

CV-alternations in Polish without segmental co-occurrence*

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1. Introduction

Nominal morphology of Polish features a plethora of alternations between consonants and vowels, with palatalisation being the most frequent. Such a case is illustrated below in (1a): before the locative singular exponent [ɛ], the stem-final coronal is replaced with a prepalatal. The puzzle emerges when other stems are considered, because palatals and velars combine with [u], which looks like CV-dissimilation (1b) and vowel retraction (1c).

(1)	stem	LOC.SG	gloss
a.	/zɛʃit/	[zɛʃiɕ-ɛ]	‘notebook’
	/ɔbʲad/	[ɔbiɛɕ-ɛ]	‘dinner’
b.	/wɔsɔɕ/	[wɔsɔɕ-u]	‘salmon’
	/xɔtɛl/	[xɔtɛl-u]	‘hotel’
c.	/rɛntʃnik/	[rɛntʃnik-u]	‘towel’
	/strax/	[strax-u]	‘fear’

The pattern has received much attention in the phonological literature, primarily because PCA patterns in Polish differ from context to context. Rule-based and OT approaches (*inter alia* Rubach 1984, 2003, Ćavar 2004, Łubowicz 2016 focus on (contradictory) segmental co-occurrence restrictions, but fail to thoroughly explain two most important properties of the pattern: (i) the assimilative-dissimilative, progressive-regressive orientation of locative PCA; (ii) morpho-syntactic sensitivity of the pattern, as it is unique to LOC.M/N.SG and not repeated identically anywhere in the language, like many other CV-alternations in Polish.

Following two representation-oriented studies Gussmann (2007), Zdziebko (2015), this paper claims that co-occurrence restrictions do not operate in Polish morpho-phonology, and that the apparent PCA illustrated in (1) originates from an abstract underlying repre-

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sensation. The three alternations are modelled as Derived Environment effects in a system where the feature [-back] has priority for realisation over [+back].

This paper is organised as follows: §2 provides an insight into locative forms in the context of other CV-alternations in Polish; §3 gives an overview of previous approaches to palatalisation and Polish locative PCA; §4 lays out the proposal, discussing the representations, derivations and the exceptional forms. §5 summarises and concludes.

2. Data

Polish declension (Swan 2002) exhibits allomorphy of LOC.SG marker for masculine and neuter nouns, conditioned by assimilative and dissimilative CV-alternations, acting progressively and regressively. When found before the case suffix, dentals and alveolars at the right edge of the stem¹ palatalise. The palatalisation includes a change of Place of articulation to prepalatal. The LOC.M/N.SG marker is consistently [-ε].

(2)	stem	LOC.M/N.SG	
	/zɛʃit/	[zɛʃiʦ-ε]	‘notebook’
	/ɔbjad/	[ɔbiedʑ-ε]	‘dinner’
	/brudas/	[brudaɕ-ε]	‘dirty man’
	/wɔbuz/	[wɔbuz-ε]	‘troublemaker’
	/mur/	[muʒ-ε]	‘wall’
	/piw/	[pil-ε]	‘dust’
	/ɔkn-ɔ/	[ɔkɲ-ε]	‘window’
	/ɔjtɕɛts/	[ɔjtɕ-ε]	‘father’
	/list/	[liɕ-ε]	‘letter’

Unlike coronal-final stems, labial-final stems receive a secondary palatalisation in the presence of the locative singular marker [ε]; the "palataliser" element might also surface as a separate segment in the form of palatal glide [j].²

(3)	stem	LOC.M/N.SG	
	/xwɔp/	[xwopʲ-ε]	‘peasant’
	/arab/	[arabʲ-ε]	‘Arab’
	/gram/	[gramʲ-ε]	‘gram’
	/graf/	[grafʲ-ε]	‘graph’
	/rɔv/	[rɔvʲ-ε]	‘ditch’

The previously listed stems end in consonants unified under the name "hard consonants". If the stem-final consonant is "soft" (post-alveolar, alveolar affricate, palatal, lateral), the exponent is -u (4). If "soft" consonants are seen as [-back] (Rubach 1984, 2003), then the vowel quality can be described as a result of backness dissimilation.

