional and relevant condition for the spreading concerns the grammatical nature of the vowels that cause the change: the feature of the vowel that instigates the change is not only phonologically contrastive but also morphologically contrastive; that is, the trigger is not any final high vowel but is a suffix vowel that is the sole carrier of a morphological distinction (e.g. masculine or second-person singular present). Therefore, in Ascrea, a phonological *and* a morphological contrast are perceptually improved through harmony. Walker (2005) disregards this grammatical condition and argues for the purely phonological character of the process.[3] In my view, however, in Ascrea, this grammatical contrast is the *additional* condition required to the (weak) trigger to instigate a change that is capable of altering elements in strong positions. The paradigmatic condition (16), which adds to the feature conditions presented in (5) on triggers, captures this extra limitation.

(16) Paradigmatic condition on triggers:
f preserves a paradigmatic distinction

In Ascrea, this condition is morphological and the relevant feature is underlyingly contrastive (similar cases are reported for other Italian varieties in Maiden, 1991 and for other Romance varieties in Dyck, 1995).[4] The Andalusian case analyzed in §3.3 will show, though, that condition (16) is not necessarily morphological but can protect a derived contrast that somehow preserves relevant input information.[5]

3.2. Valencian Catalan

The VH system of Valencian Catalan is analyzed in Jiménez (1998) within the OT model of Optimal Domains (Cole and Kisseberth, 1994).[6] Valencian VH illustrates a typical case of articulatory harmony, triggered by the color features (i.e. [front] and [back]) that appear in a strong prosodic position (stressed vowel) and spread over weak positions (unstressed vowels)

[3] Walker's (2005) viewpoint lies on the existence of a few cases she reports from other Veneto varieties where root vowels and non-final post-stressed inflectional vowels are capable of triggering harmony as well. All the examples are proparoxytones and show alternative non-harmonized variants (Central Veneto: g[ó]m(b)i-o ~ g[ú]m(b)i-o 'elbow', fas[é]-vimo ~ fas[í]-vimo 'have (1pl impf ind)'; Grado: s[ɔ́]riʃ-o ~ s[ú]riʃ-o 'mouse'), which suggest an interpretation in terms of analogical extension from the regular (non-alternating) cases.

[4] Dyck's (1995) cross-dialectal and cross-linguistic study of metaphony confirms that phonetically high vowels trigger harmony only under circumstances of high/mid contrasts in suffixes.

[5] Campos-Astorkiza (2007) also modifies Walker's (2005, 2006) analysis by including the notion of 'minimally contrastive features', which helps to account for the facts observed in Ascrea as well as those encountered in certain northern Spanish varieties that Campos-Astorkiza studies. The proposal I put forth here has a wider scope than Campos-Astorkiza's, since it incorporates not only input contrast requirements (such as the ones found in Ascrea and in varieties of northern Spain) but also surface derived distinctions that convey relevant paradigmatic information (such as those entailed by the Andalusian variety analyzed in §3.3).

[6] The examples and insights of this section owe much to Jiménez (1998, 2002) and discussion with him.

to smooth the articulation. The relevant facts are as follow. Valencian has a seven-vowel stressed system (/i, u, e, ɛ, o, ɔ, a/) and a reduced five-vowel unstressed system (/i, u, e, o, a/) as Ascrea. The characteristics of the Valencian vowels are presented in (17).[7]

(17)

	Front		Back	
	i		u	High
[+ATR]	e		o	
[–ATR]	ɛ		ɔ	
		a		Low

In the harmonic process, mid-open stressed vowels (/ɛ, ɔ/) extend their color features to the following unstressed /a/, triggering [ɛ, ɔ] in unstressed positions (18a). The example in (18b) shows that, in the same context, words with low vowels remain unaltered.

(18)

a.	/tɛ́la/	[tɛ́lɛ]	‘cloth’	cf.	/péra/	[péɾa], *[péɾe]	‘pear’
	/kɔ́za/	[kɔ́zɔ]	‘thing’	cf.	/tóta/	[tóta], *[tóto]	‘all (f sg)’
b.	/káza/	[káza]	‘house’				

Walker (2005) proposes an interpretation of Valencian VH in terms of Positional Markedness based on an observation made by Jiménez (1998: 148): “Our hypothesis is that harmony is a process whose goal is to make the marked vowels /ɛ/, /ɔ/ more perceptible.” Along these lines, Walker (2005: 965) suggests that “here, the weakness lies strictly in featural content, not prosodic position. Because [ɛ, ɔ] occur contrastively only under stress [...] and an imperative to maximize extension of perceptually difficult features [...] drives harmony”. In my view, this is an unnecessary move, since Valencian VH is better analyzed as a typical instance of harmony driven by Positional Faithfulness, that is, as a spread of features from strong (stressed) to weak (unstressed) positions to homogenize articulation. The tableau in (19) shows the basics of such pattern: the faithfulness constraint IDENT(Color)-σ́ is ranked above the markedness agreement constraint AGREE-[–ATR]Color, which ensures that [–ATR] vowels agree in color features. More general IDENT (and LICENSE) constraints are ranked lower.

