Underapplication of vowel reduction to schwa in Majorcan Catalan. Some evidence for the left syllable of the stem as a prominent position and for subparadigms[*]

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1. Introduction

In this paper I propose a formal interpretation for a set of anomalies in the Majorcan Catalan (MC) vowel system. This set is made up of cases where vowels exhibit atypical behavior, in that where we would expect to find a schwa ([ə]) due to a general process of vowel reduction of the mid front vowels [e] and [ɛ] and the open central vowel [a] in unstressed position, we find, against all expectations, the close mid front vowel [e]. In (1a) I show some alternations that are a consequence of the general process of vowel reduction in Majorcan Catalan. In (1b) I show some forms which escape from this generalization, because, instead of schwa, we systematically find the close mid front vowel [e] in unstressed position.

(1) a. *Normal application of vowel reduction to [ə] in MC*

Stressed position		*Unstressed position*	
c[á]*sa*	'house'	*c*[ə]*seta*	'house *dim.*'
caf[ɛ́]	'coffee'	*caf*[ə]*tet*	'coffee *dim.*'
carr[é]*r*	'street'	*carr*[ə]*ró*	'street *dim.*'
cont[é]*st*	'(I) answer'	*cont*[ə]*stam*	'(we) answer'
x[ɛ́]*rr*	'(I) chat'	*x*[ə]*rrau*	'(you) chat'

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b. *Underapplication of vowel reduction to [ə] in MC*

Stressed position		*Unstressed position*	
p[é]*ix*	'fish'	*p*[e]*ixet*	'fish *dim.*'
f[é]*sta*	'party'	*f*[e]*stassa*	'party *augm.*'
c[ɛ́]*l*	'sky'	*c*[e]*let*	'sky *dim.*'
p[é]*ga*	'(s/he) hits'	*p*[e]*gam*	'(we) hit'
esp[é]*ra*	'(s/he) waits'	*esp*[e]*rau*	'(you) wait'

According to my view, there are two main factors which conspire to bring about this situation: *a*) as detected in previous studies, both descriptive (Veny 1962, Bibiloni 1998, Mascaró 2002) and theoretical (Mascaró 2005, Wheeler 2005), the inclination of these vowels to become similar to the corresponding vowels which appear in the same inflectional or derivational paradigm, especially when the derivative process is productive; *b*) the privileged status of the vowels located in the left syllable of the stem.

In order to account for the first factor, I propose a novel explanation framed within the Transderivational Correspondence Theory (TCT) (Benua 1997 / 2000) and the Optimal Paradigms model (OP) (McCarthy 2005). In order to account for the second factor, which has passed unnoticed in previous examinations of the same data, I assume the Positional Faithfulness Theory (Beckman 1998 / 1999). In this paper I show how the analysis of these data leads to two interesting theoretical implications. First is the need to relativize the TCT according to the type of derivation, along the lines of Ohannesian & Pons (2009). Second is the corroboration this analysis provides that the left syllable of the stem is indeed a prominent structural position that entails finer faithfulness requirements than other structural positions. A collateral implication of the analysis of these data is the confirmation that the surface schwa that appears before *s+C* word-initial clusters in this dialect is undeniably an epenthetic vowel which does not belong to the stem.

The paper is organized as follows. In § 2 the data under analysis are presented; § 2.1 is devoted to the data relative to vowel reduction in MC and § 2.2 examines the data relative to underapplication of vowel reduction. In § 3 I spell out my analytical proposal, in § 4 I critically explore previous and alternative analyses and in § 5 I summarize the main findings of the paper.

2. Data

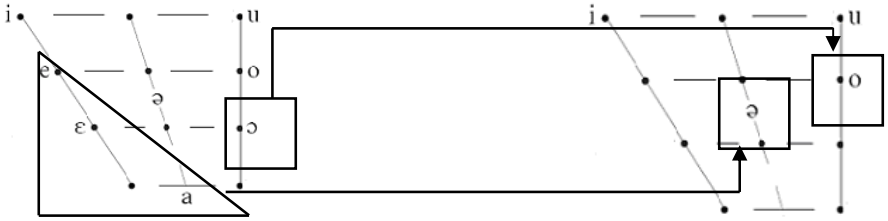
2.1 Obedience in the vowel system of MC

Most MC varieties have a vowel system of eight vowels in stressed position (2a) and four vowels in unstressed position (2b). This specific picture is the result of a general process of vowel reduction, according to which the mid front vowels [é] and [ɛ́] and the open central vowel [á] are reduced to [ə] in unstressed position, while the open mid back vowel

[ɔ́] is reduced to the close mid back vowel [o], also in unstressed position (2) (see, among others, Mascaró 2002).

