DOMAIN AND DIRECTIONALITY IN CATALAN ATR HARMONY

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1. (Barcelona) Catalan stressed and unstressed vowel systems

(1) a. Stressed b. Unstressed, "traditional" c. Unstressed, extended

a. Stressed	b. Unstressed, "traditional"	c. Unstressed, extended
i u	i u	i u
e o		e o
ɛ ɔ	ə	ə
a		

Extended system: especially in *new words* (direct loans, orthographic loans, acronyms, truncated forms… Cabré 2002, Mascaró 1976, 2002)

Vowels in a word have the following structure:

	PRETONIC	TONIC	POST-TONIC
(2) Traditional:	{i, u, ə}	{**í, ú, á, é, ɛ́, ó, ɔ́**}	{i, u, ə}

Peloponès	[pəlupunés]
Pitàgores	[pitáɣurəs]
Tessalònica	[təsəlónikə]
Barcelona	[bərsəlónə]
Homer	[umér]
Ilíada	[ilíəðə]
Siracusa	[sirəkúzə]

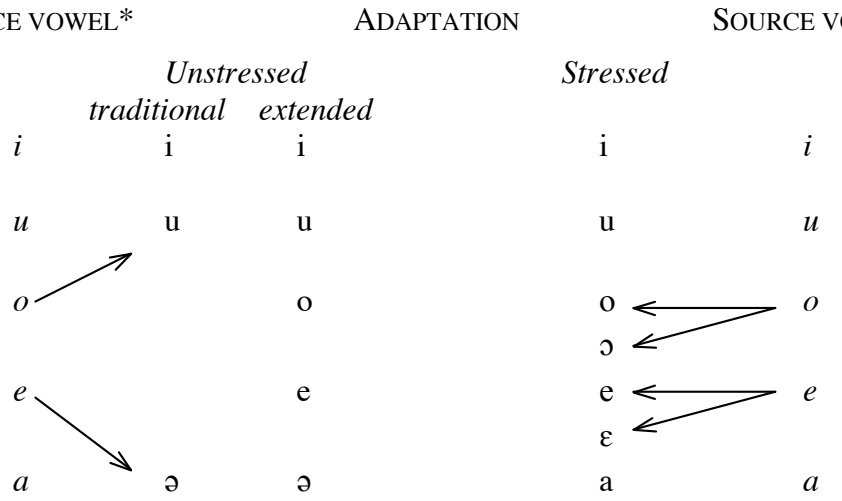
	PRETONIC	TONIC	POST-TONIC
(3) Extended:	{i, u, ə, e, o}	{í, ú, á, é, ɔ́, é, ó}	{i, u, ə, e, o}

Theodorakis	[teoðorákis]
Donatello	[donətélo]
Sòfocles	[sɔ́fokles]
Mussolini	[musolíni]

Words are stressed on the last, penultimate or antepenultimate syllable.

2. Underdetermined vowel sources in new words

(4)



*Phonetic (e.g. Spanish) or graphic

(5)

Usually:	Creta	[krétə]	Rodes	[rɔ́ðəs]
Rarely:	Greta (Garbo)	[grétə]	MOMA	[mómə]

When the source distinguishes mid open/closed, loan can be faithful:

(6) *French loans*

chaise longue	[ʃɛ̀zlɔ́ŋ]	au pair	[opɛ́r]
laisser faire	[lesèfɛ́r]	Pont l'Évêque	[pɔ̀l̃leβɛ́k]
papier mâché	[pəpjèməʃé]	prêt-à-porter	[prɛ̀təporté]
tableau	[təβló]	béchamel	[beʃəmɛ́l]
tête-à-tête	[tètətɛ́t]	comme il faut	[kɔ̀milfó]

3. Harmonic effects

In stressed position, in cases of indeterminacy (loans from Spanish, new words with orthographic source, truncated forms) there is a strong preference for mid open:

(7)

CERN	ɛ́	MOMA	ɔ́
ETA	ɛ́	DEA	é
INTERPOL	ɔ́		
OPEC	ɛ́		
ONU	ɔ́		
UEFA	ɛ́		
UNICEF	ɛ́		
OTAN	ɔ́		

(More examples in (8a).)

