Prestressing suffixes in Catalan. A challenge for OT-CC with Optimal Interleaving?

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Summary

1. Prestressing suffixes in Catalan. Basic patterns
2. Underlying representations
3. Vowel lowering. Interpretations, descriptive generalizations and interim analyses
4. The interaction between stress assignment, morpheme realization and vowel lowering via OT-CC/OI

1. PRESTRESSING SUFFIXES IN CATALAN. BASIC PATTERNS

- In Catalan, the so called prestressing suffixes (henceforth PS) (*i.e.* *–i*, *–ic*, *–it*, *–id*, *–il*, *–im*, *–fil*, *–fon*, *–graf*, *–metre*, *–leg*, *–log(a)*, *–metre*, *–ul*) show some intriguing patterns (Mascaró 1976, 1985) that have not yet been resolved (Mascaró 2003):

1.1. Unlike the rest of the derivational suffixes, they are unstressed (1).

(1)

Prestressing suffixes		*Other derivational suffixes*	
CÈNtr-ic	'central'	cenTR-AL	'central'
carBÒn-ic	'carbonic'	carboN-ET	'carbon *dim.*'
CÀl-id	'warm'	caliD-Esa	'warmth'
deCÍ-metre	'decimeter'	deciM-AL	'decimal'
purPUr-i	'purple'	purpuR-Ina	'metallic powder'

(NB: *Stressed syllables are indicated in capital letters*.)

1.2. The stress is always placed in the syllable immediately preceding the prestressing suffix (*i.e.* in the last syllable of the stem) (2). This is why paroxytone stems undergo stress shift to the last syllable of the stem (2a), whereas oxytone stems preserve the stress (2b).

(2)

(2a) *Stress shift*

Paroxytone stems (*paroxytone words after inflection*)		*Stress shift in PS words*	
CÀnon	'canon'	caNÒn-ic	'canonical'
aDÚLter	'adulterous'	adulTEr-i	'adultery'
ÀNgel	'angel'	anGÈl-ic	'angelical'
Àtom	'atom'	aTÒmic	'atomical'

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Paroxytone stems (*proparoxytone words after inflection*)		*Stress shift in PS words*	
MÈtode	'method'	meTÒd-ic	'methodic'
SÒcrates	'Sòcrates'	soCRÀt-ic	'Socratic'
PÚRpura	'purple'	purPUr-i	'purplish'
SÁtira	'satire'	saTÍr-ic	'satirical'

(2b) *Stress preservation*

Oxytone stems		*Stress preservation in PS words*	
CENtre	'center'	CÈNtr-ic	'central'
moDEST	'modest'	moDÈSt-ia	'modesty'
carBÓ	'carbon'	carBÒn-ic	'carbonic'
CENT	'a hundred'	CÈNt-im	'cent'

Note how a PS can also be adjoined to a derived stem (which, due to the stressed character of "standard derivational" suffixes, are always oxytone); in these cases, the same patterns illustrated in (2b) are found (see 2c).

(2c) *PS and derived stems*

Oxytone stems		*Stress preservation in PS words*	
introducT-OR	'introductory'	introducTOr-i	'introductory'
diviS-OR	'divisor'	diviSOr-i	'dividing'

1.3. When the underived stem ends in a *stressed* high mid vowel ([é] or [ó]), this vowel is systematically low whenever the PS is added (3).

(3) *Vowel alternations in stressed position due to the adjunction of a PS*

Stems with high mid vowels		*Stems with low mid vowels*	
esf[é]r-a	'sphera'	esf[ɛ́]r-ic	'spherical'
conv[é]	'it is convenient'	conv[ɛ]n-i	'agreement'
mod[é]st	'modest'	mod[ɛ́]st-ia	'modesty'
carb[ó]	'carbon'	carb[ɔ́]n-ic	'carbonic'
divis[ó]r	'divisor'	divis[ɔ́]r-i	'dividing'
macarr[ó]	'macaroni'	macarr[ɔ́]n-ic	'macaronic'

→ **Vowel lowering process**: see the discussion about the UR in § 2.

1.4. This vowel lowering process is responsible not only for these vocalic alternations in stressed position, which in fact are unique in the phonology of Catalan, but also for vocalic alternations in unstressed / stressed position involving both words with regular vowel reduction (with [u] and [ə] in unstressed position) (4a) and words typically

considered lexical exceptions to vowel reduction (with [o] and [e] in unstressed position) (4b).