(2) *Process of vowel reduction in Majorcan Catalan*

a. *Stressed vowel system* b. *Unstressed vowel system*



Within Optimality Theory, the reduction of a vowel system in unstressed position is generally interpreted, along the lines of Crosswhite (1999 / 2001, 2004), as an effect of the harmony scale for margins, that is, for vowels in unstressed position (3a). This harmony scale and the subsequent margin constraint hierarchy (3b) express the universal preference for segments of low sonority in the margins (*i.e*. in unstressed syllables) or, in other words, the universal dispreference for segments of high sonority in the margins (see the assumed sonority scale for vowels in 3c). (For an application of the margin constraint hierarchy to the unstressed vowel system of Catalan in general, see Wheeler 2005, and for an application of it to the unstressed vowel system of Algherese and Western Catalan, see Lloret & Jiménez 2008.)

(3) *Universal harmonic scale and constraint hierarchy for margins*

a. *Universal harmonic scale for margins*

M/ə ≻ M/i,u ≻ M/e,o ≻ M/ɛ,ɔ ≻ M/a

b. *Universal constraint hierarchy for margins*

*M/a >> *M/ɛ,ɔ >> *M/e,o >> *M/i,u >> *M/ə

c. *Sonority scale for vowels (from more to less sonority)*

a > ɛ,ɔ > e,o > i,u > ə

(After Crosswhite 1999 / 2001, 2004; Prince & Smolensky 1993 / 2004)

The application of vowel reduction to the vowels of the front series and the low vowel in MC is, therefore, due to the ranking of the positional markedness constraints *M/a, *M/ɛ and *M/e, which penalize elements of high sonority in the margins, that is, in unstressed syllables, above the faithfulness constraint which penalizes featural changes, and, of course, above *M/ə. Thus, in the tableau in (4), candidates with [a], [ɛ] or [e] in unstressed position are discarded; candidates with [ə], by contrast, are selected as optimal.

(4) *Prominence-driven vowel reduction in MC (after Crosswhite 1999 / 2001, 2004)*

a. /pas+ət/ [pəsát] 'step *dim.*'	*M/a	*M/ɛ	*M/e	*M/ə	IDENT(F)
☞ *i.* [pəsát]				*	*
ii. [pasát]	*W			L	L
b. /kəfɛt+ət/ [kəfətát] 'coffee *dim.*'	*M/a	*M/ɛ	*M/e	*M/ə	IDENT(F)
☞ *i.* [kəfənát]				**	*
ii. [kəfɛnát]		*W		L	L
c. /kaɾɾ+eɾ+on/ [kərəró] 'street *dim.*'	*M/a	*M/ɛ	*M/e	*M/ə	IDENT(F)
☞ *i.* [kərəɾó]				**	*
ii. [kəreɾó]			*W	L	L

2.2 Disobedience in the vowel system of MC

2.2.1 Disobedience in derivation

These are the regular facts. As shown in (5b), however, productive derived forms with an unstressed vowel located in the left (or initial) syllable of the stem which alternates with a stressed [é] or [ɛ́] vowel at the base-stem of the primitive are not realized as [ə], but as [e]. In these cases, therefore, there is underapplication of the general process of vowel reduction to [ə]. As illustrated in (5c), non-productive derived forms with an unstressed vowel located in the left (or initial) syllable of the stem which alternates with a stressed [é] or [ɛ́] vowel at the base-stem of the primitive undergo regular vowel reduction to [ə]. As shown in (5e) and (5f), productive and non-productive derived forms with an unstressed vowel *not* located in the left syllable of the stem with an alternating stressed [é] or [ɛ́] vowel at the base-stem of the primitive, also undergo regular vowel reduction to [ə]. (Due to space limitations, we illustrate productive derivation with diminutives. The same patterns are found, however, with all other productive suffixes. See, in this respect, Bibiloni 1998 and § 4. Along with Bibiloni's description, paradigmatic pressure induced by [ɛ́] is circumscribed the those cases in which the vowel is preceded by a labial consonant; see, however, § 4. The data in (5) is from Bibiloni 1998 and Mascaró 2005)

(5) *Normal application* vs. *underapplication of vowel reduction in derivation*

BASE		PRODUCTIVE DERIVATION		NON-PRODUCTIVE DERIVATION	
a. Stressed stem with [é] *or* [ɛ́]		*b. Unstressed stem with the vowel in the left syllable of the stem* → unexpected [e]		*c. Unstressed stem with the vowel in the left syllable of the stem* → expected [ə]	
p[é]*ix*	'fish'	*p*[e]*ixet*	'fish *dim.*'	*p*[ə]*ixater*	'fisherman'
p[é]*dra*	'stone'	*p*[e]*dreta*	'stone *dim.*'	*p*[ə]*drera*	'quarry'
Est[é]*ve*	'Stephen'	*Est*[e]*vet*	'Stephen *dim.*'		