(19)

/tɛ́la/	ID(Color)-σ́	AGR-[–ATR](Color)	ID(Color)
a. tɛ́la		*!	
☞ b. tɛ́lɛ			*
c. tála	*!		*

[7] As in the case of Ascrea, I follow Walker’s (2005) binary feature characterization: the height binary features are [high], [low], and [ATR]; the color binary features are [front] and [back] (on feature classes, see note 2). Jiménez (1998) uses [RTR] instead of [–ATR] and Round instead of [+back]. Other authors use Coronal and Labial instead of binary [front] and [back], respectively, with the benefit of unifying the place features for vowels and consonants (cf., among others, Clements and Hume, 1995). Although nothing in the explanation presented in this paper hinges on a particular feature specification, see the Andalusian example discussed in §3.3 for an interesting case of interaction between vowel and consonant features.

In addition to the pattern involved (i.e. spread taking place from strong to weak positions), a firm piece of evidence for the Positional Faithfulness view comes from another observation made by Jiménez (1998: 159): "The existence of vowel harmony triggered by /ɛ/ and /ɔ/ seems to be linked to the extraordinary openness of these vowels in Valencian (Recasens, 1991: 99-100). They are considerably more open than in the other Catalan dialects." This specific characteristic of the vowel system of Valencian explains the feature conditions placed on the harmonic elements, i.e. why the triggers are mid-open vowels, why they only target /a/, and why the harmonic features involve the color features. The feature condition regarding the trigger is explained in terms of prominence. More sonorous (open) vowels better fit strong (stressed) positions. Their articulatory influence, hence, is stronger than that of close segments and they are more prone to spread. (Note that in the case of stressed /a/ —the most open, sonorous vowel—, the effects of the harmony remain unnoticed because /ɛ, ɔ/ do not occur in unstressed position; hence, only [á]…[a] sequences from /á/…/a/ inputs exist.) It is, thus, a typical instance of strong, prominent features spreading from strong, prominent positions. Regarding the feature conditions on targets, the restriction to the low vowel is not surprising in light of the Valencian vowel system characteristics: since [ɛ, ɔ] and [a] are [–ATR] vowels and they have a very close height in Valencian, they are more prone to assimilate among them.[8] It is a requirement of similarity between target and trigger comparable to the one found in Ascrea: in Ascrea, the harmonic vowels were non-low vowels; in Valencian, the harmonic vowels are [–ATR] vowels.[9] As a result of the harmony leading to homogenize articulation between similar [–ATR] segments, color features of the weak (unstressed) vowel (/a/) adapt to the ones associated to the strong (stressed) vowels (/ɛ, ɔ, a/). A secondary effect of this extension is indeed the gain in perception of the [ɛ, ɔ] vowels. An extra cost of the harmony is the violation of structure preservation (Kiparsky, 1985), since the change gives rise to [ɛ, ɔ] allophones in unstressed position (a similar situation will be discussed regarding Andalusian VH in §3.3).

Since in this view of the facts the primary motivation for Valencian VH is articulation, the prediction is that there should not be gapped, discontinuous configurations, as it is the case; cf. (20). For example, /tɛ́trika/ does not change to [tɛ́trikɛ] because the vowel in between, [i], breaks the homogeneity of the [ɛ] gesture, and [i] is not similar enough to the trigger ([ɛ]) to become harmonized too; likewise, /rɔ́tula/ does not become [rɔ́tulɔ] because [u] breaks the homogeneity of the [ɔ] gesture, and [u] is not similar enough to the trigger ([ɔ]) to be harmonized, and so on.[10]

[8] As said, the effects of such an assimilation only overtly surface in the case of stressed /ɛ, ɔ/ followed by unstressed /a/, because /ɛ, ɔ/ do not occur in unstressed position.

[9] According to some authors, similarity is a means to differentiate local spread (or assimilation) from long-distance spread (or harmony through correspondence relations, i.e. feature extension as a copying mechanism): long-distance agreements require a certain degree of similarity between targets and triggers, while local agreements usually do not impose such conditions (Rose and Walker, 2004). Another means to differentiate long-distance agreements from local agreements is that the former may operate on specific phonological classes (only vowels or only consonants, e.g.) although the sets of features involved may clearly interact phonetically with other non-affected, transparent classes (as is the case for features such as [labial] and [coronal]).