BUT: there is a set of cases, (8b), in which mid vowels are regularly rendered as closed: **(**Bonet et al. 2006, Cabré 2002, 2006**)**

(8)

a.		b.	
Rodes	[rɔ́ðəs]	Rodos	[róðos]
Creta	[krétə]	Lesbos	[lézβos]
euro	[ɛ́wru]	euro	[éwro]
poli	[póli] 'cop' < policia	polo	[pólo] 'iced lolly'
gnosi	[nɔ́zi]	Cnossos	[nósos]
Betty (Boop)	[bɛ́ti]	Bette (Davis)	[béte]
(Coca-)Cola	[kɔ́lə]	cole	[kóle] 'school' < col·legi
Opus	[ɔ́pus]	opos	[ópos] 'competition' < oposicions
Bonnie	[bɔ́ni]	Bono	[bóno]
Ecu	[ɛ́ku]	Eko	[éko]
Shakespeare	[t͡ʃékspir]	Chester	[t͡ʃéster]
Manzoni	[mənzɔ́ni]	calzone	[kəlzóne]
Trotsky	[trɔ́t͡ski]	trotsko	[trót͡sko] 'trotskyte'
Edu	[éðu] < Eduard	Fede	[féðe] < Federic

(9) Reading (or singing) Latin:

bonus	[bɔ́nus]	Ad[é]st[e] Fid[é]l[e]s, l[é]t[i] triumphantes
bone	[bóne]	venite, venite in B[e]thl[e]h[é]m.
bonum	[bɔ́num]	Natum vid[é]t[e] R[é]g[e]m ang[e]l[ɔ́]r[u]m.
boni	[bɔ́ni]	Venite ad[o]r[é]m[u]s, venite ad[o]r[é]m[u]s,
bono	[bóno]	venite ad[o]r[é]m[u]s D[ɔ́]m[i]n[u]m.
bono	[bóno]	

A mid stressed vowel is closed when followed by another mid (necessarily closed because it is unstressed), (8b), but a preceding mid does not have any effect, (10):

(10)

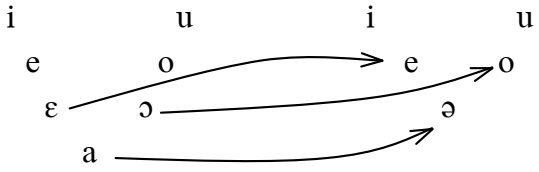
Interpol	[interpɔ́l]	(some, much less frequently, with closed stressed
Everest	[eβerést]	vowel: Comecon [komekón])
OPEC	[opék]	
Flaubert	[floβért]	
Repsol	[repsɔ́l]	
Khomeini	[xoméjni]	
Montessori	[montesɔ́ri]	
Quebec	[keβék]	

Post-tonic mid vowels do not trigger harmony in proparoxytones:

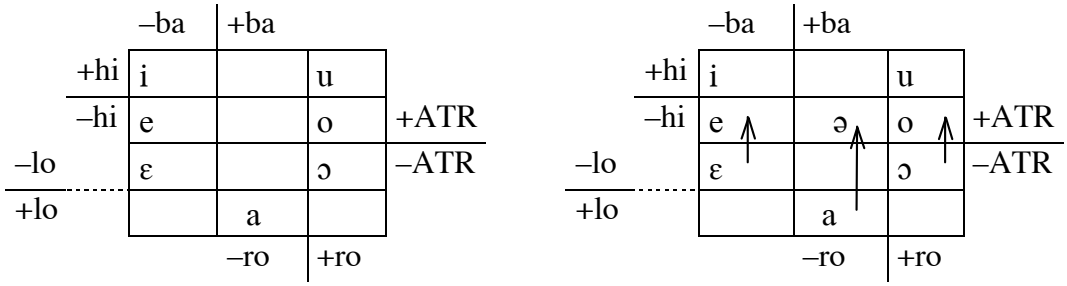
(11)	Sòfocles	[sɔ́fokles]	(rarely with closed stressed vowel:
	Jespersen	[ʒɛ́spersen]	Telemann [téləmən], but also [tɛ́ləmən])
	Chesterton	[t͡ʃésterton]	
	Mefistòfeles	[mefistɔ́feles]	
	Penèlope	[penɛ́lope]	
	Demòstenes	[demɔ́stenes]	
	Plèiades	[plɛ́jəðes]	
	Stromboli	[əstrɔ́mboli]	
	òpera	[ɔ́peɾə]	

4. Deriving the extended system

(12) a. Stressed b. Unstressed, extended



(13) a. Stressed b. Reduction in unstressed extended



(14) The feature values [±high], [±back], [±round] are never changed.