(4) *Vowel alternations in unstressed / stressed position*

(4a) *Bases: words with regular vowel reduction*

Stems with reduced vowels		*Stems with low mid vowels (PS words)*	
àt[u]m	'atom'	at[ɔ]m-ic	'atomic'
apòst[u]l	'apostle'	apost[ɔ]l-ic	'apostolic'
mèt[u]de	'method'	met[ɔ]d-ic	'methodical'
àng[ə]l	'angel'	ang[ɛ́]l-ic	'angelical'
èt[ə]r	'ether'	et[ɛ́]r-i	'ethereal'
cadàv[ə]r	'cadaver'	cadav[ɛ́]r-ic	'cadaverous'

(4b) *Bases: lexical exceptions*

Stems with exceptionally unreduced vowels		*Stems with low mid vowels (PS words)*	
càn[o]n	'canon'	can[ɔ]n-ic	'canonical'
er[o]s	'Eros'	er[ɔ]t-ic	'erotic'
micr[o]	'micro'	micr[ɔ]fon	'microphone'
tòt[e]m	'totem'	tot[ɛ́]m-ic	'totemic'
cin[e]	'cinema trunc.'	cin[ɛ́]-fil	'cinephile'
tel[e]	'TV trunc.'	tel[ɛ́]-fon	'telephonic'

1.5. Interestingly enough, vowel lowering just affects stems in PS words. Other derived forms (denominals and other zero derivational forms), which share the same stem, do not show vowel lowering (5a).

(5a) *No vowel lowering in other "derived forms"*

Other derived words (verbal forms) (denominals with "zero" derivation)		*Nominal bases*	*PS words*
num[é]ri	'to number 3rd P *sing*. PS'	núm[ə]ro	num[ɛ́]r-ic
abs[é]nti	'to be absent 3rd P *sing*. PS'	abs[é]nt	abs[ɛ́]n-cia
c[é]ntri	'to center 3rd P *sing*. PS'	c[é]ntre	c[ɛ́]ntr-ic
cl[ó]na	'to clone 3rd P *sing*. PI'	cl[ó]n	cl[ɔ]n-ic
adult[é]ri	'to adulterate 3rd P *sing*. PS'	adúlt[ə]r	adult[ɛ́]r-i
carb[o]ni	'carbonize. 3rd P *sing*. PS'	carb[ó]	carb[ɔ]n-i

Exceptionally, though, some denominals with zero derivation can show low mid vowels.

(5b)

Some derived words (verbal forms) (denominals with zero derivation)		*Nominal bases*	
apostr[ɔ]fa	'to apostrophize 3rd P *sing*. PI'	apòstr[u]f	'apostrophe'
cronom[ɛ́]tra	'to time 3rd P *sing*. PI'	cronòm[ə]tre	'chronometer'

2. UNDERLYING REPRESENTATIONS

2.1. *Vowel alternations in stressed position*

(6)

Vowel alternation		*UR*	*impossible UR*
esf[é]r-a	esf[ɛ́]r-ic	esf/e/r	*esf/ɛ/r
mod[é]st	mod[ɛ́]st-ia	mod/e/st	*mod/ɛ/st
carb[ó]	carb[ɔ]n-ic	carb/o/n	*carb/ɔ/n
macarr[ó]	macarr[ɔ]n-ic	macarr/o/n	*macarr/ɔ/n

→ impossible to derive vowel raising through the constraint hierarchy of Catalan
→ vowel lowering process

2.2. *Vowel alternations in unstressed (cases with regular VR) / stressed position*

(7)

Vowel alternation		*Possible UR (under RB)*	
àt[u]m	at[ɔ]m-ic	àt/ɔ/m	àt/o/m
èt[ə]r	et[ɛ́]r-i	et/ɛ/r	et/e/r

→ It is possible to derive VR of /ɔ/~/o/ and /ɛ/~/e/ through the constraint hierarchy of Catalan
→ vowel lowering process (if UR /o/~/e/)

2.3. *Vowel alternations in unstressed (exceptional cases wrt VR) / stressed position*

(8)

Vowel alternation		*Possible UR (under RB)*	
càn[o]n	can[ɔ]n-ic	càn/o/n	càn/ɔ/n
tot[e]m	tot[ɛ́]m-ic	tot/e/m	tot/ɛ/m

→ It is possible to derive partial VR of /ɔ/ and /ɛ/ through the constraint hierarchy of Catalan
→ vowel lowering process (if UR /o/~/e/)

3. VOWEL LOWERING. INTERPRETATIONS, DESCRIPTIVE GENERALIZATIONS AND INTERIM ANALYSES

3.1. A purely phonological interpretation: (high) vowel dissimilation

- Most PS suffixes contain a high front vowel ([i]) (*i.e. –i*, *–ic*, *–it*, *–id*, *–il*, *–im*, *–fil*) and some others a high back vowel ([u]) (*i.e. –ul*, *–fon* [fun]), which would enhance the vowel lowering of the /e/ and the /o/ in the stem, due to a dissimilatory effect.