¹For clarity purposes I will not mark final devoicing nor vowel raising in the examples.

²The secondary palatal articulation on labials is phonetically implemented in different ways across dialects of Polish, see Kochetov (1998) for an overview and analysis.

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(4)	stem	LOC.M/N.SG	
	/nɔʒ/	[nɔʒ-u]	‘knife’
	/wɔsɔɕ/	[wɔsɔɕ-u]	‘salmon’
	/paz/	[paz-u]	‘type of butterfly’
	/hɔtɛl/	[hɔtɛl-u]	‘hotel’
	/kɔɲ/	[kɔɲ-u]	‘horse’
	/pwafʃ/	[pwafʃ-u]	‘coat’
	/liɕɕ/	[liɕɕ-u]	‘leaf’

According to Wierchowska (1971), there are no differences in the articulation of derived and underlying soft consonants, thus there is no phonetic reason for masculine and neuter stems in (2) and (4) to select different suffixes.

However if the stem-final consonant is velar, we again find the allomorph *-u*. This outcome is also unexpected, because velars do not form a natural class with palatals in (4), which also select for *-u*. However, from the perspective of Rubach (1984, 2003), velars are presumably [+back], so [u] in (5) could arise under assimilation with the preceding consonant. The described alternation can be seen (and henceforth referred to as) retraction.

(5)	stem	LOC.M/N.SG	
	/rɛntʃnik/	[rɛntʃnik-u]	‘towel’
	/sɔk/	[sɔk-u]	‘juice’
	/rɔg/	[rɔg-u]	‘horn’
	/ɛmbarg-ɔ/	[ɛmbarg-u]	‘embargo’
	/strix/	[strix-u]	‘garret’
	/strax/	[strax-u]	‘fear’

There are three lexical exceptions to the described pattern, three nouns exclusively combined with [u]. Historically they originate from the Proto-Slavic *u*-declension, where they also combined with *-u* in LOC.SG (Halla-aho 2006).

(6)	stem	LOC.M/N.SG	
	/sin/	[sin-u]	‘son’
	/pan/	[pan-u]	‘gentleman, you’
	/dɔm/	[dɔm-u]	‘home’

The observed pattern of phonologically (and lexically) conditioned allomorphy could be translated into three alternations with different outcomes and directionality: (i) regressive palatalisation in (2) and (3), yields [ɛ] as the locative exponent; (ii) dissimilation in (4), and (iii) retraction in (5), both progressive, both yield [u]. The exceptional stems in (6) have a special place in the pattern, as they regularly combine with [u]. All alternations operate under strict locality: based on the multiple sources available, the segmental content left of the final consonant (group) does not seem to influence the alternations.

(7)	stem	suffix	strategy	direction
	t d n w r s z	jɛ	palatalisation	C ← V
	p b v f m	jɛ	sec. palatalisation	C ← V
	ts ɕ ʃ ʒ ɕ ʒ ʧ ʤ ɕ ɕ ɲ l' j	u	dissimilation	C → V
	k g x	u	retraction	C → V
	sin, pan, dɔm	u	lex.spec.	lex → V

The described PCA of the LOC.M/N.SG is unique in Polish, because there are other morphemes with a front vowel that do not alternate or alternate very differently compared to the locative marker(s).

Allomorphy with palatalisation is also found in derivational morphology. The stem-final coronal consonant is transformed into a prepalatal before the theme vowel /i/ (8a). Velars are also palatalised, but TV is retracted to [i] (8b), in contrast to [u] in LOC.SG. An underlying palatal is not altered, but, unlike in LOC.SG, there is no dissimilation (8c). "Harder" palatals exhibit exceptional vowel retraction (8d).