Two constraints, a faithfulness *indexed constraint* (see Pater 2004) and a markedness constraint derive the unstressed extended system:

(15) ID(hi, ba, ro)$_D$: I-O correspondent vowels have the same value for the features high, back, round, for lexical items with the diacritic feature D.

(16) *[–stress, –ATR]: No unstressed open vowels. (Unstressed [ɛ], [ɔ], [a] are forbidden.)

Unstressed prominence scale: ə > i,u > e,o > ɛ,ɔ > a

(*ŏ/a >> *ŏ/ɛ,ɔ >> ‖ *ŏ/e,o >> *ŏ/i,u >> *ŏ/ə)

(17) ID(hi, ba, ro)$_D$ >>, *[–stress, –ATR] forces the reduction pattern in (13b) for lexical items marked with the diactitic feature D.

a. Theodorakis /teodorákis/$_D$ → [teoðorákis]
and also: /tɛɔdɔrákis/$_D$ ↗
b. ventosíssim 'very windy' /bent-oz-ísim/ → [bəntuzísim]

As for the preference for stressed mid open vowels ([ɛ], [ɔ]), a low ranked constraint emerges in cases of suspended faithfulness:

(18) *[+stress, +ATR]: No stressed mid closed vowels. ([é], [ó] are better than [é], [ó].)

Stressed prominence scale: a > ɛ,ɔ > e,o > i,u > ə

(*ó/ə >> ‖ *ó/i,u >> *ó/e,o >> *ó/ɛ,ɔ >> *ó/a)

REMINDER:

PAROXYTONES	OXYTONES	PROPAROXYTONES
[béte]	[repsól]	[sófokles]
[otélo]	[eβerést]	[penélope]

5. Vowel Harmony as an effect of Positional Markedness (Walker 2005, 2006)

Since in cases of vowel harmony the trigger is the final unstressed vowel and leftward spreading typically affects the stressed vowel, an approach along the lines of Walker (2005, 2006) seems suitable.

(19) Positional peceptual Markedness Licensing effects: The harmonizing feature is attracted to strong positions; it becomes more perceptible (Walker 2005, 2006).

- LICENSE(F, S-Pos): Feature [F] in a marked structure is licensed by association to strong position S.
- *Marked structure* (F): a. F is a specification that is perceptually difficult
  b. F belongs to a prosodically weak position.
  c. F occurs in a perceptually difficult feature combination.

(20) For the extended system of Catalan:

- LICENSE([ATR]$_{\text{post-tonic-if-mid}}$, ó): [ATR] associated with a mid vowel in a post-tonic syllable must be associated with a stressed syllable.

  ([í], [ú] remain unchanged because high vowels are already [+ATR];
  [á] remains unchanged due to feature co-occurrence restrictions: *[+low, +ATR])

(21)

	Input	*Output*	Evaluation under LICENSE([ATR], ó)	Evaluation under *[+stress, +ATR]
paroxytones	/bÉtE/	[béte]	√	*
oxytones	/EbErÉst/	[eβerést]	√	√
proparoxytones	/sÓfOklEs/	[sófokles]	*	√

Here /E/ and /O/ stand for all the possible input values for [ATR].

(22)
- Positional Markedness cannot account for the fact that [+ATR] does not spread to prominent stressed vowels in proparoxytones.
- A metrical constituent, i.e. the Foot (constructed for stress assignment), delimits Vowel Harmony and has to be incorporated into the analysis somehow. For harmony processes restricted to prosodic domains see, for instance, van der Hulst and Smith (1982).

6. Span Theory (McCarthy 2004) and metrical constituents

6.1. Constraints and hierarchy

(23) Span-related constraints:

- *A-SPAN(ATR): No adjacent ATR spans. (It favors harmony spans, either [+ATR] or [–ATR].)

  Shorthand: *A-SPAN(A)

- HEAD([–stress, –low, –high], [+ATR]: Every unstressed mid vowel heads a [+ATR] span. (This constraint is also violated when a head is [–ATR].)

  Shorthand: M̆IDHD [+A]

- SPHDR(+ATR): The head of a [+ATR] span is final in that span.