[10] As Jiménez (1998) points out, there only exists one example of proparoxytone words with penultimate /a/ preceded by /ɛ́, ɔ́/ and followed by /a/, and it is a learned word: *apòstata* 'apostate'. In this case, speakers vacillate between a harmonized non-gapped pronunciation (*apòstata* [apɔ́stɔtɔ]) and a non-harmonized one

(20)	/tétɾika/	[tétɾika]	(*[tétɾikɛ])	‘gloomy (f sg)’
	/pérdua/	[pérðua]	(*[pérðuɛ])	‘loss’
	/rɔ́tula/	[rɔ́tula]	(*[rɔ́tulɔ])	‘kneecap’
	/kɔ́mika/	[kɔ́mika]	(*[kɔ́mikɔ])	‘comical (f sg)’

In the prototypical Valencian VH pattern the domain of the harmony is the foot (F), which contains the stressed syllable and all post-stressed ones (Cabré, 1993, Jiménez, 2002). Hence, pre-stressed vowels are not affected by the spread and the harmony surfaces as progressive (21a). Jiménez (1998, 2002) notes that in certain southern varieties the harmonic domain extends to the whole word, giving rise to fully harmonized words. In this case, the harmony surfaces as bi-directional (21b).

(21)	a.	/afɛ́kta/	[a(fɛ́ktɛ)$_F$]	‘affect (3sg pr ind)’
		/tovaʎɔ́la/	[tova(ʎɔ́lɔ)$_F$]	‘towel’
	b.	/afɛ́kta/	[ɛfɛ́ktɛ]	
		/tovaʎɔ́la/	[tɔvɔʎɔ́lɔ]	

3.3. Eastern Andalusian Spanish

The VH system of Eastern Andalusian Spanish is analyzed in Jiménez and Lloret (2007a) within the Positional Markedness licensing view, on which the analysis presented in this section is mainly drawn.[11] Andalusian VH is an instance of perceptually grounded harmony, spreading from weak (unstressed) to strong (stressed) positions to improve the perceptibility of the harmonic feature ([–ATR] in vowels). Unlike the Ascrea example, though, the feature that spreads is not inherently weak nor is it present underlyingly, but it derives from local assimilation. Another interesting difference with respect to the previously analyzed cases is that the harmonized words can improve articulation or not, since there exist vacillating pronunciations with gapped (i.e. discontinuous) and non-gapped (i.e. non-discontinuous) configurations in proparoxytones. The basic facts are as follows. Spanish has a five-vowel stressed and unstressed system: /i, u, e, o, a/, with the characteristics shown in (22).

(22)

		Back	
i		u	High
e		o	
	a		Low
Front			

Many Spanish varieties have cases of final consonant weakening with concomitant optional and inconsequential laxing of the preceding vowel, but Eastern Andalusian shows a stable process of word-final /s/-weakening (i.e. aspiration and further loss, depending on the

([apɔ́stata]), but a gapped realization is not possible (*[apɔ́statɔ]). On variation conditioned by homogeneity in the gestures (an instance of *GAP), see §3.3.

[11] Jiménez and Lloret (2007a) cast the analysis within General Licensing, with correspondence relations, along the lines established by Rose and Walker (2004) and Walker (2006). Here, however, for simplicity and parallelism with the Ascrea case presented in §3.1, I recast the analysis along the lines of Walker (2005). Nothing hinges on this, though (see note 1 too).

variety) involving systematic opening of the preceding vowel (23a), which becomes [–ATR], and further fronting of the low vowel /a/, which becomes [–ATR, +front] (23b). (The data presented here are from educated people from Granada, with systematic loss of -/s/.)

(23)	a.	-/is/:	[i̪]	mis	[mi̪]	‘my (pl)’
		-/us/:	[u̪]	tus	[tu̪]	‘your (pl)’
		-/es/:	[ɛ]	mes	[mɛ́]	‘month’
		-/os/:	[ɔ]	tos	[tɔ́]	‘cough’
	b.	-/as/:	[æ̪]	mas	[mæ̪]	‘plus’

In this context, preceding mid and low vowels harmonize with respect to opening (i.e. [–ATR] is the harmonic feature) (24a). Preceding high vowels do not harmonize (24b).

(24)	a.	tienes	[tjɛ́nɛ]	‘have (2sg pr ind)’	lejos	[lɛ́hɔ]	‘far’
		monos	[mɔ́nɔ]	‘monkeys’	asas	[á̪sæ̪]	‘handles’
		tesis	[tɛ́si̪]	‘thesis’	Venus	[bɛ́nu̪]	‘Venus’
	b.	crisis	[krísi̪]	‘crisis’	míos	[míɔ]	‘mine (pl)’
		muchos	[múʃɔ]	‘many’	tules	[túlɛ]	‘tulles’

The harmonic spread takes place from the last syllable to the stressed syllable. Pre-stressed (25a) and non-final post-stressed (25b) vowels can be affected or not by harmony. In both cases, there is a strong tendency to harmonize the whole word when the vowels are identical, as in (25c).