t[é]*rra*	'earth'	*t*[e]*rreta*	'earth *dim.*'	*t*[ə]*rrestre*	'terrestrial'
c[é]*l*	'sky'	*c*[e]*let*	'sky *dim.*'	*c*[ə]*lestial*	'celestial'
d. Stressed stem with [é] *or* [ɛ́]		*e. Unstressed stem with the vowel* not *in the initial syllable of the stem* → expected [ə]		*f. Unstressed stem with the vowel* not *in the initial syllable of the stem* → expected [ə]	
pap[é]*r*	'paper'	*pap*[ə]*ret*	'paper *dim.*'	*pap*[ə]*rera*	'paper basket'
cast[é]*ll*	'castle'	*cast*[ə]*llet*	'castle *dim.*'	*cast*[ə]*ller*	'casteller'
fid[é]*u*	'noodle'	*fid*[ə]*uet*	'noodle *dim.*'	*fid*[ə]*uada*	'noodle dish'
caf[ɛ́]	'coffee'	*caf*[ə]*tet*	'coffee *dim.*'	*caf*[ə]*teria*	'coffee shop'

2.2.2 Disobedience in inflection

As shown in (6), the very same patterns under similar conditions hold for inflectional verbal paradigms. In (6b), we find underapplication of vowel reduction when an unstressed vowel located in the left (or initial) syllable of the stem alternates with a stressed close mid front vowel [é] in another verbal form of the same inflectional paradigm. In (6f), by contrast, we find regular application of vowel reduction when the alternating unstressed vowel is not located in the left syllable of the stem. In inflection, however, underapplication of vowel reduction is not found when the alternating stressed vowel is the open mid front vowel [ɛ́]. This can be seen in (6d). As inflection is intrinsically productive, this factor is not at play here. (The data in 6 is from Bibiloni 1998 and Mascaró 2005.)[1]

(6) *Normal application* vs. *underapplication of vowel reduction in MC inflection*

STRESSED-STEM VERBAL FORM	UNSTRESSED-STEM VERBAL FORM
a. Stressed stem with [é] or [ɛ́]	*b. Unstressed stem with the vowel in the left syllable of the stem* → unexpected [e]
p[é]*ga*, *p*[é]*gues*, *p*[é]*gui*, *p*[é]*guis*, *p*[é]*guen* 'to hit' verbal forms	*p*[e]*gam*, *p*[e]*gau*, *p*[e]*garé*, *p*[e]*garies*... 'to hit' verbal forms
esp[é]*r, esp*[é]*res, esp*[é]*ra, esp*[é]*ri*, *esp*[é]*rin* 'to wait' verbal forms	*esp*[e]*ram*, *esp*[e]*rau*, *esp*[e]*rassis* 'to wait' verbal forms
c. Stressed stem with [ɛ́]	*d. Unstressed stem with the vowel in the left syllable of the stem* → expected [ə]
x[ɛ́]*rr*, *x*[ɛ́]*rra*, *x*[ɛ́]*rren*, *x*[ɛ́]*rris*, *x*[ɛ́]*rren* 'to chat' verbal forms	*x*[ə]*rram*, *x*[ə]*rrau*, *x*[ə]*rraries* 'to chat' verbal forms
at[ɛ́]*rra*, *at*[ɛ́]*rren*, *at*[ɛ́]*rri*, *at*[ɛ́]*rrin* 'to land' verbal forms	*at*[ə]*rram*, *at*[ə]*rrau*, *at*[ə]*rraries*... 'to land' verbal forms
e. Stressed stem with [é]	*f. Unstressed stem with the vowel* not *in the left syllable of the stem* → expected [ə]
cont[é]*st*, *cont*[é]*stes*, *cont*[é]*sta*... 'to answer' verbal forms	*cont*[ə]*stam*, *cont*[ə]*stau*, *cont*[ə]*staria*... 'to answer' verbal forms
acc[é]*pt*, *acc*[é]*ptes*, *acc*[é]*pta*... 'to accept' verbal forms	*acc*[ə]*ptam*, *acc*[ə]*ptau*, *acc*[ə]*ptaria*... 'to accept' verbal forms

[1] Learned words with an unstressed *e* also show underapplication of vowel reduction to schwa, especially when located in the left syllable of the stem and when preceded by a labial consonant (*esp*[e]*cial* 'especial', *p*[e]*riodista* 'journalist', *f*[e]*licitat* 'happiness', etc.). Non-learned words, on the contrary, show the regular process of vowel reduction (*p*[ə]*daç* 'dishtowel', *m*[ə]*norquí* 'Minorcan'). Due to space limitations, these patterns will not be addressed in this paper. See, in this respect, Bibiloni 1998: 536-537 and Pons (2009).