  Shorthand: SPHDR(+A)

- ***Local constraint conjunction***: ALIGN-R(Wd, Ft) &$_{\text{Word}}$ HEAD(V́, –ATR)
  (The local conjunction of constraints C1 and C2 in domain D is violated if and only if both C1 and C2 are violated by the same instances of D (Smolensky 1995).)

  Shorthand: (Wd, Ft,R)&Hd(V́, –A)

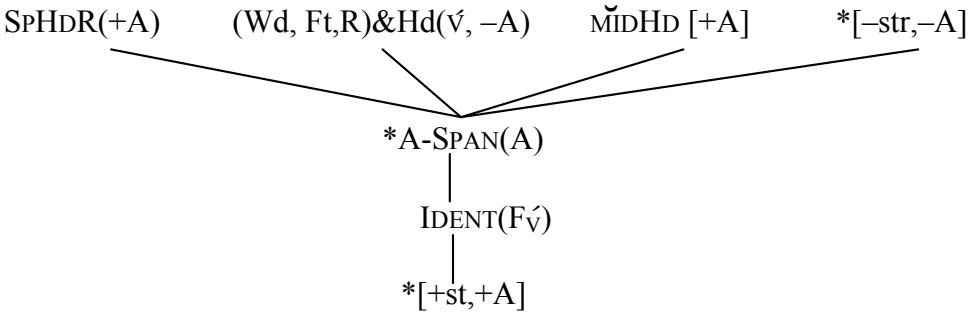
  - ALIGN-R(Wd, Ft): The right edge of a Word is aligned with the right edge of a Foot.
  - HEAD(V́, –ATR): Every stressed vowel heads a [–ATR] span.

  This local constraint conjunction will only be relevant for the evaluation of proparoxytones.

(24) Other constraints:

- IDENT(F$_{\text{V́}}$): Correspondent stressed vowels are identical in features.
- *[–stress, –ATR]: Cf. (16). Shorthand: *[–str,–A]
- *[+stress, +ATR]: Cf. (17). Shorthand: *[+st,+A]

(25) Constraint ranking:



6.2. Obligatory harmony: paroxytones

• Regardless of the input value for [ATR], paroxytones will systematically surface with [+ATR] mid vowels.This is illustrated in (26) - (29) with *Bette* [béte].

• The tableaux (26) - (29) differ only with respect to the evaluation of IDENT($F_{\acute{V}}$).

• The constraint conjunction ALIGN-R(Wd, Ft) &$_{Word}$ HEAD(V́, –ATR) is irrelevant in paroxytones because the right edge of the Foot coincides with the right edge of the Word, hence one of the conjoined constraints, ALIGN-R(Wd, Ft), is satisfied and, therefore, the local constraint conjunction is satisfied.

In the remaining tableaux, '( )' indicates span edges; feet appear in boldface.

(26) *Bette* [béte], from /bɛ́tɛ/

/bɛ́tɛ/	SPHDR (+A)	(Wd, Ft,R)& Hd(V́, –A)	MIDHD [+A]	*[–str,–A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)
a. (**bɛ́tɛ**)			*	*!		
b. (**bɛ́tɛ**)				*!		
c. (**bɛ́**)(**tɛ**)				*!	*	
d. (**béte**)	*		*!			*
e. ☞ (**béte**)						*
f. (**bé**)(**te**)					*!	*
g. (**bɛ́**)(**te**)					*!	
h. (**bé**)(**te**)					*!	*

(27) *Bette* [béte], from /bétɛ/

/bétɛ/	SPHDR (+A)	(Wd, Ft,R)& Hd(V́, –A)	MIDHD [+A]	*[–str,–A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)
a. (**bɛ́tɛ**)			*	*!		*
b. (**bɛ́tɛ**)				*!		*
c. (**bɛ́**)(**tɛ**)				*!	*	*
d. (**béte**)	*		*!			
e. ☞ (**béte**)						
f. (**bé**)(**te**)					*!	
g. (**bɛ́**)(**te**)					*!	*
h. (**bé**)(**te**)					*!	