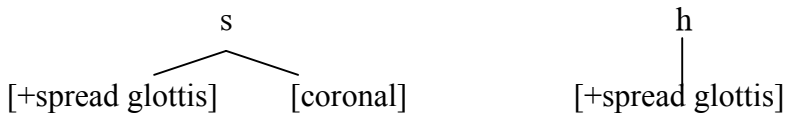
(25)	a.	momentos	[momɛ́ntɔ] ~ [mɔmɛ́ntɔ]	‘instants’
	b.	tréboles	[trɛ́βolɛ] ~ [trɛ́βɔlɛ]	‘clovers’
	c.	tenéis	[tɛnɛ́j]	‘have (2pl pr ind)’
		monótonos	[mɔnɔ́tɔnɔ]	‘monotonous (pl)’

In Spanish, there are very few words ending in *-j* /h/ (*reloj* ‘watch’, *boj*(*e*) ‘box tree, boxwood’, (*h*)*erraj* ‘coal dust’, *sij* ‘Sikh’), but they all show the same behavior as *-s* words (e.g. *reloj* [relɔ] ~ [rɛlɔ]).

As illustrated by the previous examples, the grammatical nature of the final consonant that initiates the opening is irrelevant in the variety under study, since it can be the sole exponent of a suffix (e.g. *monos* [mɔnɔ], where *-s* is the plural marker), part of a suffix (e.g. *tenéis* [tɛnɛ́j], where *-is* is the second-person-plural marker) or part of the stem (e.g. *reloj* [rɛlɔ]). In all cases, the harmonic process applies as expected.

The opening and further fronting of /a/ are local assimilations derived from the feature characteristics of the two fricatives involved in the process (i.e. /s/ and /h/). Jiménez and Lloret (2007a) depart from the feature characterization of /s/ and /h/ proposed in Vaux (1998), cf. (26), which is also followed by Gerfen (2002) to account for other cases of /s/-aspiration (and concomitant lengthening) that Eastern Andalusian shows in word-internal coda position (cf. *casta* [ká^{h}t.ta] ‘caste’).

(26)



The representation of /s/ as [+spread glottis] is phonetically supported by the well-known fact that voiceless fricatives are produced with a greater width than are voiceless stops. Under this view, /s/-aspiration is interpreted as loss of supralaryngeal features (i.e. debuccalization). In the variety under study, [s, h] are not allowed word-finally, neither are aspirated vowels (-[V^h]). In Jiménez and Lloret, this limitation is derived from the interaction of different licensing constraints with conditions on codas, which are not of focal interests for present purposes. For expositional convenience, here I use the constraint *-s/h (a coda condition banning [s], [h] and any other instance of aspiration in word final position) as a cover constraint for such effects. The interesting facts to be discussed concern the way the features characterizing -/s/ and -/h/ are preserved in the outputs. The claim is that the laryngeal feature [+spread glottis] surfaces as the vocalic feature [–ATR], because the opening of the glottis contributes to the raising of the first formant (i.e. opening) in vowels. Hence, the extension of [+spread glottis] as [–ATR] on the previous vowel guarantees preservation of the laryngeal feature present in /s/ and /h/. It is a way of satisfying MAX(LaryngealF) ("A laryngeal F in the input has a correspondent in the output"; Gordon, 2001: 19) under loss of the trigger (i.e. under loss of /s, h/ due to *-s/h).[12] Additionally, the feature [coronal], present in /s/, is preserved by association to the previous vowel too, as a means to comply with MAX(Place). On the preceding vowel, [coronal] is interpreted as the vocalic feature [front]. The effects, though, are only visible in the case of /a/, which turns to [æ], because /e, ɛ, i/ already are front vowels and back vowels, which are all round (labial) in Catalan, cannot be front (*ROUND/FRONT: 'Round vowels are not Front'; cf. Archangeli and Pulleyblank, 1994).[13] This is a typical case of feature co-occurrence restrictions preventing certain changes, or blocking harmony when it would apply to one of the dispreferred target configurations. On the whole, new [–ATR] vowels arise, which violate the markedness constraint against the occurrence of [–ATR] vowels, i.e. *V/–ATR ('No [–ATR] on vowels'). The crucial ranking needed to account for the local output expression of the deleted -/s, h/ is shown in (27).

(27) * ROUND/FRONT, *-s/h >> MAX(LarF), MAX(Pl) >> *V/–ATR >> MAX

The tableau in (28) illustrates how this ranking works. Any candidate ending in [s, h] or in any other instance of aspiration is discarded by *-s/h (cf. (28a-c, e-g, i-k)). Candidates that incorporate the [coronal] feature of -/s/ in the preceding back (round) vowel are discarded too due to feature incompatibility (cf. (28i-l)). In this situation, candidate (28h) wins over candidate (28d) because it preserves as many features as possible from -/s/ on the previous vowel (i.e. the laryngeal feature [+spread glottis], implemented on vowels as [–ATR]).