3. Analysis

3.1 Disobedience in derivation

3.1.1 Generalizations and Optimality Theory analysis

Within derivation, there are four crucial conditions for the underapplication of vowel reduction, none of which is sufficient on its own.

a. The unstressed affected vowel must have a corresponding stressed vowel in the stem of the primitive word. The first vowel of the word *petit* 'small', which does not alternate with any stressed vowel, undergoes regular vowel reduction to [ə] (*p*[ə]*tit*), whereas the first vowel of the word *peixet* 'fish *dim.*', which alternates with a stressed vowel (*p*[é]*ix* 'wind'), does not undergo regular vowel reduction to [ə] (*p*[e]*ixet* 'wind *dim.*'). This condition can be interpreted as a standard output-to-output faithfulness constraint effect (Benua 1997 / 2000). The activity of a constraint such as O-OIDENT(post), which states that within the derivational paradigm correspondent surface segments must have the same featural specification for [post], would explain the lack of vowel reduction. BASE-PRIORITY, on the other hand, ensures that the direction of the pressure is from the base to the derived form and not the other way around.

b. The vowels in the alternating stressed stem must be front and mid (*i.e.* [é] and [ɛ́]), given that the pressure does not work when the primitive has the low vowel [á] (*i.e.* *c*[á]*sa* 'house' ~ *c*[ə]*seta* 'house *dim.*'; **c*[a]*seta*). This condition can be understood as the result of the activity of the positional markedness hierarchy for margins (see § 2.1 and 7a). The high ranking of *M/a inhibits the possible effects of the constraint demanding homogeneity in the stem —in this case, O-OIDENT(low)— when the alternating vowel is [á] (*i.e.* *c*[á]*sa vs*. *c*[ə]*seta*, **c*[a]*seta*). The high ranking of *M/ɛ, on the other hand, answers for the fact that the selected vowel in cases of paradigmatic pressure from a stem with [ɛ́] is [e] and not [ɛ] (*c*[ɛ́]*l vs*. *c*[e]*let*, **c*[ɛ]*let*). The idea is that [ɛ] is too sonorous to appear in unstressed position in these dialects.

c. The derived form must be productive (cf. *p*[é]*ix* 'fish' ~ *p*[e]*ixet* 'fish *dim.*', *p*[e]*ixot* 'fish *augm.*', with underapplication of vowel reduction, *vs*. *p*[ə]*ixater* 'fisherman', *p*[ə]*ixateria* 'fish shop', with normal application of vowel reduction). This requirement is a very important one in that it makes necessary a refinement of the submodel designed to account for surface resemblances between the members of a derivational paradigm. Since different behavior is found depending on the kind of derivation (*i.e.* productive derivatives are more faithful to the base than non-productive derivatives), and given the fact that this is a very common pattern across languages, generated derivational paradigms are likely to have an uneven and irregular structure. In fact, a hierarchical structure is already predicted in Benua's TCT, in that the base has priority over the derived forms. But we propose an even more hierarchical structure. We suggest that, instead of flat paradigms, structured paradigms which contain subparadigms are generated, and therefore the OO-faithfulness constraints are relativized according to these subparadigms. In this way, the superior proximity of the productive derivative to

the primitive form with respect to the non-productive derivative is explicitly formalized (See Pons & Ohannesian 2009, for a more detailed formalization of subparadigms within derivation based on the formal and semantic distances established between the base and the derivative forms). Thus, the constraint proposed in *a* to account for the paradigmatic pressure within the derivational paradigm, O-OIDENT(post), needs to be split into two different constraints: O-OSUBPARIDENT(post), which requires that, within the subparadigm, correspondent surface segments must have the same featural specification for [post], and O-OPARIDENT(post), which requires that, within the paradigm, correspondent surface segments must have the same featural specification for [post].

d. The position of the vowels under surface correspondence must be within the left syllable of the stem (cf. *p*[e]*ixet* 'fish *dim.*', *Est*[e]*vet* 'Stephen *dim.*' —in which the first vowel is epenthetic— *vs*. *pap*[é]*r* 'paper' ~ *pap*[ə]*ret* 'paper *dim.*'). This requirement can be understood, along the lines of Beckman (Beckman 1998 / 1999), as a positional faithfulness effect, in that in a prominent position, such as the left syllable of the stem, vowels exhibit a stronger tendency to be faithful to the correspondent segment than in other structural positions. Thus, the constraints proposed above to account for the paradigmatic pressure within the (sub)paradigm need to be relativized even further, with an explicit reference to faithfulness in vowels located in the initial syllable of the stem (see 7b).

In (7) I present these four conditions expressed in terms of constraints. And in the tableaux (8) and (9), it can be seen how they interact and bring about the desired results. (Although not illustrated in these tableaux, we assume, of course, the activity in the constraint hierarchy of the non-relativized OO-IDENT constraints.)

(7) *Relevant constraints*

a. *Positional prominence constraints* (Crosswhite 2001, 2004; McCarthy 2008)

*M/a: Assign one violation mark for every [a] in the margin.

*M/ɛ: Assign one violation mark for every [ɛ] in the margin.

*M/e: Assign one violation mark for every [e] in the margin.

b. *(Relativized) Transderivational correspondence constraints*

OO-PARIDENTLEFTSYLLSTEM(post): Within the derivational paradigm, assign one violation mark for every output segment located in the left syllable of the stem whose output correspondent has different values for the feature [post] (adapted from Benua 1997 / 2000, Ohannesian & Pons 2009, Beckman 1998 / 1999; see also McCarthy 2008).