(28) *Bette* [béte], from /béte/

/béte/	SPHDR (+A)	(Wd, Ft,R)& Hd(v́, –A)	MIDHD [+A]	*[–str,–A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)
a. (**bétɛ**)			*	*!		
b. (**bétɛ**)				*!		
c. (**bé**)(**tɛ**)				*!	*	
d. (**béte**)	*		*!			*
e. ☞ (**bété**)						*
f. (**bé**)(**te**)					*!	*
g. (**bé**)(**te**)					*!	
h. (**bé**)(**te**)					*!	*

(29) *Bette* [béte], from /béte/

/béte/	SPHDR (+A)	(Wd, Ft,R)& Hd(v́, –A)	MIDHD [+A]	*[–str,–A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)
a. (**bétɛ**)			*	*!		*
b. (**bétɛ**)				*!		*
c. (**bé**)(**tɛ**)				*!	*	*
d. (**béte**)	*		*!			
e. ☞ (**bété**)						
f. (**bé**)(**te**)					*!	
g. (**bé**)(**te**)					*!	*
h. (**bé**)(**te**)					*!	

By Lexicon Optimization, the input /béte/ will be chosen.

From now on, for simplicity we ignore candidates with left-headed spans, because they will always be ruled out by SPHDR(+A); we also ignore candidates with unstressed [ɛ], [ɔ], because they will always be ruled out by *[–str,–A].

6.2. Oxytones

The constraint conjunction ALIGN-R(Wd, Ft) &$_{\text{Word}}$ HEAD(v́, –ATR) is also irrelevant in oxytones because the right edge of the Foot coincides with the right edge of the Word, hence one of the conjoined constraints, ALIGN-R(Wd, Ft), is satisfied and, therefore, the local constraint conjunction is satisfied.

In oxytones, the constraint IDENT($F_{\acute{V}}$) becomes crucial in cases where the value for [ATR] from the source is known.

(30) *Molière* [moljɛ́r]

/moljɛ́r/	(Wd, Ft,R)& Hd(v́, –A)	MIDHD [+A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)	*[+st,+A]
a. (mo**ljɛ́r**)		*!		*	*
b. (mo)(**ljɛ́r**)			*	*!	*
c. ☞ (mo)(**ljɛ́r**)			*		

(31) *Fauré* [foɾé]

/foɾé/	(Wd, Ft,R)& Hd(v́, –A)	MIDHD [+A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)	*[+st,+A]
a. (fo**ɾé**)		*!			*
b. ☞ (fo)(**ɾé**)			*		*
c. (fo)(**ɾɛ́**)			*	*!	

When the value for [ATR] does not depend on the source, IDENT($F_{\acute{V}}$) is suspended and constraints like *[+st,+A] become crucial.

(32) *Everest* [eβeɾɛ́st], from /ebeɾÉst/ (we ignore inputs with unstressed /ɛ/)

/ebeɾÉst/	(Wd, Ft,R)& Hd(v́, –A)	MIDHD [+A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)	*[+st,+A]
a. (eβe**ɾɛ́st**)		**!			*
b. (eβe)(**ɾɛ́st**)		*!	*		
c. (eβe)(**ɾɛ́st**)		*!	*		*
d. (e)(βe)(**ɾɛ́st**)			**		*!
e. ☞ (e)(βe)(**ɾɛ́st**)			**		

6.4. Proparoxytones

In proparoxytones the local constraint conjunction becomes crucial.

(33) *Sòfocles* [sɔ́fokles], from /sÓfokles/ (we ignore inputs with unstressed /ɔ/, /ɛ/)

/sÓfokles/	(Wd, Ft,R)& Hd(v́, –A)	MIDHD [+A]	*A-SPAN (A)	IDENT ($F_{\acute{V}}$)	*[+st,+A]
a. (**sófo**kles)	*	*!			*
b. (**sófo**)(kles)	*!		*		*
c. (**só**)(**fo**kles)	*	*!	*		*
d. (**sɔ́**)(**fo**kles)		*!	*		
e. (**só**)(**fo**)(kles)	*!		**		*
f. ☞ (**sɔ́**)(**fo**)(kles)			**		

6.5. Schwa

As in many other languages, schwa never participates in harmony.

(34)	ETA	[ɛ́tə]	DEA	[déə]
	feta	[fɛ́tə]	Honda	[óndə]
	Kojak	[kɔ́ʒək]	MOMA	[mómə]
	dòlar	[dɔ́lər]		

Possibilities: (a) Schwa is not specified for [ATR] (cf. Crosswhite 2004).

(b) The span-head constraint (i.e. MIDHD[+A]) explicitly excludes schwa, the central mid vowel.

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