[12] An alternative way of satisfying MAX(LaryngealF) involves aspiration in the offset of the previous vowel with concomitant vowel and consonant compensatory lengthening effects, a situation typically encountered in internal coda position; e.g. *casta* [ká^{h}t.ta] 'caste' (Gerfen, 2002).

[13] As mentioned in note 7, in certain feature systems vowel and consonant interactions can be derived from the same set of features.

(28)

/tós/	*ROUND/FRONT	*-s/h	MAX(LarF)	MAX(Pl)	*V/–ATR	MAX
a. tós		*!				
b. tóh		*!		*		
c. tó^{h}		*!		*		
d. tó			*!	*		*
e. tɔ́s		*!			*	
f. tɔ́h		*!		*	*	
g. tɔ́^{h}		*!		*	*	
☞h. tɔ́				*	*	*
i. t̪ɔ́s	*!	*			*	
j. t̪ɔ́h	*!	*			*	
k. t̪ɔ́^{h}	*!	*			*	
l. t̪ɔ́	*!				*	*

The tableau in (29) illustrates the same ranking at work in the case of a final low vowel, which can incorporate the [coronal] feature from -/s/. Here, the winning candidate, (29f), shows a [–ATR, +front] vowel, [æ̪], which satisfies both MAX(LarF) as well as MAX(Pl) and does not violate *ROUND/FRONT. (From now on, I only include the relevant candidates in the tableaux for the sake of simplicity.)

(29)

/más/	*ROUND/FRONT	*-s/h	MAX(LarF)	MAX(Pl)	*V/–ATR	MAX
a. más		*!				
b. máh		*!		*		
c. má^{h}		*!		*		
d. má			*!	*		*
e. má̪				*!	*	*
☞f. mæ̪					*	*

When fricatives occur in intervocalic position, they are maintained because they appear in onset position and hence do not violate the word-final coda condition on *s/h*. In these circumstances, there is no need to implement vowels with the [–ATR] feature and the most faithful candidate, (30a), wins.

(30)

/tóse/	*ROUND/FRONT	*-s/h	MAX(LarF)	MAX(Pl)	*V/–ATR	MAX
☞a. tóse						
b. tóhe				*!		
c. tóe			*!	*		*

d.	tɔ́se				*!	
e.	tɔe		*!	*	*	*

Tableaux (28) and (29) have illustrated how -/s, h/ are preserved on the phonetic characteristics of the previous vowels as an instance of local feature extensions giving rise to a novel (surface) vowel contrast through the derived [ATR] feature. This is not the case for the other assimilated feature —i.e. [coronal] (on consonants), [front] (on vowels)—, because [front] is already contrastive in the input vocalic system of Spanish (cf. (22)). The claim is that [–ATR] spreads, and not [+front], because it constitutes a weak trigger for two reasons. It does not convey an input contrast but bears a surface distinction and furthermore, it occurs in a weak (word-final) position. Hence, despite its morphological nature (it can be the expression of a morpheme or not) and its phonetic nature ([–ATR] is not an inherently weak property), it spreads to strong positions (i.e. stressed syllables) to become more visible. Note additionally that the new [ATR] contrast emerges in the unstressed (weak) system of Andalusian Spanish, while other Romance languages with [ATR] input distinctions show this contrast in the stressed (strong) system (we saw this distribution, e.g., in the vowel systems of Ascrea Italian and Valencian Catalan). The long distance assimilation is accounted for by ranking the licensing constraint LICENSE(–ATR)-ǵ, which demands the association of [–ATR] to a stressed syllable, above *V/–ATR (the markedness constraint that penalizes [–ATR] vowels). The fact that high vowels ([i, u]) remain unaffected by harmony is captured by high ranking the co-occurrence feature restriction *HIGH/–ATR ('High vowels are not [–ATR]'; cf. Archangeli and Pulleyblank, 1994). The basic relevant ranking is presented in (31).

(31) ... MAX(LarF), MAX(Pl) >> *HIGH/–ATR >> LICENSE(–ATR)-ǵ >> *V/–ATR ...

The tableau in (32) illustrates a regular case of [–ATR] spreading from the final unstressed syllable to the previous stressed syllable, which contains a mid vowel that can associate the [–ATR] value (cf. (32c)). The tableau in (33) illustrates the same situation in the case of a high stressed vowel, which does not associate the [–ATR] value due to feature incompatibility (cf. (33c)). The winning candidate, though, presents a [–ATR] word-final final high vowel (cf. (33b)) in order to satisfy the high ranked MAX(LarF) constraint, that is, in order to preserve the laryngeal feature of the deleted *-s*. (In the tableaux below I do not include candidates with final [s] or aspiration for simplicity.)