(9) *c[é]ntr[i]c *carb[ó]n[i]c → c[ɛ́]ntr[i]c, carb[ɔ́]n[i]c
*tel[é]f[u]n *micr[ó]f[u]n → tel[ɛ́]fon, micr[ɔ́]fon

- ARGUMENTS IN FAVOR (1). Other cases not involving PS suffixes show the same effects: a following [i] or [j] in the adjacent syllable (10a) or a following [j] in the same syllable (10b) favor the occurrence of low mid vowels (almost categorical pattern)

(10a) *Occurrence of low mid vowels whenever a posttonic* [i] or [j] *follows (in the adjacent syllable)*

col·l[ɛ́]g**i**	confer[ɛ́]nc**i**a	Ant[ɔ́]n**i**	cab[ɔ́]r**i**a
'school'	'lecture, speech'	'Anthony'	'obsession *pop*.'
ex[ɛ́]rc**i**t	d[ɛ́]r**i**a	cust[ɔ́]d**i**a	hist[ɔ́]r**i**a
'army'	'obsession *pop*.'	'guard'	'history'

(Data from Mascaró 2008, 2011; Wheeler 2005: 37-52, *GIEC*, see Appendix-A)
(NB: *PS suffixed words are, of course, excluded*)

(10b) *Occurrence of low mid vowels whenever a posttonic* [j] *follows (in the same syllable)*

nucl[ɛ́]**i**c	'nucleic'	Alc[ɔ́]**i**	'place name'
seborr[ɛ́]**i**c	'sebaceous'	alm[ɔ́]**i**na	'tip'
ol[ɛ́]**i**c	'oleic'	andr[ɔ́]**i**de	'android'

(Data from Mascaró 2008, 2011; Wheeler 2005: 37-52, *GIEC*, Appendix-A)

→ Note how the [u] in *–f*[u]*n* and *–l*[u]*ga*, being high, could also have a dissimilatory effect.)

–fon	tel[ɛ́]-fon	'telephone'	micr[ɔ́]-fon	'microphone'
–loga	NE		psic[ɔ́]-log(a)	'psycologist'

Cf. inherited words: *c*[ɔ́]*dul*; loanwords and the like: [ɔ́]NU, [ɛ́]du…

- ARGUMENTS IN FAVOR (2). This tendency emerges in loanwords and learned words, which show the same patterns.

(11) *Occurrence of low mid vowels in loanwords and learned words*

M[ɛ́]ss**i**	Cr[ɔ́]**y**ff
L[ɛ́]**i**den	gas[ɔ́]**i**l
i[ɛ́]t**i**	f[ɔ́]l**i**
conf[ɛ́]t**i**	b[ɔ́]l**i**
espagu[ɛ́]t**i**	Conan D[ɔ́]**i**le
f[ɛ́]rr**i**	G[ɔ́]**i**a
B[ɛ́]t**i**s	Cr[ɔ́]**i**ff
Ob[ɛ́]l**i**x	
Ast[ɛ́]r**i**x	

(Mascaró 2002, 2011; *GIEC*)

- ARGUMENTS AGAINST. Not all PS suffixed words contain high vowels: *–graf*, *–metre*, *–leg* and, nevertheless, lowering applies:

(12) *Low mid vowels with PS without high vowels*

–metre	tel[ɛ́]-m[ə]tre, term[ɔ́]-m[ə]tre, cron[ɔ́]-m[ə]tre
–graf	tel[ɛ́]-gr[ə]f
–man	mel[ɔ́]-m[ə]n, clept[ɔ́]-m[ə]n
–leg	psic[ɔ́]-l[ə]g, astr[ɔ́]-l[ə]g

POSSIBLE DIACHRONIC EXPLANATION OF THESE FACTS. The pattern found in PS suffixed words with high (front) vowels (inducing vowel lowering and with a significant highest frequency) could have attracted the pattern of the rest of PS suffixed words without high (front) vowels.

3.2. A purely prosodic interpretation (Fabra 1912, 1956; Mascaró 2003, 2008, 2011)

- Words with a marked prosodic structure (such as paroxytone ending in a *-C* and proparoxytone words) tend to show low mid vowels (Fabra 1912: 459-460, 1956: 4; Mascaró 2003: 119). Note that all PS contain a final –C, except for *–i*.