OO-SUBPARIDENTLEFTSYLLSTEM(post): Within the derivational subparadigm, assign one violation mark for every output segment located in the left syllable of the stem whose output correspondent has different values for the feature [post] (adapted from Benua 1997 / 2000, Ohannesian & Pons 2009, Beckman 1998 / 1999; see also McCarthy 2008).

BASE-PRIORITY: Assign one violation mark for every output segment of the base which has a different featural specification than its input correspondent (adapted from Benua 1997 / 2000).

The tableau in (8) illustrates underapplication of vowel reduction in productive derivational forms with a vowel located in the left syllable of the stem and alternating with a stressed [é]. It can be seen that the selected paradigm candidate (8a) is the one in which underapplication of vowel reduction to schwa only applies in the subparadigm. This is because the ranking of *M/e above OO-PARIDENTLEFTSYLLSTEM(post) blocks the selection of paradigm candidate (8b), in which underapplication of vowel reduction applies across the entire paradigm. The ranking of OO-SUBPARIDENTLEFT SYLLSTEM(post) above *M/e, moreover, blocks the selection of the candidate with regular application of vowel reduction (8c). BASE-PRIORITY, finally, blocks the selection of the candidate with paradigmatic pressure to the base (8d).

(8) *Underapplication of vowel reduction in MC derivation*

<*p*/e/*dra*, *p*/e/*dreta*, *p*/e/*drera*>	BASE -PRIOR	OO-SUBPAR IDENTLEFT SYLLSTEM(post)	*M/e	OO-PAR IDENTLEFT SYLLSTEM(post)	IDENT (F)
☞ a. <<*p*[é]*dra*, *p*[e]*dreta*> *p*[ə]*drera*>			*	****	*
b. <<*p*[é]*dra*, *p*[e]*dreta*> *p*[e]*drera*>			**W	L	L
c. <<*p*[é]*dra*, *p*[ə]*dreta*> *p*[ə]*drera*>		**W	L	****	**W
d. <<*p*[ə́]*dra*, *p*[ə]*dreta*> *p*[ə]*drera*>	*W		L	L	***W

The very same ranking explains the selection of the paradigm candidate with underapplication of vowel reduction to schwa circumscribed to the subparadigm in productive derivational forms with a vowel located in the left syllable of the stem and alternating with a stressed [ɛ́] (e.g. <<*t*[ɛ́]*rra*, *t*[e]*rreta*> *t*[ə]*rrestre*>). In this case, however, absolute uniformity within the paradigm is not possible because of the high ranking of *M/ɛ (ranked at the same level as BASE-PRIORITY).

The tableau in (9) illustrates normal application of vowel reduction in productive and non-productive derivational forms with a vowel *not* located in the left syllable of the stem and alternating with a stressed [é]. In this case, OO-SUBPARIDENTLEFT SYLLSTEM(post) is vacuously satisfied by all the paradigm candidates because the affected vowel is not located in the left syllable of the stem. The ranking of *M/e above IDENT(F) explains the selection of the candidate with normal application of vowel reduction (9a). (Here it is where the non-relativized OO-IDENT constraint, without reference to the position of the segments within the stem, could play a role with respect to the competition between paradigm candidates with underapplication and paradigm candidates with normal application of vowel reduction: the simple ranking of this constraint below *M/e would block the selection of the former.)

(9) *Normal application of vowel reduction in MC derivation*

<*pap*/e/*r*, *pap*/e/*ret*, *pap*/e/*rera*>	BASE -PRIOR	OO-SUBPAR IDENTLEFT SYLLSTEM(post)	*M/e	OO-PAR IDENTLEFT SYLLSTEM(post)	IDENT (F)
☞ a. <<*pap*[é]*r*, *pap*[ə]*ret*> *pap*[ə]*rera*>					**
b. <<*pap*[é]*r*, *pap*[e]*ret*> *pap*[ə]*rera*>			*W		L
c. <<*pap*[é]*r*, *pap*[e]*ret*> *pap*[e]*rera*>			**W		L
d. <<*pap*[ɔ́]*r*, *pap*[ə]*ret*> *pap*[ə]*rera*>	*W				***W

3.2 Disobedience in inflection

3.2.1 Generalizations and Optimality Theory analysis

Within verbal inflection, there are three crucial conditions for the underapplication of vowel reduction, none of which, again, is sufficient on its own.

