Valencian vowel harmony

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Valencian Catalan vowel harmony is a phenomenon by which the two [RTR] mid vowels /ɛ/, /ɔ/ in stressed position spread the features Front and Round to the vowel /a/. In the prototypical case, both /ɛ/ and /ɔ/ trigger feature spreading to posttonic /a/. In some varieties, however, only /ɛ/ or only /ɔ/ triggers the process. On the other hand, there are also more liberal varieties where both vowels spread their features in both directions, to the left and to the right. In this paper, Valencian vowel harmony is explained as a means to make the features of stressed [RTR] mid vowels more perceptible, following the postulates of Optimal Domains Theory (Cole & Kisseberth 1994, 1995). The uniform behavior of both vowels is made to follow from the fact that the features Front and Round belong to the same class, Color features. In accordance with Feature Domain Theory (Padgett 1995a,b) we do not assume any hierarchical organization within the Color class, which allows the independent spreading of Front and Round.*

1. Introduction

Valencian is the southernmost dialect of the Catalan language. It is spoken in approximately the territory that constituted the ancient Kingdom of València, with the exception of some relatively small western and southern areas, where the native language is Spanish. Within the Valencian dialect three major subdialects are usually distinguished: Northern Valencian, Central Valencian or Apitxat and Southern Valencian (cf. Veny 1983, among others).[1] Vowel harmony is especially prevalent in Southern Valencian, but it is also attested in a number of localities in the Central and Northern areas.

Vowel harmony in Valencian has attracted the attention of researchers since the pioneering work of Alcover (1903) and Hadwiger (1905). In spite of this, at present we do not have any comprehensive study of Valencian vowel harmony in all of its varieties. Colomina (1985a) describes in detail the variation existent in the Alacantí or southernmost area of Southern Valencian, providing a lineal generative analysis. Subsequently, Palmada (1991, 1994a) has analyzed Valencian harmony using the mechanisms of Autosegmental Phonology. In this paper, we offer an overview of the

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different harmony systems found in Valencian Catalan, casting our analysis within the framework of Optimality Theory (OT) and, more specifically, Optimal Domains Theory (Cole & Kisseberth 1994, 1995). In addition, we will attempt to establish a link between the spreading of [-back] = Front and [+round] = Round, which go together in most varieties with a harmony process, employing Feature Class Theory (FCT, Padgett 1995a,b). Our goal is to construct a system of principles that can predict the different types of harmony found in Valencian.

Typically, Valencian harmony is a phonological process by which posttonic /a/ becomes [ɛ] or [ɔ] when preceded, respectively, by stressed /ɛ/ and /ɔ/. This is illustrated in the following examples where two varieties with and without harmony are compared: [2]

(1)

			Canals	València	
a.	terra	/tɛra/	[téɾɛ]	[téra]	'land'
	tela	/tɛla/	[télɛ]	[tɛla]	'cloth'
	perla	/pɛɾla/	[pɛɾlɛ]	[pɛɾla]	'pearl'
	afecta	/afɛkta/	[afɛ́ktɛ]	[afɛ́kta]	'it affects'
b.	cosa	/kɔza/	[kɔ́zɔ]	[kɔ́za]	'thing'
	porta	/pɔɾta/	[pɔɾtɔ]	[pɔ́ɾta]	'door'
	boira	/bɔira/	[bɔ́jɾɔ]	[bɔ́jɾa]	'fog'
	aporta	/apɔɾta/	[apɔɾtɔ]	[apɔɾta]	's/he brings'

Colomina (1985a) accounts for vowel harmony facts of the type illustrated by the Canals examples in (1) by means of the following two rules, within the framework of lineal generative phonology:

(2) Colomina (1985a)

a. /a/ —> [ɛ] / # (seg) /é/ [-syll]$_1$ __ #

b. /a/ —> [ɔ] / # (seg) /ɔ́/ [-syll]$_1$ __ #

Most varieties with a harmony process present the results illustrated for Canals in (2a) and (2b). However, there are some varieties which have harmony only when the stressed vowel is /ɛ/, as in Cullera, or only when the stressed vowel is /ɔ/, as in Borriana:

(3)

		Cullera	Borriana	
a.	terra	[téɾɛ]	[téra]	'land'
	tela	[télɛ]	[téla]	'cloth'
	perla	[pɛɾlɛ]	[pɛɾla]	'pearl'
	afecta	[afɛ́ktɛ]	[afɛ́kta]	'it affects'
b.	cosa	[kɔ́za]	[kɔ́zɔ]	'thing'
	porta	[pɔɾta]	[pɔ́ɾtɔ]	'door'
	boira	[bɔ́jɾa]	[bɔ́jɾɔ]	'fog'
	aporta	[apɔ́ɾta]	[apɔɾtɔ]	's/he brings'

There is no harmony ever with any other stressed vowel. In non-harmonic contexts, final /a/ is usually realized as [a]. This is true both in varieties with harmony, such as Canals, and in varieties without harmony, such as that spoken in the city of València. However, in a few local varieties, this final vowel is realized as [ɛ] (e.g. in Sueca), [ɔ] (e.g. in Ontinyent) or [ə] (e.g. in Palmera) in all words, regardless of the quality of the stressed vowel:

(4)