- ARGUMENTS IN FAVOR. Most words (inherited words, loanwords, and learned words) with this prosodic structure show low mid vowels.

(13) *Low mid vowels in paroxytone words ending in a –C / paroxytone words*

p[ɛ́]tal	abd[ɔ́]men	an[ɛ́]cdota	acr[ɔ́]polis
'petal'	'abdomen'	'anecdote'	'Acropolis'
f[ɛ́]mur	an[ɔ́]mal	d[ɛ́]spota	c[ɔ́]mode
'femur'	'anomalous'	'despot'	'comfortable'

(Data from Fabra 1912: 459-460; Mascaró 2011; *GIEC*; see Appendix)
(NB: *Words with PS and with a following [i] / [j] are, of course, excluded*)

- ARGUMENTS AGAINST (1). This tendency is not categorical in the case of paroxytone words ending in a *–C*.

(14) *Paroxytone non-verbal lexical elements ending in a –C (without posttonic –i and without a PS)*

Words with [é]	11	Words with [ó]	4
Words with [ɛ́]	18	Words with [ɔ́]	24
% [ɛ́]	**62,1**	% [ɔ́]	**85,7**

(Mascaró 2011: 13)

- ARGUMENTS AGAINST (2). There are <u>some</u> exceptions in the case of proparoxytone words.

(15) *Exceptions*

c[é]rvola	'deer'	f[ó]rmula	'formula'
fer[é]stega	'wild'	p[ó]lvora	'powder'
ll[é]pola	'greedy *fem.*'	t[ó]mbola	'tombola'

(Some other exceptions: *t*[ó]*rtora*, *g*[ó]*ndola*, *esc*[ó]*rpora*…)

- ARGUMENTS AGAINST (3). The PS *–i* does not end in a *–C*, so that a prosodic marked structure is not created when this PS is adjoined to the stem.

(16) *Vowel lowering with –i*

adult[ɛ́]ri 'adultery'
carb[ɔ́]ni 'quemical element'
imp[ɛ́]ri 'empire'
……

- Mascaró (2003: 119), though, after precluding a DEE approach (framed within Comparative Markedness (McCarthy 2003) to these data (see § 3.3), suggests, following Fabra's observations, that what it is at play here is a constraint against high mid vowels in marked stressed words (such as paroxytones and proparoxytones).

- $_{O,N}$ *e,*o ES ("no high mid vowels under **E**xceptional **S**tress") is the constraint responsible for vowel lowering, and it ensures that all stressed vowels, old and new, lower in marked stress structures.

- Cases like *préssec* (see 14) and *fórmula* (see 15) have to be treated as exceptions.

- <u>Remaining problems</u>: *a*) almost half of the oxytone words with [é] ending in a *–C* (see 14: *pr*[é]*ssec*) should be treated as exceptional. *b*) the PS *–i* does not create an exceptional prosodic structure (see 16: *adult*[ɛ́]*ri*).

- Our solution: Only [e] and [o] in a *derived* (*i.e.* <u>*new*</u>) prosodic structure are forbidden

(17) → $_{N}$ ES *e,*o >> IDENT(ATR) >> $_{O}$ ES *e,*o

- Remaining problem. The PS *–i* does not create an exceptional prosodic structure.

POSSIBLE DIACHRONIC EXPLANATION OF THESE FACTS. The pattern found in PS suffixed words with the syllabic structure (C)VC (inducing vowel lowering and with a significantly highest frequency) could have attracted the pattern of the PS suffixed words with *–i*.

3.3. A morphoprosodic interpretation (prosodic / phonological DE)[2]

- Vowel lowering occurs in a <u>prosodic</u> derived environment, that is, whenever a (vacuous or non-vacuous) restressing process occurs, due to the adjunction of an unstressed derivational affix (Mascaró 1976; Mascaró 2003).

(18)

		Base	Restressing	Vowel lowering
a.	/o/	CÀnon	caNÒn-ic	can[ɔ́]n-ic
	/e/	aDÚLter	adulTEr-i	adult[ɛ́]r-i
	/o/	MÈtode	meTÒd-ic	met[ɔ́]d-ic
b.	/o/	CROM	CRÒmic	cr[ɔ́]m-ic
	/e/	HoMER	hoMÈric	hom[ɛ́]r-ic

- Using Compartive Markedness (McCarthy 2003), the ranking $_{N}$*é, *ó >> IDENT(ATR) >> $_{O}$*é, *ó could explain the avoidance of [e] and [o] in derived structures (by restressing [stress shift], in this case) and, therefore, vowel lowering (Mascaró 2003: 116). → "lowering of only derived stressed mid vowels".