(32)

/tjénes/	MAX(LarF)	MAX(Pl)	*HIGH/–ATR	LIC(–ATR)-ǵ	*V/–ATR
a. tjéne	*!				
b. tjéɛ				*!	*
☞c. tjɛ́ɛ					**

(33)

/krísis/	MAX(LarF)	MAX(Pl)	*HIGH/–ATR	LIC(–ATR)-ó	*V/–ATR
a. krísi	*!				
☞b. krísi̯			*	*	*
c. kri̯si̯			**!		**

If Andalusian VH is well interpreted as an instance of Positional Markedness harmony, the prediction is that it may give rise to gapped configurations in proparoxytone words, because the weak feature can be properly licensed just through association to the strongest position (i.e. the stressed syllable). The data match this prediction, since Andalusian shows gapped configurations with unaffected post-stressed vowels, although they alternate with non-gapped variants with harmonic realizations; cf. (34). The example in (34b) shows that the harmonic domain includes the clitics. In this context, if more than one syllable appears in non-final post-stressed position, either all of them harmonize or only the stressed vowel assimilates.

(34)

a.	tréboles	[trέβolɛ] ~ [trέβɔlɛ]		‘clovers’
b.	cómetelos	[kɔ́metelɔ] ~ [kɔ́mɛtɛlɔ]		‘eat them’
		(*[kɔ́mɛtelɔ], *[kɔ́metɛlɔ])		

The analysis presented so far can straightforwardly handle this variation by the specific ranking of the *GAP constraint on feature linkage (upon Archangeli and Pulleyblank, 1994), which expresses an articulatory condition against discontinuous gestures. If *GAP is ranked below *V/–ATR, it gives rise to discontinuous outcomes (cf. (35a)), whereas when it is ranked above *V/–ATR, it gives rise to homogeneous outcomes, with the side effect of further highlighting the harmonic feature (cf. (35b)). This analysis also ensures that either all the non-final post-stressed vowels harmonize (a maximal pattern that favors articulation as well as perception) or only the stressed vowel harmonizes (a minimal pattern that benefits perception in detriment of articulation) (cf. (34b)). The tableaux in (36) and (37) illustrate both situations.

(35)

a.	Unaffected post-stressed:	... LICENSE(–ATR)-ó >> *V/–ATR >> *GAP ...
b.	Affected post-stressed:	... LICENSE(–ATR)-ó , *GAP >> *V/–ATR ...

(36)

/tréboles/	LIC(–ATR)-ó	*V/–ATR	*GAP
☞a. trέβolɛ		**	*
b. trέβɔlɛ		***!	

(37)

/tréboles/	LIC(–ATR)-ó	*GAP	*V/–ATR
a. trέβolɛ		*!	**
☞b. trέβɔlɛ			***

The last issue to address concerns pre-stressed vowels, which may also be affected by harmony or not, as illustrated in (38).

(38)	momentos	[momɛ́ntɔ] ~ [mɔmɛ́ntɔ]	‘instants’
	reloj	[relɔ́] ~ [rɛlɔ́]	‘watch’
	relojes	[relɔ́hɛ] ~ [rɛlɔ́hɛ]	‘watches’

When harmony spreads up to the initial syllable, a complete homogeneous domain arises. This is the maximal-extension pattern of VH. The question now is which factor induces the maximal spreading. It can be interpreted either as a matter of articulation (to homogenize the gestures) or as a matter of perception (to further reinforce the visibility of the harmonic feature). Under the former view, these cases are analyzed as instances of laziness (LAZY: ‘Minimize effort’; cf. Kirchner, 1998), which subsumes the effects of *GAP. Under the latter view, they are analyzed as instances of a licensing constraint involving all vowels to maximally reinforce the visibility of the harmonic feature. Examples with intervening high vowels (cf. (39)), which cannot associate the [–ATR] value due to the feature co-occurrence restriction *HIGH/–ATR, provide clear support for the licensing view.

(39)	cojines	[kohínɛ] ~ [kɔhínɛ]	‘cushions’
	cotillones	[kotiʒɔ́nɛ] ~ [kɔtiʒɔ́nɛ]	‘cotillions’