	Canals, València	Sueca	Ontinyent	Palmera	
capa	[kápa]	[kápɛ]	[kápɔ]	[kápə]	'cape'
mira	[míɾa]	[míɾɛ]	[míɾɔ]	[míɾə]	's/he looks'
lluna	[ʎúna]	[ʎúnɛ]	[ʎúnɔ]	[ʎúnə]	'moon'

The change of quality of final unstressed /a/ in all words illustrated in (4) is a phenomenon that must be considered independent of the harmony process; even though it may very well have arisen by analogy with harmonic words, that is, those containing stressed /ɛ/ or /ɔ/. The independence of these two phenomena is clear in those varieties which have harmony and, in addition, neutralization of final /a/ as [ɛ] or [ɔ] in non-harmonic contexts, such as those of Benitatxell and Ontinyent:

(5)

		Bentitatxell	Ontinyent	
terra	/tɛra/	[téɾɛ]	[téɾɛ]	'land'
cosa	/kɔza/	[kɔ́zɔ]	[kɔ́zɔ]	'thing'
mira	/miɾa/	[míɾɛ]	[míɾɔ]	's/he looks'

Although, in these varieties, the effect of neutralization coincides with the result of one of the two harmony processes (with /ɛ/ and with /ɔ/, respectively), the existence of harmony with the other vowel allows us to conclude that harmony takes place with both [RTR]-mid vowels and that the neutralization of word-final /a/ with one of the [RTR]-mid vowels in non-harmonic contexts is an independent process. This independence is even more clear in a variety such as that of Palmera where only /ɔ/ triggers harmony, and otherwise final /a/ is realized as schwa:

(6)

PALMERA

a.	cosa	[kɔ́zɔ]	'thing'
	porta	[pɔ́ɾtɔ]	'door'
b.	terra	[tɛ́rə]	'land'
	capa	[kápə]	'cape'
	mira	[mírə]	's/he looks'
	lluna	[ʎúnə]	'moon'

Instead, in varieties where harmony is restricted to words with only one of the two [RTR]-mid vowels and this coincides with the result of neutralization, it would seem that there is nothing that would allow us to postulate the existence of harmony, since the independently motivated neutralization of final /a/ with one of the two [RTR]-mid vowels produces the same result. In Sueca, for instance, final /a/ is always realized as [ɛ] regardless of the quality of the stressed vowel. In Xaló, on the other hand, final /a/ is always [ɔ]:

(7)

	SUECA	XALÓ	
terra	[tɛ́rɛ]	[tɛ́rɔ]	'land'
cosa	[kɔ́zɛ]	[kɔ́zɔ]	'thing'
mira	[mírɛ]	[mírɔ]	's/he looks'

Nevertheless, there is an argument in favor of the existence of a harmony process even in these cases: whereas in these varieties harmonic realizations are kept with almost no variation across styles or generations,[3] the neutralization of /a/ as [ɛ] or [ɔ] in non-harmonic contexts is a receding phenomenon, limited to the least formal registers (cf. Casanova 1997). That is, in a given locality with neutralization in [ɔ], for instance, we may find that there is variation between [mírɔ] and [míra], [tɛ́rɔ] and [tɛ́ra], but there is no variation in words such as [kɔ́zɔ], where the stressed vowel is /ɔ/. Given that from the point of view of sociolinguistic variation these are independent phenomena, we may also treat them independently from each other. In this paper, we will concentrate only on the harmony process. We will leave aside the positionally conditioned (not segmentally-conditioned) realizations of final /a/.

Assuming, thus, that harmony, on the one hand, and nonconditioned allophony and neutralization of /a/, on the other, are two phenomena which can be separated descriptively, we obtain all the possibilities represented in (8). In the left column, we note the different options regarding harmony, and on the top row we indicate the realization of final stressless /a/ in contexts without harmony. From the combination of these two parameters, we obtain twelve possible systems. For the three possibilities indicated with a double question mark, we do not know of any variety with these characteristics. The remaining empty spaces are assumed to be impossible.[4]

(8) Harmony and realization of final unstressed /a/ in non-harmonic contexts

	-a	-ɛ	-ɔ	-ə
no harmony	València			??
ɛ-a→ɛ-ɛ, ɔ-a→ɔ-ɔ	Canals	Benitatxell	Ontinyent	??
ɛ-a→ɛ-ɛ	Cullera	Sueca		??
ɔ-a→ɔ-ɔ	Borriana		Xaló	Palmera

In addition to the variation reflected in the table in (8), the geographical distribution of these phenomena is also rather variable.[5] To begin with, harmony is not found in the whole Valencian territory. With a high degree of consistency it characterizes only the Southern Valencian subdialect. Nevertheless, there are towns belonging to the other two subdialects where harmony processes of the same type are also attested (e.g. Borriana). Sometimes, in these other areas the phenomenon is limited to certain social groups. For instance in the

Central Valencian varieties spoken in El Cabanyal and Albuixec only older speakers present harmony.

Secondly, the distribution of the different types of harmony is not regular either, even in Southern Valencian. It is pretty much impossible to trace isoglosses. We may note that, in any case, the most general situation is to have harmony with both [RTR]-mid vowels.

From a theoretical point of view, the interest of the Valencian harmony process lies precisely on the amount of variation that it presents. As has been mentioned, in addition to the prototypical case where both [RTR]-mid vowels trigger harmony, there are varieties where only one of them does. Furthermore, in a few restricted cases, harmony is bidirectional from the stressed vowel. The problem is how to develop a system of principles which is able to account for the general situation, capturing the necessary link between the harmonizing features, and which, at the same time, has enough inherent flexibility to predict the existence of other marginal situations. The analysis must also be congruent with the general properties of the Valencian vowel system.