a. The unstressed affected vowel must have a correspondent stressed [é] vowel in the stem of another verbal form. This condition can be interpreted as the result of the activity of two OP-IDENT(F) constraints (McCarthy 2005) that demand that correspondent surface segments in the *inflectional paradigm* must have the same featural specification for the features [post] and [ATR], respectively: OP-IDENT(post) and OP-IDENT(ATR). The former ensures underapplication of vowel reduction when the alternating stressed vowel is [é], and the latter blocks underapplication of vowel reduction (driven by the constraint OP-IDENT(post)) when the alternating stressed vowel is [ɛ́], since the mapping [e] ↔ [ɛ] implies a modification of the [ATR] featural values. According to this proposal, overapplication of vowel reduction in stressed position, which would be expected given the ranking of these OP-IDENT constraints above the markedness constraint *M/e (see, for instance, the tableau in 11), is blocked by the high ranked markedness constraint *Peak/ə (see 11c in the same tableau), which penalizes a segment of low sonority, such as the schwa, as a syllable peak. It is important to mention here two relevant predictions of the OP model: on the one hand, the fact that the direction of the pressure cannot be motivated, *a priori*, by any particular member of the paradigm: rather, markedness is the factor that governs the direction of the pressure, in our particular case *Peak/ə; on the other hand, the fact that only overapplication of a process is predicted by this submodel, unless a specific markedness constraint blocks it, in our particular case *Peak/ə. In the vowel system of Majorcan Catalan, we find [ə] in stressed position (e.g. *cad*[ɔ́]*na* 'chain', *c*[ɔ́]*ba* 'onion', etc.). And this may appear to be in contradiction with the invoked constraint *Peak/ə, but, in fact, it is not. In Majorcan Catalan, the schwa is no longer a productive phoneme. In fact, in this dialect, most loanwords with a graphic *e* in stressed position are now adapted with the close-mid vowel [e], not with [ə] (e.g. *Intern*[é]*t* 'Internet', *cass*[é]*t* 'cassette', *ved*[é]*t* 'cabaret star', etc.) as was the case in the past. This is to say that [ə] is permitted when it is underlying but not when derived.

b. The vowel in the stressed stem must be front and mid-high (*i.e.* [é]), given that the pressure does not work when the alternating stressed form has [á] (cf. *p*[á]*ssa* 'it happens' *vs*. *p*[ə]*ssarà* 'it will happen', **p*[a]*ssarà*) or [ɛ́] (see 6d). This requirement can be explained by the high ranking of the positional markedness constraints *M/a and *M/ɛ, which penalize these vowels in unstressed position and inhibit the possible effects of the constraint that demands uniformity in the stem.

c. The position of the vowels under surface correspondence must be within the left syllable of the stem (cf. *p*[e]*gam* 'we hit'; *esp*[e]*ram* 'we wait' —in which the first vowel is epenthetic— *vs*. *cont*[ə]*stam* 'we answer' or *acc*[ə]*ptam* 'we accept'). This condition, finally, can be interpreted again as a positional faithfulness effect, in that in a prominent position (such as the left syllable of the stem), there is a greater tendency to faithfulness than in a non-prominent position (such as the right syllable of the stem). Thus, the constraints proposed in *a* should be relativized with an explicit reference to the left syllable of the stem (see 10a and 10b). (As seen, the second vowel of words such as *Est*[e]*vet* (see § 3.1.1) and *esp*[e]*rar* is affected by the (structurally relativized) paradigmatic pressure, and this can be taken as a strong proof that the initial vowel, realized as schwa, is indeed epenthetic. If it was not, this vowel would not be affected by the paradigmatic pressure, because it would occupy a different position than the initial syllable of the stem. This is an issue that I leave for future research. I am grateful to John J. McCarthy and Donca Steriade for valuable discussion on this aspect.)

As inflectional paradigms are productive *per se*, productivity is not a factor at play within the inflectional verbal paradigm.

In (10), I present these three conditions expressed in terms of constraints. And in tableaux (11) to (13), it can be seen how they interact and lead to the desired results.

(10) *(New) Relevant constraints*

a. *Positional prominence constraints*

*Peak/ə: Assign one violation mark for every [ə] in the peak (Prince & Smolensky 1993).

b. *(Relativized) Optimal Paradigm constraints*

OP-IDENTLEFTSYLLSTEM(post): Within the inflectional paradigm, assign one violation mark for every output segment located in the left syllable of the stem whose output correspondent has different values for the feature [post] (adapted from McCarthy 2005 and Beckman 1998 / 1999).

OP-IDENTLEFTSYLLSTEM(ATR): Within the inflectional paradigm, assign one violation mark for every output segment located in the left syllable of the stem whose output correspondent has different values for the feature [ATR] (adapted from McCarthy 2005 and Beckman 1998 / 1999).

The tableau in (11) illustrates underapplication of vowel reduction to schwa in inflected forms with a vowel located in the left syllable of the stem and alternating with a stressed [é]. The paradigm candidate with normal application of vowel reduction (11b) is

discarded because of the ranking of both OP-IDENTLEFTSYLL(ATR) and OP-IDENTLEFTSYLL(post) above the markedness constraint *M/e (see 12 for the explicit ranking argument between these two constraints). The paradigm candidate with overapplication of vowel reduction in a stressed syllable (11c), which would be expected given the ranking noted above, is discarded because of the activity of the high ranked constraint *P/ə.