- ARGUMENTS AGAINST (1) (*theoretical*). It is impossible to discriminate between *old* and *new* structures as far as the quality of the vowels is concerned (Mascaró 2003: 116): the FFCs (*i.e.* [kánónik]) and the candidates without vowel lowering (*i.e.* [kənónik]) are identical wrt vowel quality.

[2] § 3.3 and § 3.4 are presented in Mascaró (2003) as a single interpretation: for the sake of clarity, we split them into two interpretations.

(19)

/kánónik/	ONE WORD STRESS	$_{N}$*é, *ó	IDENT(ATR)	$_{O}$*é, *ó
FFC a. kánónik	*!			*
💣 b. kənónik		Satisfied!	*	*
☹ c. kənɔ́nik			**!	

(Adapted from Mascaró 2003: 116)

- The problem is even clearer in oxytone bases (*cr*[ó]*m*, *cr*[ɔ́]*mic*), where vacous restressing applies.

- ARGUMENTS AGAINST (2) (*empirical*). It is not always the case that vowel lowering occurs due to restressing (stress shift) (Mascaró 2003: 118).

(20)

/e/	NÚmero	num[e]ri
	aDÚLter	adult[e]ri
/o/	ÀNcora	anc[o]ra
	FÒSfor	fosf[o]ra

- This is why Mascaró (2003) precludes the *prosodic* DEE approach and abandons, in fact, his own approach (in Mascaró 1976), which could be sustained, in the SPE model, thanks to the *strict cycle condition* (SCC): see (22).

- Our solution to the theoretical problem: stress is not present in the UR, so that the candidates without vowel lowering (*[kanónik], *[krómik]), with a different structure than the FFC ([kanonik], [kromik]), incur in a violation of $_{N}$*é, *ó (No new stressed *é, *ó) and therefore, are (happily ☺) discarded.

(22) Some history: According to Mascaró (1976), a vowel lowering rule of the type [+syl, –high, +acc] → [–ATR] applies under certain conditions (*i.e.* when certain new information is added). The difference between (a) and (b) (below) is the following: in (a) the property [+acc] is underlying information (so that no crucial new information is added by any cycle), but in (b) there is a rule that assigns stress to the preceding vowel when a PS is added (so that crucial new information is added and the rule of vowel lowering can be applied). The rule of vowel lowering, moreover, applies whether or not the vowel was already stressed in another cycle, following the SCC: this explains vowel lowering in (c).

a.	b.	c.
c[é]ntre, c[é]ntri	c[ɛ́]ntric	símb[u]l → simb[ɔ́]lic
cal[ó]r, acal[ó]ri	cal[ɔ́]ric	

3.4. A PURELY MORPHOLOGICAL INTERPRETATION (morphological DE)

- Vowel lowering occurs in a morphological derived environment, that is, whenever an unstressed derivational affix is adjoined to the stem, whereas is does not occur in non-derived environments.

(23)

NDE	NDE	DE
mod[e]st 'modest'	mod[e]sta 'modest *fem.*'	mod[ɛ́]stia 'modesty'
divis[o]r 'divisor'	divis[o]ra 'divisor *fem.*'	divis[ɔ́]ri 'dividing'

- ARGUMENTS IN FAVOR: Coincidence between structures created by derivation (*mod*[ɛ́]*stia*) and structures present in the adaptation of loanwords and in learned words (with a general tendency to adapt *e* / *o* as [ɛ́] and [ɔ́]).

- ARGUMENTS AGAINST. It is not always the case that vowel lowering occurs in a derived environment: "zero" derivation forms do not show vowel lowering (Mascaró 2003)

(24) *Denominal verbal forms without vowel lowering* (see 5a)

número	num[e]ri
centre	c[e]ntri
adúlter	adult[e]ri

- Solution: Are the structures in (20b) strictly derived?

4. THE INTERACTION BETWEEN STRESS ASSIGNMENT, MORPH REALIZATION, AND VOWEL LOWERING VIA OT-CC/OI

4.1. Lack of synchronic consistency in the previous interpretations. According to our view, the interpretations exposed in § 3 are circumstances that, all together, might have diachronically lead to a specific synchronic situation. Due to the significant number of counterexamples and exceptions, though, none of the interpretations can be sustained from a strictly synchronic point of view.