The remainder of this paper is organized in three sections. In section 2, we present the main points of the theoretical framework that we will use in the formalization of the facts. In section 3, the different types of harmony found in Valencian are analyzed within this framework. Finally, in section 4 we summarize the facts and the predictions made by our analysis.

2. *Theoretical background*

In this paper we assume the postulates of Optimality Theory (OT, cf. McCarthy & Prince 1993a, Prince & Smolensky 1993, among others). One of the basic contributions of this theory is the elimination of phonological rules. That is, the output is obtained from the input without a derivation, at least within a given level. Potential outputs are evaluated by a number of general well-formedness constraints. Among the list of output candidates compatible with a given input, the optimal output is selected. The differences that can be observed in the treatment of a given sequence in different languages, or different dialects of the same language, are not due to the existence of different principles, since all phonological principles are assumed to be universal. Instead, within OT, it is assumed that this

variation is the result of different orderings among universal principles. That is, differences among languages are due to the different priorities established in each language for the satisfaction of these principles. The grammar of a language thus consists of a set of universal principles ordered in a specific hierarchy. In case two principles are in conflict, the winning candidate will be the one that satisfies the higher ranked principle. In any case, however, violations are minimized.

Let us exemplify the proposals made in OT with a simple example from Valencian Catalan which is related to the main topic of this paper. As in all other Catalan dialects, in Valencian the [RTR]-mid vowels /ɛ/, /ɔ/ can only occur in a stressed syllable. Underlying /ɛ/, /ɔ/ become [e], [o], respectively, in stressless syllables. The principles that allow us to select the optimal candidate are, on the one hand, the requirement that the feature [RTR] be projected from underlying to surface representation, Max-RTR (cf. McCarthy & Prince 1994); and, on the other, a constraint which restricts the feature [RTR] to stressed positions (cf. Palmada 1991, 1994a,b):

(9) a. Max-RTR: Every RTR element of S1 has a correspondent in S2.

b. Stress-RTR: Only stressed syllables can license the feature RTR.

The ranking that is established between these two principles in Catalan would be Stress-RTR >> Max-RTR (that is, Stress-RTR dominates Max-RTR). This follows from the universal ranking of positional faithfulness. Stress-RTR can be interpreted as a positionally-defined faithfulness restriction. That is, Stress-RTR is roughly equivalent to Max-Stress/RTR and forces the realization of RTR in the most prominent position in the word: the stressed syllable. Consequently, Stress-RTR or Max-Stress/RTR must dominate Max-RTR, which demands the realization of RTR independently of context.

This ranking produces the correct results for two inputs like /tɛla/ 'cloth' and /tɛlɐ/ 'loom'. In the first example, /ɛ/ is in stressed position and permits the appearance of RTR. The winning candidate is, therefore, (10a). In the second example, on the other hand, stress falls on the second syllable and the presence of RTR on the first syllable would violate the Stress-RTR constraint. Consequently, the optimal candidate is (11b), which does not contain the feature RTR.

(10) Input: /tɛla/; ranking: Stress-RTR >> MAX-RTR

	Stress-RTR	MAX-RTR
☞ a. tɛ́la		
b. téla		*!

(11) Input: /tɛlɛr/; ranking: Stress-RTR >> MAX-RTR

	Stress-RTR	MAX-RTR
a. tɛlɛ́r	*!	
☞ b. telɛ́r		*

In Autosegmental Phonology, vowel harmony is based on phonological representations. We will assume, instead, the proposals of Optimal Domain Theory (ODT, Cole & Kisseberth 1994, 1995). In ODT some of the basic postulates of Autosegmental Theory are rejected. Harmony follows not from the representations but from the requirement that a given feature must characterize a morphologically or phonologically defined domain (Cole & Kisseberth 1994). A feature underlyingly associated with a segment may be realized over a larger domain to maximize perceptibility and articulator stability.

Within the ODT framework no specific feature geometry is assumed. Features spread separately. Nevertheless, a set of features may behave as a unit in a given harmony process. From Padgett (1995a,b) we adopt the assumption that features may belong to specific sets without implying that they are included under a single node. Thus, the features Front and Round belong to the same class, Color features, and, consequently, a given phonological operation may spread them jointly. This seems to be the unmarked option; but it is not the only possibility. These two features may also behave independently from each other. In this paper, we will assume that Catalan vowels are characterized by two feature classes, Height and Color, and that spreading operations may act on these classes or on individual features. With this proposal, we are able to capture the naturalness of the prototypical cases without excluding those patterns that depart from the unmarked situation.

3. Valencian vowel harmony

In the next subsections we will first present the Valencian vowel inventory and then examine the different types of vowel harmony. We will argue that the different attested possibilities can be captured with minimal variations in the hierarchy of principles.

3.1. Vowel inventory

We characterize the Valencian vowels as in (12). We assume that all features are unary (cf. Palmada 1991, 1994a,b, for a somewhat different view):

(12) Valencian vowel inventory

		Front		Round
ATR	High	i		u
		e	(ə)	o
		ɛ		ɔ
RTR	Low		a	

In this table, Front and Round are Color features (Odden 1991, Padgett 1995a,b) and High, Low, ATR and RTR are Height features. Notice, in particular that ATR and RTR are Height features, required by the existence of four degrees of aperture. We only indicate those features which appear to play an active role in the phonology of Valencian.