In words like *cojines* /kohínes/, for example, the stressed vowel is not affected by the [–ATR] spread because it is high (an effect of the ranking *HIGH/–ATR >> LICENSE(–ATR)-σ́; cf. (31)). This word nevertheless shows two optional vowel-harmonic variants. It can display the minimal stress-targeted pattern and, under the impossibility of licensing [–ATR] in the stressed (high) vowel, a non-gapped configuration arises: [kohínɛ], with the non-discontinuous configuration […o [+ATR] … í[+ATR] … ɛ[–ATR]]. Or it can display the maximal-extension pattern by assimilating the initial vowel, in which case a gapped configuration arises: [kɔhínɛ], with the discontinuous configuration […ɔ [–ATR] … í[+ATR] … ɛ[–ATR]]. If articulation (governed by LAZY-type of constraints, for instance) were the decisive factor of harmony, there would be no need to extend the harmonic [–ATR] feature to pre-stressed vowels when an intervening [+ATR] vowel occurs. Since it does, it is because licensing considerations impel harmony, which in this case fits the pattern of maximal extension. In Jiménez and Lloret (2007a), assimilation of pre-stressed vowels is analyzed as an instance of the licensing constraint LICENSE(–ATR)-V, which favors the association of the weak feature to all vocalic (strong) positions in order to maximally reinforce the visibility of this phonetic property.[14] LICENSE(–ATR)-V (impelling [–ATR] association to all vowels) has a wider scope than LICENSE(–ATR)-σ́ (impelling [–ATR] association to the stressed vowel only); therefore, it must be ordered lower (inclusive relation). Its position with respect to *V/–ATR shapes the two patterns: if *V/–ATR is ranked above LICENSE(–ATR)-V, pre-stressed vowels remain unaffected (40a); if it is ranked below it, they harmonize (40b). The tableaux in (41) and (42) illustrate the patterns in (40a) and (40b), respectively.

(40)	a.	Unaffected pre-stressed:	... LIC(–ATR)-σ́ >> *V/–ATR >> LIC(–ATR)-V ...
	b.	Affected pre-stressed:	... LIC(–ATR)-σ́ >> LIC(–ATR)-V >> *V/–ATR ...

[14] Vowels are the peaks of the syllable and as such appear in a stronger position than consonants, which occur in the margins of the syllable.

(41)

/kohínes/	*HIGH/–ATR	LIC(–ATR)-σ́	*V/–ATR	LIC(–ATR)-V
☞a. kohínɛ		*	*	**
b. kɔhínɛ		*	**!	*
c. kɔh̰ínɛ	*!		***	

(42)

/kohínes/	*HIGH/–ATR	LIC(–ATR)-σ́	LIC(–ATR)-V	*V/–ATR
a. kohínɛ		*	**!	*
☞b. kɔhínɛ		*	*	**
c. kɔh̰ínɛ	*!			***

The interpretation under licensing also predicts that if more than one vowel appears in pre-stressed position either all of them harmonize or none, as it is the case; cf. (43). The tableau in (44) illustrates the minimal stress-targeted pattern. The tableau in (45) illustrates the maximal-extension pattern.

(43) monederos [moneðéɾɔ] ~ [mɔneðéɾɔ] ‘purses’
(*[monɛðéɾɔ], *[mɔneðéɾɔ])

(44)

/monedéros/	LIC(–ATR)-σ́	*V/–ATR	LIC(–ATR)-V
☞a. moneðéɾɔ		**	**
b. mɔnɛðéɾɔ		****!	
c. monɛðéɾɔ		***!	*
d. mɔneðéɾɔ		***!	*

(45)

/monedéros/	LIC(–ATR)-σ́	LIC(–ATR)-V	*V/–ATR
a. moneðéɾɔ		**!	**
☞b. mɔnɛðéɾɔ			****
c. monɛðéɾɔ		*!	***
d. mɔneðéɾɔ		*!	***

When pre-stressed and non-final post-stressed vowels occur in the same word, as in (46), either only the stressed vowel harmonizes (the minimal stress-targeted pattern, cf. (46a)), or stressed and post-stressed vowels harmonize (in order to satisfy *GAP, cf. (46b)), or all of them harmonize (the pattern that maximally satisfies LICENSE(–ATR)-V, cf. (46c)). It is impossible, though, that pre-stressed vowels harmonize but not the post-stressed ones, cf. (46d).[15]

[15] As previously said, when all the vowels are equal, they are more prone to assimilate, as in *monótonos* ‘monotonous (m pl)’, with the pronunciation [mɔnɔ́tɔnɔ] favored over the others. This is just another instance of

(46) /rekóhelos/ recógelos ‘pick them’

a. [rekɔ́helɔ]
b. [rekɔ́hɛlɔ]
c. [rɛkɔ́hɛlɔ]
d. *[rɛkɔ́helɔ]

These cases are particularly important for the analysis put forth here. *GAP (an articulatorily based constraint) and LICENSE(–ATR)-V (a perceptually based constraint) are not instances of a unique constraint; however, they interact in a significant way: when *GAP is violated LICENSE(–ATR)-V is violated as well, but not vice versa. Hence, the prediction is that there is no way of avoiding the effects of *GAP while satisfying LICENSE(–ATR)-V, as shown in (47).