(8)	a.	/gwos-i-ɕ/	[gwoɕ-i-ɕ]	'to voice'	palatalisation
	b.	/skok-i-ɕ/	[skotɕ-i-ɕ]	'to jump'	palatalisation+dissimilation
	c.	/u-spokoj-i-ɕ/	[u-spokoj-i-ɕ]	'to calm down'	–
	d.	/partatɕ-i-ɕ/	[partatɕ-i-ɕ]	'to bungle'	dissimilation

On the other hand, the exponent for INS.M/N.SG *-em* also contains a front vowel, but does not influence any Place change on the root/stem it concatenates with (9).

(9)	stem	INS.M.SG	
	/autɔbus/	[autɔbus-ɛm]	'bus'
	/prezident/	[prezident-ɛm]	'president'
	/mʲɛtɕ/	[mʲɛtɕ-ɛm]	'sword'
	/nɔʒ/	[nɔʒ-ɛm]	'knife'

(Swan 2002:67)

Lack of palatalisation before a front vowel is not unique to the INS.M/N.SG marker: according to Rubach (1984), adjectival suffixes /-ɛ/, /-ɛɔ/, and /-ɛmu/ also do not show an interaction with the stem-final consonant.³

All of the described alternations (and their absence) have a front vowel and palatalisation of coronals as their common denominators, but crucially all differ in their respective effects on the vowel of the concatenated morphemes. If we focus on the alternating morphemes only, summarised in (7) and compared to (9) and (8), it is easy to fall under the impression that every construction is derived by its own set of phonological rules.

Another, and final complication comes from Surface Palatalisation (Rubach 1984, 2003). Namely, any consonant followed by an /i/, also across word boundaries, is provided with a secondary palatal articulation. Note that this is not a Place change like in (2).

³The full list of non-alternating front-vowel-initial morphemes can be found in Zdziebko (2015). See Czaplicki (2013) for a detailed overview of different palatalisation contexts and their surface realisations, also Czaykowska-Higgins (1988) for the verbal domain.

(10) *Surface Palatalisation in Polish* (Rubach 2003:203)

głos [gwɔs]	[gwɔs' irɛni]	'Irene's voice'
	[gwɔs ɛvi]	'Ewa's voice'
obraz [ɔbras]	[ɔbras' irɛni]	'Irene's picture'
	[ɔbras ɛvi]	'Ewa's picture'
brat [brat]	[brat' irɛni]	'Irene's brother'
	[brat ɛvi]	'Ewa's brother'
kod [kɔt]	[kɔt' irɛni]	'Irene's code'
	[kɔt ɛvi]	'Ewa's code'

At last, there is one final question to answer: what can these data tell us about the nature of palatalisation and other CV-alternations in Polish, morphologically restricted and unrestricted?

3. Previous approaches

The first group of previous accounts addressing the described PCA is composed of accounts relying on co-occurrence (rules and later constraints) as the driving force for (7). Rule-based studies such as Rubach (1984, 1986), Czaykowska-Higgins (1988), Szpyra-Kozłowska (2001), Rydzewski (2016) build on the assumption that phonetic palatalisation always precedes phonemic Place change: a consonant is first complemented with palatality from the following front vowel, subsequently simplified into a prepalatal / post-alveolar. Rubach (1984) argues that the second step can only be accomplished at the morpheme boundary, under word-well-formedness requirements. This is inspired by the empirical fact that palatalisation is absent morpheme-internally, and Surface Palatalisation does not yield a Place change, rather secondary articulation.

Rubach (2003) assumes the co-occurrence constraint family PAL, which triggers assimilation – palatalisation and retraction – on different levels of derivation. An implication of this account is that [+back] as a feature value is consistently inferior to [-back] in Polish phonology. In other words, when faced with the dilemma which feature is to be realised, Polish phonological grammar gives priority to [-back] over [+back]. This will become important later in the proposed analysis.