Some Valencian varieties systematically lack the vowel [ə]. This is due to a constraint that prevents certain feature combinations from surfacing.

In the next subsections we will consider the different types of harmony found in Valencian, starting from the most common situation.

3.2. Prototypical vowel harmony: Canals

The Canals variety presents the unmarked case in which the two stressed [RTR]-mid vowels spread their Color features to a final /a/ producing a uniform vowel sequence.

(13) CANALS

a.	terra	/tɛra/	[téɾɛ]	'land'
	tela	/tɛla/	[téle]	'cloth'
	cosa	/kɔza/	[kózɔ]	'thing'
	tova	/tɔva/	[tóvɔ]	'soft, fem. sg.'
b.	història	/istɛria/	[istéɾjɛ]	'hysteria'
	pèrdua	/pɛrdua/	[pɛrðwɛ] ~ [pɛrðua]	'loss'
	boira	/bɔira/	[bójɾɔ]	'fog'
	història	/istɔria/	[istóɾjɔ]	'history'

It can be observed in (13b) that the presence of an intervening consonant or glide is irrelevant for the harmony process. On the other hand, a syllabic high vocoid between the stressed and the final vowels blocks the application of the process. In this variety, in a word such as *pèrdua* the sequence of vocoids can be pronounced either as a diphthong or as a hiatus, depending on the style. As shown above, the pronunciation of the high vocoid as a glide or as a vowel conditions the application of vowel harmony. In (14) additional examples are given showing that when an ATR vowel intervenes between the stressed and the final low vowel harmony is blocked:

(14) CANALS

mèdica	[méðika]	'medical, fem. sg.'
tètrica	[tétɾika]	'gloomy, fem. sg.'
pèrdua	[pérðua]	'loss'
pècora	[pékoɾa]	'harpy'
ròtula	[ɾótula]	'kneecap'
còmica	[kómika]	'comical, fem. sg.'

Final /a/ is realized as [a] with all other stressed vowels, including /e/ and /o/:

(15) CANALS

pera	[péɾa]	'pear'
mira	[míɾa]	's/he looks'
tota	[tóta]	'all, fem. sg.'
suma	[súma]	'sum'
casa	[káza]	'house'

Harmony takes place only within the morphological word and does not even affect clitics:

(16) CANALS

porta-la	/pɔɾta#la/	[pɔɾtɔla]	'take it, fem. sg.'
pela-la	/pɛla#la/	[pélɛla]	'peel it, fem. sg.'
cou-la	/kɔw#la/	[kówla]	'boil it, fem. sg.'

These examples containing clitics can be compared to word-internal cases such as *apòstata* [apóstɔtɔ] 'apostate', where harmony does apply. From this example we can also conclude that vowel harmony is not necessarily restricted to only the vowel immediately following the stressed one. Nevertheless, it should be noted that there are almost no words where a potential low vowel target occurs in a posttonic nonfinal syllable (in a proparoxytonic word) and the stressed vowel is /ɛ/ or /ɔ/; none in the common vocabulary. The learned word *apòstata* 'apostate' is the only example we have been able to find. But, in any case, the speakers that we have consulted have clear intuitions that this word could be adapted with vowel harmony; something which is impossible in cases involving clitics.

An apparent counterexample to the claim that harmony is restricted to the domain of the morphological word would be *poc a poc* [pókɔpók] 'little by little' where the preposition *a* undergoes harmony. However, this example can be treated as a lexicalized unanalyzed item.

We may describe Color harmony in the Canals variety of Valencian Catalan as a process with the following characteristics: it is triggered by RTR mid vowels in stressed position and affects RTR posttonic vowels. The process is blocked by any syllabic element between trigger and potential target, but not by consonants or glides.

(17) Canals vowel harmony (prototypical Valencian harmony process)

Argument: Color
Trigger: Mid RTR stressed vowels
Target: RTR vowels
Direction: From left to right
Domain: Morphological word
Transparent segments: Consonants and glides
Opaque segments: Vowels

Our hypothesis is that harmony is a process whose goal is to make the marked vowels /ɛ/, /ɔ/ more perceptible.[6] Following the postulates of ODT, we assume that Valencian harmony reflects the higher ranking of the constraint that requires a larger domain for the Color features of the [RTR]-mid vowels over the constraint that requires features to coincide exactly with the segments that sponsor them underlyingly. The general principles that evaluate the realization of Color features are the following:

(18) Color alignment

a. Widescope alignment (Color, R; MWord, R): Let f be a feature of the Color class. Align f with the right boundary of the Morphological Word. [WSA-Right (Color)]

b. Widescope alignment (Color, L; MWord, L): Let f be a feature of the Color class. Align f with the left boundary of the Morphological Word. [WSA-Left (Color)]

c. Basic alignment (Color, R; X, R): Let f be a feature of the Color class and X the segment that sponsors it underlyingly. Align f with the right boundary of X. [BA-Right (Color)]

d. Basic alignment (Color, L; X, L): Let f be a feature of the Color class and X the segment that sponsors it underlyingly. Align f with the left boundary of segment X. [BA-Left (Color)]