(47)

	/ e ó e o /	LIC(–ATR)-ó́	*GAP	LIC(–ATR)-V	
a.	e ɔ́ e ɔ	satisfied	violated	violated	Minimal-extension pattern
b.	e ɔ́ ɛ ɔ	satisfied	satisfied	violated	Medium-extension pattern
c.	ɛ ɔ́ ɛ ɔ	satisfied	satisfied	satisfied	Maximal-extension pattern
d.	ɛ ɔ́ e ɔ	satisfied	violated	violated	*Unattested pattern*

The striking result is that under Jiménez and Lloret’s account none of the possible rankings is compatible with the unattested pattern illustrated in (47d). In other words, through constraint re-ranking the results in (47a-c) can emerge, but the unattested result in (47d) is impossible to achieve. (48) summarizes the key rankings of the attested patterns. (Recall that the ranking of the constraint LICENSE(–ATR)-ó́ above LICENSE(–ATR)-V is universally fixed due to their inclusive relation.)

(48) a. *Minimal-extension pattern* (only the stressed vowel agrees in [–ATR]):
LIC(–ATR)-ó́ >> *V/–ATR >> LIC(–ATR)-V, *GAP

b. *Medium-extension pattern* (vowels up to the stressed syllable agree in [–ATR]):
LIC(–ATR)-ó́, *GAP >> *V/–ATR >> LIC(–ATR)-V

c. *Maximal-extension pattern* (all vowels agree in [–ATR]):
In this pattern the relevant ordering is: LIC(–ATR)-V >> *V/–ATR
Hence: LIC(–ATR)-ó́ >> LIC(–ATR)-V >> *V/–ATR, *GAP, or
LIC(–ATR)-ó́ >> LIC(–ATR)-V, *GAP >> *V/–ATR, or
LIC(–ATR)-ó́, *GAP >> LIC(–ATR)-V >> *V/–ATR

Adopting an articulatory view of harmony by deriving the effects of *GAP and LICENSE(–ATR)-V from LAZY-type constraints, for instance, does not make the right prediction, because in this case factorial typology cannot preclude the inexistence of the pattern presented in (47d). This remarkable result confirms the adequacy of the analysis presented here in terms of licensing, as well as the need for a model that allows the interaction between articulatory and perceptual restrictions to account for all the effects harmonic phenomena present.

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the aforementioned requirement of similarity between targets and triggers in long-distance assimilations, comparable to the ones previously reported for Ascrea and Valencian VH.

4. CONCLUSION

In §3 I have sketched the analysis of three cases of VH in Romance. The review leads us to the conclusion that configurations on VH can be triggered either by demands of articulation or by demands of perception. Valencian illustrates a typical case of articulatory VH driven by Positional Faithfulness, with the spread taking place from strong to weak positions. Ascrea and Andalusian are instead instances of perceptual harmony driven by Positional Markedness, with the spread going from weak to strong positions. Since Valencian VH is articulatory driven, discontinuous (gapped) configurations are predicted not to emerge and the gains on the perceptibility of the harmonic feature are considered to be a side effect. Contrariwise, in perceptually driven VH patterns, discontinuous configurations are predicted to be able to exist and secondary gains on articulation coexist in accordance with these configurations: Ascrea VH illustrates a case of gapped configurations while Andalusian illustrates a case with restricted (and predicted under the account presented here) variation. In sum, using both articulatory and perceptual approaches to harmony provides a more grounded analysis of VH and yields a more robust understanding of the phenomenon.[16]

Feature content alone does not trigger harmony, but there is an array of properties that induce the spread regarding gestural, perceptual, and contrastive factors. In each case, the selection of the harmonic feature depends on specific properties that features have in each system, such as the extraordinary openness of mid [–ATR] vowels in Valencian. Along these lines, I have claimed that perceptually driven VH needs an extra paradigmatic reason for the spread: in Ascrea, the harmonic feature is phonetically inherently weak ([+high]), appears in a weak position (in a word-final unstressed vowel), and is the sole exponent of a morphological contrast; in the Andalusian variety under study, the harmonic feature is not phonetically inherently weak ([–ATR]), it does appear in a weak position (in a word-final unstressed vowel), and, although [ATR] is not an input contrastive feature, it ends up conveying a derived distinction in a weak position.

Whatever the pattern, limitations regarding similarity between targets and triggers are common in this type of long distance agreements and play a crucial role when delimiting the scope of harmony: in Ascrea the harmonic vowels are non-low, in Valencian the harmonic vowels are [–ATR], and in Andalusian unstressed vowels are more prone to show the maximally assimilated pattern if all vowels are alike.

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[16] Revithiadou *et al.* (2006) propose an insightful analysis of vowel harmony for Asia Minor dialects of Greek using both kinds of mechanisms to explain harmonic patterns in which the Greek and the Turkish patterns coexist within the same variety and word due to language contact.

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