PAL as a co-occurrence constraint is also seen as the driving force of the CV-alternations in Ćavar (2004), Łubowicz (2006, 2007, 2016). A common denominator of these studies is that certain aspects of CV-alternations is access to phonetic information, in form of a look-ahead concept of 'contrast preservation' (Łubowicz 2003), to maintain underlying contrasts otherwise neutralised on the surface. For Łubowicz (2016) this force is principal in selecting lexically listed allomorphs (Kager 1996) in addition to lexically indexed PAL, but for dissimilative and assimilative [u] recourse to *FRONT/U is necessary.

An important insight from this set of studies revolves around dependency of the locative exponents on the quality of the stem-final consonant. As Łubowicz (2016) notices, [ɛ] is found after coronals and labials ("front"), and [u] after palatals and velars ("back"). Assimilation is disputable since soft consonants are traditionally seen as [-back] (Clements and Hume 1995, Bateman 2011, Bhat 1978), but the connection in height is obvious.

The second group of accounts sees the source of allomorphy in the underlying representations. In Gussmann (2007), morphemes are lexically specified with diacritics stating whether they trigger or undergo palatalisation, but also the type of palatalisation that they trigger or undergo (also suggested in Czaykowska-Higgins 1988). Zdziebko (2015) stems from Gussmann's Element Theory (Harris 1994), with palatalisation ascribed to different underlying representations of the triggering morphemes, which under *REALIZE-MORPHEME* (van Oostendorp 2005) must all be incorporated into the string. According to Czaplicki (2013:33), palatalisation has so many different patterns in Polish, that "a high level of abstractness of phonological representations is necessary to account for the data".

The assumption crucial for the below proposed account, which stems from the second group of previous studies, is that exceptional behaviour of a morpheme must be a lexical property of the said morpheme, in line with Inkelas et al. (1997).

4. Proposal

Leaning onto Gussmann (2007), Zdziebko (2015), but also Rubach (2003), I propose that Place-changing CV-alternations arise under two conditions: (i) a well-formed segment in Polish, regardless whether it is a consonant or a vowel, surfaces specified for $[\pm\text{high}]$ and $[\pm\text{back}]$; (ii) some morphemes have abstract URs, some have concrete. If a morpheme does not participate in an alternation, this implies that its UR is fully specified, i.e., well-formedness requirements are already met.

4.1 Theoretical assumptions

To properly understand the representations to be proposed, we need to go back to the summary table in (7), where [u] appears in more phonological contexts than [ɛ]. In turn, the emergence of [ɛ] correlates with the success of palatalisation.

Coronals and labials are affected under concatenation of *LOC.SG*, but palatals and velars are not. In earlier studies, palatalisation was performed as overwriting the consonant's underlying backness, by replacing it with [-back] from the vowel (Rubach 1984). This does not make a clear distinction between a non-palatalising velar and a palatalising coronal. I propose that this distinction also lies in the underlying representation: a velar is underlyingly [+back,+high], but a coronal or a labial is [-high]. Under the well-formedness requirements mentioned earlier, these consonants must acquire backness either via sharing or epenthesis. Underlying palatals are, following Rubach (1984), [-back,+high].

(11) *Underlying representations of consonants in Polish (adapted from Rubach 1984)*

a. palatal	b. velar	c. coronal	d. labial
• / -b +h	• / +b +h	• -h	• -h

Turning to the suffix, the feature which unites /ɛ/, coronals and labials is [-high]. On the other side, palatals, velars, and [u] are universally united by the feature [+high] (Chomsky

and Halle 1968, Kenstowicz and Kisseberth 1979, Rubach 1984). Bringing these together, we get a system in which a [-high] vowel surfaces after a [-high] consonant, and a [+high] vowel after a [+high] consonant, meaning that there is a height assimilation process between the consonant and the vowel (locative marker), underspecified for height.