The hierarchy established for Canals Valencian would be that in (19), which is the result of collapsing the subhierarchies in (19a) and (19b). In the global hierarchy we have not indicated the directionality in widescope alignment. This is because the presence of the general principle between the two principles of basic alignment will produce the right results by itself:

(19) Hierarchy for Canals Valencian:
BA (Color, L; X, L) >> WSA (Color, L/R; Word, L/R) >> BA (Color, R; X, R)

a. WSA (Color, R; Word, R) >> BA (Color, R; X, R)
b. BA (Color, L; X, L) >> WSA (Color, L; Word, L)

As stated in (19), the principles that require Color features to be aligned with the right boundary of the morphological word (or, more generally, with the boundaries of the morphological word), dominate BA-Right. On the other hand, the leftward extension of the domain of these features is blocked by BA-Left.

Harmony is, in addition, restricted by the presence of several other constraints. First of all, we find a restriction on which vowels can function as harmony targets. Following Cole & Kisseberth's (1995) analysis of Yawelmani, we maintain that a Uniformity constraint forces the right-boundary of the domain for Color features to coincide with an RTR domain:

(20) Uniformity (Color, RTR): If two segments are found in a single Color domain, they must also be included in a single RTR domain.

The principle in (20) amounts to a unification of the domains for Color and RTR, requiring monotonic domains. If there is no spreading of Color, there is no reason to unify the RTR domain. The fact that /ɛ/ and /ɔ/ are never found in unstressed position implies that only /a/, the other RTR vowel, can be the target of harmony. Hovewer, the constraint order Uniformity (Color, RTR) >> WSA (Color) does not by itself guarantee that non-RTR vowels will not undergo harmony. The feature RTR could be inserted in the representation. Since this does not happen, we must assume that WSA (Color) is dominated both by the co-occurrence restriction in (21a) and by the principle in (21b) which evaluates input/output correspondences. The presence of these two constraints in the hierarchy ensures that deletion of ATR and insertion of RTR are not available strategies to satisfy Uniformity (Color, RTR).

(21) Ranking: Uniformity (Color, RTR), *[ATR, RTR], Max-ATR >> WSA (Color)

a. *[ATR, RTR]
b. Max-ATR: Every ATR element of S1 has a correspondent in S2

From the ranking in (21) it follows that if a vowel does not bear, or cannot bear, the feature RTR, it cannot be part of the Color domain of a stressed [RTR]-mid vowel. If there is no available target, no harmonic extension of Color features will take place. On the other hand we need to consider examples such as *tètrica* /tɛtrika/, where the final vowel would appear to be a potential target. In principle, an option would be to expand the RTR/Color domain of the stressed vowel up to the last vowel, as long as these features remained unexpressed on the vowel /i/, which is incompatible with RTR. However, this option is eliminated by the principle Express-V, which requires the features of an RTR/Color domain to be manifested on all potential bearing units for these features:

(22) Express-V: Let f be a distinctive feature for segments belonging to the V class. Let X be a segment belonging to the V class in the domain of f: express f in segment X.

The constraint Express-V prevents the extension of RTR/Color features when these would have to remain unexpressed on some vowel inside the domain. That is, Express-V >> WSA (Color).

As was shown, consonants are transparent for the harmony process. This follows from a co-ocurrence restriction *[Color, C], which prevents the characterization of consonants by Color features, ranked above a general feature expression principle. On the other hand, the opacity of vowels requires the higher ranking of the more specific principle Express-V:

(23) Ranking: Express-V >> WSA (Color), *[Color, C] >> Express

a. Express: Let f be a distinctive feature. Let X be a segment in the domain of f: express f in segment X.
b. *[Color, C]: Avoid Color specifications for segments of class C.

As was shown in (13b), glides are transparent segments for the harmony process. Glides behave like consonants and will not be affected by Express-V, but only by the more general principle Express. Consonants and glides allow the spreading of RTR in the domain without expressing this feature.

Finally, another principle which constrains harmony is the requirement that low vowels should not bear Color specifications, *[Low, Color]. If this principle and Max-Low were ranked above WSA (Color), /a/ would block harmony. Since, instead, low vowels undergo harmony, it must be the case that WSA (Color) and *[Low, Color] dominate Max-Low:

(24) WSA (Color), *[Low,Color] >> Max-Low

a. *[Low, Color]: Avoid Color specifications in low vowels.
b. Max-Low: Every Low feature of the input has a correspondent in the output.

The basic idea is that in the prototypical case the Color features of the [RTR]-mid vowels spread to the right-edge of the word. The process only affects those vowels that can be included in a single RTR/Color domain. ATR vowels are opaque because of Uniformity (Color, RTR) and Express-V. On the other hand, the transparency of consonants derives from Express and *[Color, C].