4.2. New descriptive generalizations. In this paper we show that among these data it is possible to detect some consistencies which allow us to make a picture of how the analysis could be.

- Prestressing suffixes, unlike the rest of derivational affixes, behave as most inflectional affixes, as far as stress assignment is concerned (*esFEr-a*, *carBÒn-ic vs*. *carboNET*): both kinds of affixes are "invisible" to stress.

(25)

→ PS = Inflectional affixes wrt stress assignment
→ PS ≠ Derivational affixes wrt stress assignment

- But they behave differently as for vowel lowering (*carb*[ó]*n-s*, *esf*[é]*r-a vs*. *carb*[ɔ́]*n-ic*, *esf*[ɛ́]*r-ic*), as they do with respect to other derivational affixes (*num*[é]*ri*, *carb*[ó]*ni*, etc.).

(26)

→ PS ≠ Inflectional affixes wrt to vowel lowering
→ PS ≠ Other derivational affixes wrt vowel lowering

- The behavior of PS with respect to stress assignment has to be considered exceptional with respect to the rest of derivational affixes, but not exceptional with respect to other affixes.

- The behavior of PS with respect to vowel lowering has to be considered, therefore, as exceptional within the phonology of Catalan, and it cannot be derived through the constraint ranking of the language.

4.3. Preanalysis of vowel lowering (some reflections about vowel lowering as a DEE)

4.3.1. Constraint hierarchy to explain the distribution of stressed mid vowels in Catalan:

(27) IDENT(ATR) >> *é, *ó >> *é, ɔ́

→ MARKEDNESS CANNOT explain vowel lowering (or vowel raising).

Therefore:

- We cannot explain the data as an instance of an orthodox DEE à la McCarthy (2007) / Wolf (2008) [See Appendix-B]

- In McCarthy (2007) and Wolf (2008), DEE [in our case: *esf*[é]*r-ic*, *carb*[ɔ́]*n-ic*?] are **explained through the blocking of a general process of the language** (induced by M >> F_2), which applies in the DE [in our case: *esf*[é]*r-ic*, *carb*[ɔ́]*n-ic*?], **in an underived context** [in our case: *esf*[é]*ra*, *carb*[ó]], **through PRECEDENCE constraints of the type PREC(F_1, F_2) ranked above the constraint hierarchy** (*i.e.* PREC(F_1, F_2) >> M >> F_2). These PRECEDENCE constraints demand that a violation of F_2 must be preceded by a violation of F_1.

- In other words, "a process (F_2 violation) is allowed to apply only when its application is made possible by the application of some other process (F_2-violation)" (Wolf 2008: p. 252).

- Only apparently, then, Catalan data related to PS are instances of DEE.

(28)
→ vowel lowering [IDENT(ATR) violation] after affixation [INSERT-affix violation]?
→ vowel lowering [IDENT(ATR) violation] after restressing [DEP(Stress) violation]?

- NO: Vowel lowering in the DE cannot be achieved through:

(29) *é, *ó >> IDENT(ATR) >> *é, ɔ́

BECAUSE both /e, o/ and /ɛ, ɔ/ underlying vowels need to be protected

4.3.2. Preanalysis for stress assignment

- Stress assignment *crucially* precedes PS and INFL affixation (*i.e.* PS and INFL morph insertion follow stress assignment.)

  - PREC[DEP(Stress), PS-affixation]
  - PREC[DEP(Stress), INFL-affixation]

4.3.3. Some (non orthodox and somehow wrong) attempts

Stress assignment precedes PS and INFL affixation

(30) **PREC(DEP(stress), PS-affixation):** Assign a violation-mark to a candidate for each time that:
a. A PS morph is inserted (a violation of INSERT-PS), and this is not preceded by stress assignment (a violation of DEP(Stress))
b. A PS morph is inserted (a violation of INSERT-PS), and this is followed by stress assignment (a violation of DEP(Stress)).

(31) **PREC(DEP(stress), INFL-affixation):** Assign a violation-mark to a candidate for each time that:
a. An INFL morph is inserted (a violation of INSERT-PS), and this is not preceded by stress assignment (a violation of DEP(Stress))
b. An INFL morph is inserted (a violation of INSERT-PS), and this is followed by stress assignment (a violation of DEP(Stress)).

→ Idea behind (1): PS and INFL are equally "blind" to stress assignment.
→ Idea behind (2): Stress assignment precedes PS & INFL affixation.