(11) *Underapplication of vowel reduction in MC inflection*

esp/e/*r*, *esp*/e/*res*, *esp*/e/*ra*, *esp*/e/*ram, esp*/e/*rau, esp*/e/*ren*	*P/ə	OP-IDENTLEFT SYLLSTEM (ATR)	OP-IDENTLEFT SYLLSTEM (post)	*M/e	IDENT (F)
☞a. <<*esp*[é]*r*, *esp*[é]*res*, *esp*[é]*ra*, *esp*[e]*ram, esp*[e]*rau, esp*[é]*ren*>>				**	
b. <<*esp*[é]*r*, *esp*[é]*res*, *esp*[é]*ra*, *esp*[ə]*ram, esp*[ə]*rau, esp*[é]*ren*>>		(x16) W	(x16) W	L	**W
c. <<*esp*[ǽ]*r*, *esp*[ǽ]*res*, *esp*[ǽ]*ra*, *esp*[ə]*ram, esp*[ə]*rau, esp*[ǽ]*ren*>>	****W			L	******W

The tableau in (12) illustrates normal application of vowel reduction in inflectional forms with a vowel located in the left syllable of the stem and alternating with a stressed [é]. The paradigm candidate which shows underapplication of vowel reduction to schwa and partial reduction to [e] (12b) is discarded because it incurs several violations of the constraint OP-IDENTLEFTSYLLSTEM(ATR). The paradigm candidate with absolute uniformity (12c) is also ruled out, in this case because it incurs two violations of the constraint *M/ɛ. The selected paradigm candidate is thus that which shows normal application of vowel reduction (12a).

(12) *Normal application of vowel reduction in MC inflection*

x/ɛ/*rr*, *x*/ɛ/*rres*, *x*/ɛ/*rra*, *x*/ɛ/*rram, x*/ɛ/*rrau, x*/ɛ/*rren*	*M/ɛ	*P/ə	OP IDENTLEFT SYLLSTEM (ATR)	OP IDENTLEFT SYLLSTEM (post)	*M/e	IDENT(F)
☞ a. <<*x*[ɛ́]*rr*, *x*[ɛ́]*rres*, *x*[ɛ́]*rra*, *x*[ə]*rram, x*[ə]*rrau, x*[ɛ́]*rren*>>				W(x16)		**
b. <<*x*[ɛ́]*rr*, *x*[ɛ́]*rres*, *x*[ɛ́]*rra*, *x*[e]*rram, x*[e]*rrau, x*[ɛ́]*rren*>>			W(x16)	L	**W	**
c. <<*x*[ɛ́]*rr*, *x*[ɛ́]*rres*, *x*[ɛ́]*rra*, *x*[ɛ]*rram, x*[ɛ]*rrau, x*[ɛ́]*rren*>>	**W			L		L
d. <<*x*[ǽ]*rr*, *x*[ǽ]*rres*, *x*[ǽ]*rra*, *x*[ə]*rram, x*[ə]*rrau, x*[ǽ]*rren*>>		****W		L		******W

The tableau in (13) illustrates normal application of vowel reduction in inflectional forms with a vowel *not* located in the left syllable of the stem and alternating with a stressed [é]. In these particular cases, as the vowel is not situated in the left syllable of the stem, it

is not targeted by the OP constraints. This is why the selected candidate is the one displaying normal application of vowel reduction.

(13) *Normal application of vowel reduction in MC inflection*

cont/e/*st*, *cont*/e/*stes*, *cont*/e/*sta*, *cont*/e/*stam*, *cont*/e/*stau*, *cont*/e/*sten*	*P/ə	OP IDENTLEFT SYLLST (ATR)	OP IDENTLEFT SYLLST (post)	*M/e	IDENT (F)
☞ a <<*cont*[é]*st*, *cont*[é]*stes*, *cont*[é]*sta*, *cont*[ə]*stam*, *cont*[ə]*stau*, *cont*[é]*sten*>>					**
b. <<*cont*[é]*st*, *cont*[é]*stes*, *cont*[é]*sta*, *cont*[e]*stam*, *cont*[e]*stau*, *cont*[é]*sten*>>				**W	L
c. <<*cont*[ə́]*st*, *cont*[ə́]*stes*, *cont*[ə́]*sta*, *cont*[ə]*stam*, *cont*[ə]*stau*, *cont*[ə́]*sten* >>	****W				**