The complete ranking for the Canals variety, which, as mentioned, represents the prototypical case within Valencian, is given in (25) and all the partial orderings that have been established are repeated in (26a-d):

(25) Complete ranking for Canals: BA-Left, Uniformity (Color, RTR), *[ATR, RTR], Max-ATR, Express-V >> WSA (Color), *[Color, C], *[Low, Color] >> Express, Max-Low, BA-Right

(26)

a. BA (Color, L; X, L) >> WSA (Color; Word) >> BA (Color, R; X, R)
b. *[ATR, RTR], Uniformity (Color, RTR), Max-ATR >> WSA (Color)
c. Express-V >> WSA (Color), *[Color, C] >> Express
d. WSA (Color), *[Low, Color] >> Max-Low

Let us now consider a few examples. In harmonic words such as /rɔza/ [rɔ́zɔ] or /tɛra/ [tɛ́rɛ] the relevant principles are those in (27) where a tableau for /rɔza/ is provided:

(27) Input: /rɔza/

Ranking: Express-V >> WSA (Color), *[Low, Color] >> Max-Low, BA-Right, Express
Feature domains: (Color), {RTR}

	Express V	WSA (Color)	*[Low, Color]	Max-Low	BA-R (Color)	Express
a.r{(ɔ)}za		*!				
b.r{(ɔza$_{rd/lo}$)}			*!		*	*
☞ c.r{(ɔzɔ)}				*	*	*

In the first candidate, Color features are realized only on the segment that sponsors them underlyingly. Since WSA (Color) dominates BA-R(Color), this candidate is discarded. Candidates (27b) and (27c) represent cases where the Color features of the stressed vowel are aligned with the right edge of the word. The deciding principle in this case is *[Low, Color]: candidate (27c), which satisfies this principle by violating Max-Low is the winner. In this candidate Express is

violated, but this is irrelevant for the selection of candidates. This is because the placing of WSA (Color) above Express in the ranking implies that consonants are transparent for harmony.

When the vowel following a stressed [RTR]-mid vowel is not low, there is no harmony. This is due to the ranking in (28), illustrated with a tableau for /fɛro/ 'iron':

(28) Input: /fɛro/
Ranking: *[ATR, RTR], Express-V, Max-ATR, Uniformity (Color, RTR) >> WSA (Color)
Feature domains: (Color), {RTR}

	*[ATR, RTR]	Express-V	Max-ATR	Uniformity	WSA (Color)
☞ a.f{(é)}ro					*
b.f{ɛ́}ro)				*!	
c.f{(éro$_{atr/rtr}$)}	*!				
d.f{(éro$_{<atr>/rtr}$)}			*!		
e.f{(éro$_{atr/<rtr>}$)}		*!			

In (28b), the Color features of the stressed vowel are realized on the final vowel without including both vowels in a single RTR domain. This candidate violates Uniformity (Color, RTR) and is discarded by the ranking. Candidates (28c-d) represent the usual harmonic type but with insertion of RTR to satisfy Uniformity. In (28c) the final round vowel bears RTR and ATR simultaneously; whereas in (28d) the underlying ATR specification is deleted. The ranking of the co-occurrence restriction *[ATR, RTR] and the faithfulness principle Max-ATR above WSA (Color) eliminates the availability of these mechanisms for the satisfaction of Uniformity. In (28e), we present a hypothetical case in which the domain RTR/Color is aligned with the right-edge of the word but remains unrealized on the surface. This candidate violates Express-V and is rejected. The only available possibility in a case where the posttonic vowel does not contain the feature RTR is, thus, not to spread the Color features of the stressed vowel, as in (28a).[7]

In (29) it is shown that the same ranking gives the correct results for a word such as /rɛplika/ where /ɛ/ and /a/ are not adjacent vowels:

(29) Input: /rɛplika/
Ranking: *[ATR, RTR], Express-V, Max-ATR, Uniformity (Color, RTR) >> WSA (Color)
Feature domains: (Color), {RTR}

	*[ATR, RTR]	Express-V	Max-ATR	Uniformity	WSA (Color)
☞ a.r{(é)}plika					*
b.r({ɛ́}plika)				*!	
c.r{(épli$_{atr/rtr}$ka)}	*!				
d.r{(épli$_{<atr>/rtr}$ka)}			*!		
e.r{(épli$_{atr/<rtr>}$ka)}		*!			

In (29b), the Color features are spread to the right-edge of the word, but since /i/ does not bear RTR, this candidate is discarded by Uniformity (Color, RTR). In (29c-d) there is identity between RTR and Color domains, but this is done by violating the co-ocurrence restriction *[ATR, RTR] in (29c). In (29d) this co-ocurrence restriction is avoided by means of the deletion of ATR. But this is in violation of Max-ATR. As for (29e), the incompatibility between /i/ and RTR is solved by leaving RTR unexpressed in this segment. This representation violates Express-V and is consequently discarded. The winning candidate is (29a), which only violates the lower principle WSA (Color).

In this variety, then, the Color features of a stressed vowel will spread only over a domain consisting of RTR vowels. Since the principles that prohibit the introduction of RTR are ranked above WSA-Color, there will be no harmony when there is no agreement between RTR and Color domains. Color features are left unexpressed in consonants within the domain, but the presence of Express-V in the hierarchy ensures that vowels will not be transparent to the process.

There will be no harmony when the stressed vowel is not RTR, since Color harmony is parasitic on the presence of RTR. Valencian harmony is thus similar to other cases of parasitic harmony.