The morpheme vowel is [-back] if following a palatalised coronal or labial. Given (11), [-back] must be provided by the vowel. On the other hand, the vowel is [+back] after a [+high] consonant regardless of its backness value, which implies that [+back] must also be inherent to the vowel. Therefore, the locative marker contains a vowel underspecified for height and overspecified for backness, with both [+back] and [-back] floating.

(12) *Representation of the LOC.M/N.SG morpheme*



A segment not specified for a certain feature falls under the auspices of downward well-formedness constraint SPECIFY, defined as in (13a). Since the root node in (12) does not dominate any features, I define the constraint simply over F as an abbreviation for height and backness. The morpheme is specified with two features not associated to any higher node. Such a structure violates ASSOCIATE in (13b); the constraint refers to both values, but only for brevity purposes: different results for [+back] and [-back] on the surface must be subject each to their respective ASSOCIATE constraints.

- (13) a. • SPECIFY(• → [F])
 ↓ Assign * for every instance of a segment
 F not specified for features.
- b. • ASSOC(IATE)[±back]
 ↑ Assign * for every instance of a [±b] feature
 ±b not dominated by a root node.

From previous research going back to Akinlabi (1996), but also van Oostendorp (2006, 2008), Wolf (2007), Trommer (2011) we are informed that floating material is cross-linguistically preferably realised outside of its morphological domain. This effect satisfies DERIVEDENVIRONMENT defined in (14). Invoking these constraints is additionally motivated by the fact that all of the addressed alternations in Polish locative case forms are absent morpheme-internally Rubach (1984).

- (14) DE Assign * for every node [±back] associated by an
 [±b] epenthetic association line to a tautomorphemic
 root node, but not to a heteromorphemic root node.

When (12) is combined with a palatal-final or velar-final stem, the assumption is that alternations are absent because the consonant is underlyingly already specified for backness. A segment can serve as landing sites for the features from the morpheme, identical to their underlying specification, under the assumption on fusion of identical features associated to the same segment (Struijke 2002). Successful fusion violates UNIFORMITY in (15).

(15)

- UNIF Assign * for every higher node R in P such that:
 [±b] (i) R dominates αF_1 in M;
 (ii) R does not dominate αF_2 in M;
 (iii) R dominates both αF_1 and αF_2 in P.

The assumed structure of the locative marker in (12) shows a segment which does not dominate any height, for which we have determined to be always contributed by the consonant. Such an assimilation is interpreted as sharing of height, which, when present in a candidate, incurs a violation of *SHARE[±high] in (16).

- (16) *SHARE[±high]
 * • • Assign * for every sequence $R_1, R_2, [\pm h]$, such that:
 \ / (i) $R_1 < R_2$
 ±h (ii) R_1 dominates [±h] in M
 (iii) R_1 and R_2 both dominate [±h] in P.

Another sharing relation needs a separate constraint. Namely, [ʔɛ] can only surface if the consonant is coronal or labial, i.e., [-high] and underspecified for [±back]. The result is a front consonant followed by a front vowel, which implies that the backness feature must be shared between the two segmental root nodes. The corresponding *SHARE[±back]! constraint is however different from the one in (16) in that it is only violated if both association lines connecting the two root nodes to the feature are not underlyingly present.⁴ In turn, it is vacuously satisfied if at least one of the association lines does not fulfil this requirement. This is crucial for deriving the difference between the presence and absence of palatalisation, the latter arguably the case morpheme-internally.

- (17) *SHARE[±back]!
 * • • Assign * for every sequence $R_1, R_2, [\pm b]$, such that:
 \ / (i) $R_1 < R_2$
 ±b (ii) R_1 is associated to [±b] with an epenthetic AL;
 (iii) R_2 is associated to [±b] with an epenthetic AL.