Vowel lowering precedes PS and INFL affixation

(32) **PREC(IDENT(ATR), PS-affixation):** Assign a violation-mark to a candidate for each time that:
a. A PS morph is inserted (a violation of INSERT-PS), and this is not preceded by vowel lowering (a violation of IDENT(ATR))
b. A PS morph is inserted (a violation of INSERT-PS), and this is followed by vowel lowering (a violation of IDENT(ATR)).

→ Idea behind: PS morphs can only be attached to stems with low vowels.

Tableaux

(33) *Stress assignment precedes PS affixation AND Vowel lowering precedes PS affixation*

/ROOT+PS-AFFIX/	Prec [DEP(Stress), PS-affixation]	Prec [IDENT(ATR), PS-affixation]	STW	DEP(stress)	IDENT(ATR)	*é, *ó	*ɛ́, *ɔ́
a. <esf[e]r-affix, esF[e]R-affix, esF[e]R-ic, esf[ɛ]r-ic> LUMSeq: <DEP(stress), INSERT-PS, IDENT(ATR)>		W*(!)	*	*	*		*
b. <esf[e]r-affix, esf[e]r-ic, esf[e]RI-C, esF[ə]Ri-C> LUMSeq: <INSERT-PS, DEP(Stress)>	W*(!)		L	*	L		L
c. <esf[e]r-affix, esF[e]R-affix, esF[e]R-ic> LUMSeq: <DEP(Stress), INSERT-PS>		W*(!)	*	*	L	W*	L
?☞d. **<esfer-affix, esF[e]R-affix, esF[ɛ]R-affix, esf[ɛ]r-ic>** LUMSeq: <DEP(stress), IDENT(ATR), INSERT-PS>			*	*	*		*

Problem: candidate chains *a* and *d* are <u>not</u> harmonically improving, given IDENT(ATR) >> *é, *ó (see Appendix B).

(34) *Stress assignment precedes INFL affixation*

/ROOT+INFL-AFFIX/	Prec [Dep(Stress), INFL-affixation]	STW	Dep(stress)	Ident(ATR)	*é, *ó	*ɛ́, *ɔ́
a. <esf[e]r-affix, esF[e]R-affix, esF[e]R-a, esF[ɛ]R-a> <Dep(Stress), INSERT-INFL, Ident(ATR)>			*	W*(!)	L	W*
☞ b. **<esf[e]r-affix, esF[e]R-affix, esF[e]R-a>** <Dep(Stress), INSERT-INFL>			*		*	
c. <esf[e]r-affix, esf[e]r-a, esf[e]RA> < INSERT-INFL, Dep(Stress)>	W*(!)		*		*	
d. <esf[e]r-affix, esf[e]r-a, esf[e]RA, esf[ə]RA> < INSERT-INFL, Dep(Stress)>	W*(!)		*		L	

Remaining problem (not crucial here): candidate chain *a* is not harmonically improving, given IDENT(ATR) >> *é, *ó (see Appendix-B).

(35) *Stress assignment precedes PS affixation AND Stress Assignment precedes Vowel lowering*

/ROOT+PS-AFFIX/	Prec [DEP(Stress), PS-affixation]	Prec [DEP-Stress, IDENT(ATR)]	STW	DEP(stress)	IDENT(ATR)	*é, *ó	*ɛ́, *ɔ́
a. <esf[e]r-affix, esF[e]R-affix, esF[e]R-ic, esf[ɛ]r-ic> LUMSeq: <DEP(stress), INSERT-PS, IDENT(ATR)>		OK	*	*	***!**		*
b. <esf[e]r-affix, esf[e]r-ic, esf[e]RI-C, esF[ə]Ri-C> LUMSeq: <INSERT-PS, DEP(Stress)>	*!	OK		*			
💣 c. <esf[e]r-affix, esF[e]R-affix, esF[e]R-ic> LUMSeq: <DEP(Stress), INSERT-PS>		OK (vacuously satisfied)	*	*		*	
☹ d. **<esfer-affix, esF[e]R-affix, esF[ɛ]R-affix, esf[ɛ]r-ic>** LUMSeq: <DEP(stress), IDENT(ATR), INSERT-PS>		OK	*	*	***!**		*

(36) *Stress assignment precedes PS affixation AND Vowel lowering precedes Stress Assignment precedes*