4. Previous and alternative analyses

Previous descriptive and theoretical approaches to these facts have already detected that a paradigmatic effect is at play here (Veny 1962, Bibiloni 1998, Mascaró 2002, Mascaró 2005, Wheeler 2005). The accounts differ, however, in the explanation they give for the asymmetries found in the data, that is, between those cases which, although likewise potentially exposed to paradigmatic pressure, show either underapplication of vowel reduction or normal application of vowel reduction. According to Bibiloni's (1998) description, the application or not of vowel reduction depends on the productivity of the process and the phonetic context in the case of derivation, and on the type of word in the case of inflection. Bibiloni claims that when the stressed vowel is [é] the paradigmatic pressure is only induced when a bilabial consonant precedes the affected unstressed vowel (cf. *p*[e]*uet* 'foot *dim.*' *vs.* ~ *bist*[ə]*quet* 'steak *dim.*'). Given the list of contrasting patterns adduced by the author, the hypothesis according to which it is the position of the vowel within the stem the relevant factor can be maintained. Bibiloni also argues that the set of verbal forms which exhibit underapplication of vowel reduction in unstressed position (e.g. *p*[e]*gar* 'to hit', *cr*[e]*mar* 'to burn') are generally non-learned or frequently used words, whereas the set of verbal forms which exhibit normal application of vowel reduction (e.g. *acc*[ə]*lerar* 'to accelerate', *acc*[ə]*ptar* 'to accept', etc.) are generally learned and not frequently used words. While I do agree with the explanation based on the productivity of the derivative process to explain underapplication within derivation (see the analysis in § 3), I am less satisfied with the explanation based on the type of word. This approach has to address several problems. The first one is that, as pointed out by the author himself, this condition has many exceptions in that many non-learned words show regular vowel reduction (e.g. *conf*[ə]*ssar* 'to confess', *cont*[ə]*star* 'to answer', etc.) and some learned words show underapplication of vowel reduction to schwa (e.g. *op*[e]*rar* 'to operate', *imp*[e]*rar* 'to prevail', *sup*[e]*rar* 'to exceed'). The second problem is that in forms without vowel alternations, such as the one mentioned in footnote 1, it is precisely the non-learned forms which show regular reduction and the learned forms which show lack of vowel reduction to schwa. It seems that the position of the affected vowel within the stem is, yet again, a more crucial factor. According to

Mascaró's (2005) proposal, cases with normal application of vowel reduction and cases with underapplication of vowel reduction exhibit different behaviors because the latter bear a lexical mark responsible for the demotion, in the constraint hierarchy, of the markedness constraint favoring the schwa in unstressed position (V=ə, in his analysis). The ranking V=ə >> IDENT(F) explains vowel reduction in the forms lacking this lexical mark (e.g. *fid*[ə]*uet* 'noodle *dim.*'). The opposite ranking, IDENT(F) >> V=ə (driven by the lexical mark ↓V=ə), is obtained for the forms exhibiting underapplication of vowel reduction to schwa (e.g. *c*[e]*let* 'sky *dim.*'). The difficulty with this account is that it must be stipulated which forms bear this lexical mark and which ones do not, when in fact it is possible to detect more general patterns behind these data: as advocated for in the present paper, the productivity of the process and the position of the vowel within the stem. On the other hand, it is must be said in favor of this account that all forms with underapplication of vowel reduction show monosyllabic simple stems, and monosyllabic words tend to exhibit, at least in Catalan, many exceptions with respect to the regular phonology of the language. An alternative analysis along these lines, thus, would be to resort to a positional faithfulness constraint responsible for the featural protection of the vowels which belong to a monosyllabic stem. Wheeler's (2005) account narrowly follows Bibiloni's description of the facts. The pertinent discrepant behavior is attributed to three specific morphophonologically and phonetically conditioned PARADIGM UNIFORMITY constraints the demand the homogeneity of the stem across the inflectional and the derivational paradigm: a first constraint according to which "a palatal vowel in the stem of an inflected conjugation I verb when unstressed corresponds to a palatal vowel in the same stem when stressed, provided certain phonological conditions involving the adjacent consonants are fulfilled"; a second constraint according to which "a palatal vowel in a nominal stem, unstressed, before a productive affix, corresponds to a stressed palatal vowel in the base"; and a third constraint according to which "a palatal vowel in a nominal stem, unstressed, preceded by a bilabial, before a productive affix, corresponds to a stressed palatal vowel in the base". In this case, the constraints proposed are too specific and seem only to work for the data under analysis.

5. Concluding remarks

In this paper I have argued that underapplication of vowel reduction to schwa in MC derivational and inflectional forms is a direct consequence of the interaction of the prominence constraint hierarchy for vowels in unstressed position and a set of output to output faithfulness constraints relativized according to two factors: the productivity of the derivational process and the position of the affected vowel within the stem. The asymmetry, with respect to vowel reduction, between productive and non-productive derived forms demands an uneven structure for the generated paradigm candidates as well as the invocation of specific O-O faithfulness constraints with an explicit reference to the subparadigm. The asymmetry between forms with the affected vowel in the initial syllable of the stem and forms with the vowel in other positions supports an even further relativized version of the very same constraints with an overt reference to this specific structural position, the initial or the left syllable of the stem.

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