The vowel of the locative marker always surfaces carrying some vocalic feature value, which means that SPECIFY(• → [F]) is undominated and the main driving force behind the allomorphy. The height is always shared from the consonant to the vowel, so *SHARE[±high] must be ranked lower. If palatalisation is sharing of [-back], then *SHARE[±back]! is violated, and if that candidate is optimal, then this constraint must also be outranked by SPECIFY(• → [F]). Finally, the morpheme vowel is more frequently [u] than [ʔɛ], which implies that both [-back]-oriented DE and ASSOCIATE outrank their [+back]-oriented counterparts.

- (18) *Initial rankings (to be revised):*

SPECIFY(• → [F]) >> *SHARE[±high] >> *SHARE[±back]!
 DE[-back] >> DE[+back]
 ASSOC[-back] >> ASSOC[+back]

⁴The option for a markedness constraint accessing information on the type of association lines is not unusual in *Extended Stratal Containment* (Trommer 2011, 2021, Zimmermann 2017, Paschen 2018): this is precisely the type of information the DE constraints have access to, so a markedness constraint must be able to refer it. I thank Marko Simonović for drawing my attention to this issue.

4.2 Derivations

Let us first take a look at the two progressive / C→V alternations. The tableau in (19) illustrates the assumed derivation of a palatal-final stem concatenated with (12). The data is clear in this case: all underlying palatals are only ever followed with [u], which resembles CV dissimilation.

Since height of the vowel is always dependent on the height of the preceding consonant, all candidates henceforth only contain height sharing from the consonant. The derivation operates with three [\pm back] features from the input: one from the consonant, and two floating. Given that [+high] is shared from the consonant, the result can only be [i] or [u]. The optimal candidate should have [u] as an outcome, therefore tautomorphemic association of [-back] should be excluded, and this is formalised as undominated ranking of DE[-back]. It follows that candidates a. and d. in (19) are rendered suboptimal. Candidates b. and c. both feature tautomorphemic realisation of [+back], but differ with respect to the fate of [-back]: in b. the floating [-back] is realised heteromorphemically, fused on the palatal consonant. In c. the floating [-back] is not associated to any higher node, i.e., unpronounced. Since $\text{ASSOC}[-\text{back}] \gg \text{ASSOC}[\text{+back}]$, candidate b. in (19) is selected as optimal. The grammar where [+back] is computationally inferior to [-back] is also one of the implications of some of the earliest accounts on Polish CV-alternations such as Rubach (1984, 2003).

(19) *Dissimilation is fusion of [-back]*

			DE [-b]	UNIF [+b]				DE [+b]		UNIF [-b]
a.			*!		*					*
b.					*			*		*
c.					*		*!	*		
d.			*!		*				*	

Thus the ranking giving rise to a dissimilation effect for palatal-final stems is DE[-back] \gg ASSOC[-back]; DE[+back] \gg ASSOC[+back], meaning that [-back] is preferably realised outside of the host morpheme than not realised at all. The illusion of dissimilation is achieved through fusion of [-back] on the consonant, and tautomorphemic realisation of [+back], on the morpheme vowel. By resorting to this interpretation, the dissimilation effect is derived without reference to the OCP / *[-back][+back] as a segmental co-occurrence re-

striction, which, if it were used for this derivation, would have made wrong predictions about Polish CV combinations, rarely not matching in backness.

Note that one of the predictions of this derivation is the possibility of depalatalisation, found in candidate (19a), as a consequence of heteromorphic realisation of [+back]. Due to the constraint hierarchy in Polish, candidates with depalatalisation are presumably never optimal, but remain as a potential output which could win under certain conditions, at a lower stratum, or in a different grammatical system.

Allomorph [u] is also found after velars. If the pattern from (19) is applied to the context of a velar-final stem, the predictable outcome for now is that [-back] will be realised tautomorphemically. The problem is that this scenario derives velar palatalisation, which is absent in Polish in the context of LOC.M/N.SG. Tableau (20) illustrates the derivation. When a velar-final stem is concatenated with (12), there are three [\pm back] features and two segments. We already know that [i] is a suboptimal output because of high ranking of DE[-back], which excludes candidates a. and d. from further consideration. Left with candidates b. and c., the output of b. in (20) is a derived sequence consisting of a palatal(ised) consonant followed by [u]. Operations leading to this outcome are similar to the ones in the corresponding candidate in (19): [-back] is realised heteromorphemically, and [+back] tautomorphemically.