/ROOT+PS-AFFIX/	Prec [DEP(Stress), PS-affixation]	Prec [IDENT(ATR), DEP(Stress)]	STW	DEP(stress)	IDENT(ATR)	*é, *ó	*ɛ, *ɔ
a. <esf[e]r-affix, esF[e]R-affix, esF[e]R-ic, esf[ɛ]r-ic> LUMSeq: <DEP(stress), INSERT-PS, IDENT(ATR)>		*!	*	*	*!		*
b. <esf[e]r-affix, esf[e]r-ic, esf[e]RI-C, esF[ə]Ri-C> LUMSeq: <INSERT-PS, DEP(Stress)>	*!	OK (vacuously satisfied)		*			
💣 c. <esf[e]r-affix, esF[e]R-affix, esF[e]R-ic> LUMSeq: <DEP(Stress), INSERT-PS>		OK (vacuously satisfied)	*	*		*	
☹ d. **<esfer-affix, esF[e]R-affix, esF[ɛ]R-affix, esf[ɛ]r-ic>** LUMSeq: <DEP(stress), IDENT(ATR), INSERT-PS>		*!	*	*	*!		*

Appendix-A: Data

(10a); p. 5: more data

est[ɛ́]r**i**l	mat[ɛ́]r**i**a	el[ɔ́]gi	mem[ɔ́]r**i**a
d[ɛ́]b**i**l	Val[ɛ́]nc**i**a	[ɔ́]l**i**	n[ɔ́]**i**a
inc[ɛ́]nd**i**		[ɔ́]rd**i**	b[ɔ́]**i**a
n[ɛ́]c**i**		p[ɔ́]di	
mist[ɛ́]r**i**			
in[ɛ́]d**i**t			
obs[ɛ́]qu**i**			

(Data from Mascaró 2008, 2011; Wheeler 2005: 37-52, *GIEC*)

(10b); p. 5: more data
aster[ɔ́]ide
b[ɔ́]ira
cof[ɔ́]i
est[ɔ́]ic
(Data from Mascaró 2008, 2011; Wheeler 2005: 37-52, *GIEC*)

(13); p. 7: more data

[ɛ́]ter	aut[ɔ́]nom	[ɛ́]mfasi	d[ɔ́]mino
	ll[ɔ́]brec	etc[ɛ́]tera	hip[ɔ́]tesi
	hidr[ɔ́]gen	g[ɛ́]nere	n[ɔ́]mada
	pr[ɔ́]leg	g[ɛ́]nesi	n[ɔ́]mina
	pr[ɔ́]sper	m[ɛ́]tode	[ɔ́]rfena
		r[ɛ́]plica	pr[ɔ́]rroga
			s[ɔ́]mines
			pr[ɔ́]stata

(Data from Fabra 1912: 459-460; Mascaró 2011; *GIEC*; see Appendix)

Appendix-B: Theoretical framework

- OPTIMAL INTERLEAVING (Wolf 2008). The basics (simplified).

a) Morphological spell-out (morpheme realization) occurs in the phonological component of the grammar.
b) A correspondence relation is established between morphemes and morphs. This correspondence relation is regularized through faithfulness constraints of the type MAX-M and DEP-M.

c) Morpheme realization is, thus, one of the operations that GEN performs, so derivational steps that realize morphemes are interleaved among steps that perform phonological operations.
d) Concomitantly, constraints on morpheme realization are interleaved among phonological constraints in the ranking that EVAL applies.
e) Spell-out can occur at any location in the phonological representation.

- CANDIDATE CHAINS (McCarthy 2007). The basics (simplified).

  a) A candidate chain associated with an input /in/ in a language with the constraint hierarchy H is an ordered *n*-tuple of forms C = <f0, f1, ..., fn> that meets the following 3 conditions:

- **Faithful initial form**: f0 is a faithful parse of /in/. (Specifically, it's the faithful parse of /in/ that's most harmonic according to H.)
- **Gradual divergence**: In every pair of immediately successive forms in C, <..., fi, fi+1, ...> (0≤i<n), fi+1 has all of fi's unfaithful mappings, plus one.
- **Harmonic improvement**: In every pair of immediately successive forms in C, <..., f_i, f_{i+1}, ...> (0≤i<n), f_{i+1} is more harmonic than f_i according to $EVAL_H$.

→ There are various alternative ways of formulating the gradual divergence requirement (*i.e.* in terms of faithfulness, phonological operations, or even perceptual similarity). In this paper, in terms of faithfulness and operations.

→ Important precursor to OT-CC: Prince & Smolensky (2004: 94-95): "some general procedure (Do-α) is allowed to make a certain single modification to the input, producing the candidate set of all possible outcomes of such modification. This is then evaluated; and the process continues with the output so determined… There are constraints inherent in the limitation to a single operation and in the requirement that each operation in the sequence improve Harmony."

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