3.3. *Restricted vowel harmony: Cullera and Palmera systems*

In this section we will examine two varieties in which only one of the RTR mid vowels triggers harmony. In Cullera /a/ is realized as [ɛ] after stressed /ɛ/ and otherwise as [a], including after /ɔ/. In Palmera, on the other hand, /a/ is realized as [ɔ] after /ɔ/ and elsewhere as [ə]:

(30)

		Cullera	*Palmera*	
a.	/rɔza/	[rɔ́za]	[rɔ́zɔ]	'rose'
	/bɔira/	[bɔ́jra]	[bɔ́jrɔ]	'fog'
b.	/tɛra/	[téɾɛ]	[téɾə]	'land'
	/pɛrla/	[péɾlɛ]	[péɾlə]	'pearl'
c.	/kaza/	[káza]	[kázə]	'house'
	/mira/	[míra]	[míɾə]	's/he looks'
	/pura/	[púra]	[púɾə]	'pure, fem. sg.'

These facts show that features belonging to the Color class may behave in a non-unitary fashion (cf. Padget, 1995a,b). Within the theoretical framework we are adopting, we can derive these facts by ranking the principle that requires that Front or Round be restricted to the segment sponsoring it above WSA (Color). In Cullera, for instance, only Front can extend its domain to the right edge of the word:

(31) CULLERA
Inputs: /tɛra/, /rɔza/
Ranking: BA-R(Round), Express-V >> WSA (Color), *[Low, Color] >> Max-Low, BA-R(Front)
Feature domains: (Color), {RTR}

	BA-R (Round)	Express-V	WSA (Color)	*[Lo, Color]	Max-Low	BA-R (Front)
a.t{(é)ra}			*!			
☞ b.t{(éɾɛ)}					*	*
☞ c.r{(ɔ́)za}			*			
d.r{(ɔ́zɔ)}	*!				*	

As can be seen in the tableau, BA-R(Round) is irrelevant for the input /tɛra/ and (31a) is selected as optimal candidate. For /rɔza/, on the other hand, the high position of BA-R(Round) in the hierarchy causes (31c) to be selected as optimal.

For Palmera, the analysis would be basically the same, but the relevant principle would be BA-R(Front). That is, the ranking would be the same as in Cullera, but BA-R(Round) and BA-R(Front) would have to exchange places.

3.4. *Bidirectional vowel harmony: Vinalopó Mitjà*

Some varieties present less restrictive harmonic systems. In particular, in some localities in the Vinalopó Mitjà region (El Pinós and L'Alguenya, cf. Montoya 1989: 100), there is bidirectional harmony. In these varieties both posttonic and pretonic /a/ undergoes harmony:

(32) *Vinalopó Mitjà*

afecta	/afɛkta/	[ɛfɛ́ktɛ]	'it affects'
Ayela	/ajɛla/	[ɛjɛ́lɛ]	'a town'
tovallola	/tovaʎɔla/	[tovɔʎɔ́lɔ]	'towel'
carxot	/karʧɔt/	[kɔrʧɔ́t]	'slap'

These facts constitute a situation that is predicted by the theory. To account for them we simply need to rank WSA (Color) above the two Basic Alignment restrictions, BA-Left (Color) and BA-Right (Color). In this way, any low vowel to the right or to the left of an RTR stressed vowel will agree with the latter in Color features, as shown in (33). To simplify, in the tableau we do not include any other constraints besides Basic Aligment and Wide Scope Alignment and collapse the two Basic Alignment principles as a single restriction:

(33) *Vinalopó Mitjà*
Input: /afɛkta/
Ranking: WSA (Color) >> BA (Color)
Feature domains: (Color), {RTR}

	WSA (Color)-L/R	BA (Color)-L/R
a. af{(é)}kta	L!/R	
b. af{(éktɛ)}	L	R
c. {(ɛfé)}kta	R!	L
☞ d. {(ɛfɛ́ktɛ)}		L/R

The winning candidate for this variety is (33d), where the Color specifications of the stressed vowel are aligned with both edges of the word.

3.5. *Generalized vowel raising and Uniformity: La Canyada de Biar*

The harmony system employed in La Canyada de Biar has been studied by Colomina (1985a) and reanalyzed by Hualde (1996) within the model of Lakoff (1993). This variety presents Round harmony when the stressed vowel is /ɔ/; but with the interesting complication that /o/ and /ɔ/ are neutralized in the surface. We know that a stressed [o] is underlyingly /ɔ/ because it triggers rounding of the final vowel:

(34) La Canyada de Biar

/dona/	[dóna]	's/he gives'
/dɔna/	[dóno]	'woman'

In this variety, the RTR domain must be evaluated by Uniformity (Color, RTR) on underlying representations. Within OT, in principle, all constraints apply to surface representations; except for Faithfulness constraints which establish input/output relations and therefore have access to both levels. Uniformity must thus be considered a constraint of the Faithfulness family to account for these data. But we still have the problem that the RTR feature remains unexpressed in the output. The solution is to situate a restriction against [ɔ] above Express-V. In this way, it is guaranteed that the selected candidate is the one that presents harmony but without realization of RTR:

(35) La Canyada de Biar
Input: /rɔza/
Ranking: *ɔ >> Express-V >> WSA (Color), *[Low, Color] >> Max-Low, BA-R(Round)
Feature domains: (Color), {RTR}

	*ɔ	Express-V	WSA (Color)	*[Low Color]	Max-Low	BA-R (Rd)
a.r{(ɔ)za}	*!		*			
b.r{(ɔza)}	*!			*		*
c.r{(ɔzɔ)}	*!				*	*
☞d.r{(ózo)}		*			*	*
e. r{(ó)}za		*	*!			

Candidates (35a-c) are discarded because they violate the restriction against [ɔ]. Between (35d) and (35e), the ranking chooses (35d), because the lack of realization of the RTR domain counts as a single violation. Since both candidates tie in the violation of Express-V, (35d) is preferred, because it satisfies the next principle, WSA (Color). The selection of this candidate crucially depends on the consideration that what remains unexpressed is the whole domain of a feature and that, in the evaluation of domains, the size of the domain is unimportant.

A question that must be raised is what is the advantage of representation (35d), which, after all, does not preserve the RTR domain, over a non-harmonic representation. The answer would seem to be that even though RTR remains unexpressed, the extension of the Color domain of /ɔ/ provides an indirect way to express this contrastive feature in surface forms. This would seem to offer further evidence for Cole & Kisseberth's (1995) proposal that Uniformity functions as an input/output Faithfulness principle, which allows the realization of certain underlying distinctions even when, as in our case, this is obtained by means of different features from those which are underlyingly present.

4. *Conclusion*

In this article, we have reviewed Valencian vowel harmony within the ODT framework (Cole & Kisseberth 1994, 1995). We have argued that harmony is triggered by a principle demanding the spreading of features for greater perceptibility. The spreading of Front and Round within a domain defined by RTR would have the advantage of making feature combinations that are marked within the systems (RTR/Front and RTR/Round) more perceptible; that is, it would optimize the perception of these feature combinations.

We have seen that the features Round and Front are generally linked, so that the process affects both of them. This follows from the fact that these two features belong to the same class: Color features (Odden 1991 and, especially, Padgett 1995a,b). Now, according to the postulates of Padgett's Feature Class Theory, Round and Front are not linked under a node and can also be affected individually by phonological processes. We have seen that in certain varieties such as those of Cullera and Palmera only one of these two features spreads.

The theoretical system of principles predicts the existence of ten possible scenarios for the spreading of the Color features of stressed

RTR vowels. Of these five are documented in Valencian Catalan: no harmony (as in València), rightward Round harmony (as in Palmera), rightward Front harmony (as in Cullera), rightward Round and Front harmony (as in Canals) and bidirectional Round and Front harmony (as in Vinalopó Mitjà). On the other hand, there are no attested varieties where there is only leftward spreading or bidirectional spreading of only one of the features. The prototypical situation is rightward spread of both Color features. As we mentioned, the presence of harmony can be attributed to the marked status of certain feature combinations, their spreading being a way of making them more perceptible.

We have employed the mechanisms of ODT to describe the harmony systems found in Valencian and examine different issues related to this phenomenon. We are aware that there are still many aspects both of the harmony phenomenon and of the neutralization of final /a/ that need further work.

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Notes

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1 Alacantí is normally mentioned as a differentiated variety within Southern Valencian (cf. Colomina 1985a). This distinction is not relevant with respect to the vowel harmony phenomenon, since this is found throughout the Southern Valencian area, as we will see. However, we will use this term occasionally for convenience.

2 As the examples show, this is a progressive assimilation; although there are varieties that also allow regressive assimilation, such as those of El Pinós and L'Alguenya in the Vinalopó Mitjà area (Montoya 1989: 100). In addition, it is possible to find regressive assimilation in the speech of children of areas with harmony.

3 In spite of the fact that grammarians recommend the elimination of the phenomenon from formal styles (cf. Sanchis Guarner 1950, Lacreu 1990).

4 We assume that the non-conditioned realization of final /a/ as [ɛ] or [ɔ] implies the existence of the corresponding harmonic process.

5 As mentioned above, there is no comprehensive study of all Valencian varieties. The most detailed study is that of Colomina (1985a), which is only concerned with Alacantí. Further information can be found in Colomina (1985b, 1991), González (1991), Beltran (1994), Sancho (1995) and Casanova (1997). For information on their native varieties I am grateful to Maria Borràs, Vicent Cabrera, Josep V. Calatayud, Joan Antoni Chàfer, Àngels Falcó, Francisco José Llinares, Xavier Lluna, Anna Martí, Josep Antoni Martínez, Anna Eva Peig, Empar Pellicer, Ramon X. Rosselló, Alejandra Sebastià, Asunción Tarrazó and Josep Andrés Torres. I also want to thank Rafael Ramos and Emili Casanova.

6 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 other Catalan dialects. A reason for postulating a connection between these two facts is the following: in the context /ɔna/, where a nasal intervenes, the /ɔ/ vowel is less open than in other contexts, since the nasal has a raising influence on the preceding vowel. In this context, harmony appears to be optional in some dialects that otherwise have obligatory harmony. Thus, in Palmera, words such as /pɔka/ 'little, fem.', /kɔla/ 'it filters' are realized as [pɔkɔ], [kɔlɔ]; but /dɔna/ 'woman' may surface as [dɔnə], without harmonization.

7 We do not make use of co-occurrence restrictions such as *[Front, Round] which would be needed if the Color features of /ɛ/ spread to /o/ (cf. Palmada 1991, 1994a). It seems to us that the lack of harmony in this cases can be obtained by Uniformity (Color, RTR). Note also that in other non-harmonic cases such as /pɛle/ [pɛle] 's/he peel, subjunctive' or /mɔro/ [mɔro] 'Moor' there would be no violation of Color co-occurrence restrictions. Given this, the hypothesis that the extension of the harmonic domain takes only RTR specifications into account appears to be a simpler and more restrictive hypothesis.

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