The difference lies in the underlying specification of the stem-final consonant, in this case [+back], cf. (11b). Heteromorphic realisation of [-back] yields dissociation of [+back], and its fusion with the [+back] on the vowel. The constraint militating against this is UNIFORMITY[+back]. The fatal violation renders candidate c., with tautomorphemically realised [+back] and non-realised [-back], optimal.

(20) *Retraction is non-realisation of [-back]*

			DE [-b]	UNIF [+b]				DE [+b]		UNIF [-b]
a.			*!	*!	*					
b.				*!	*			*		
c.					*		*	*		
d.			*!		*				*	

The ranking giving rise to the correct optimal outcome is UNIF[+back] \gg ASSOC[-back] \gg UNIF[-back], meaning that [-back] is preferably realised heteromorphemically, but only if this does not result in fusion of [+back]. The only way to satisfy both requirements in the

case of velar-final stem is to not realise [-back] at all, and to realise [+back] on the vowel, which on the surface looks like retraction. By resorting to this interpretation, the retraction effect is derived without reference to CV-agreement / * $[\alpha\text{back}][\beta\text{back}]$ as a segmental co-occurrence restriction, which, if used in this derivation, would have made right predictions about Polish CV combinations, but simultaneously clash with the predictions of the OCP.

Note that candidate b. in (20) is discarded by UNIFORMITY[+b], but there could be a candidate where [+back] of the consonant is only dissociated and remains unpronounced. This is an unfavourable option, as it would produce a palatalised velar followed by [u], which is incorrect. Such an outcome is excluded by MAX($\bullet \rightarrow [\pm b]$), which states that all input association lines between backness features and higher nodes must surface. This constraint would have to outrank DE[-back] for palatalisation of velars to be excluded and only possible for coronals.

Palatalisation is found with coronals and labials, which are presumably underlyingly underspecified for backness (11c-d). In order to satisfy SPECIFY($\bullet \rightarrow [F]$) they need to acquire backness, either via sharing, or via epenthesis, if there is no source on the right.⁵ They can however provide height, meaning that the following locative exponent can only be a [-high] vowel. Under the current hierarchy, however, the predicted outcome is a palatalised consonant followed by a back vowel, parallel to what we have seen in the tableau in (19).

In order to derive the right result we need to come up with more candidates which also do not violate the undominated constraints. The feature co-occurrence constraint can be satisfied with a simple repair: the [-high] can be replaced with an epenthetic [+high].⁶ However this still does not explain why palatalised coronals and labials are not followed by [ɔ] and not [ɛ]. The solution lies in the definition of DE constraints (cf. 14): they are satisfied by a sharing relation between a tautomorphemic and a heteromorphemic node. This is precisely what the data in (2) and (3) show: palatalisation is present only if the vowel remains [-back] as well as the consonant. In the tableau in (21) there are two candidates with feature sharing between the consonant and the vowel. This avoids violations of SPECIFY($\bullet \rightarrow [F]$), as both the consonant and the vowel in the output are specified. Candidate e. employs sharing of [-back], and candidate f. sharing of [+back], where in both cases both association lines are epenthetic, therefore both violate *SHARE[$\pm\text{back}$]. In candidate e. [+back] is left unrealised, and in candidate f. [-back] is unrealised. The decision is made by *SHARE[$\pm\text{high}$], because in candidate e. [-high] is passed over to the vowel, and replaced with an epenthetic [+high]. The doom of candidate f. becomes sharing of [-high]. Even if the violation of *SHARE[$\pm\text{high}$] in the case of candidate f. is avoided the same way like in candidate e., with reassociation of [-high] and epenthesis of [+high], candidate e. would still prevail over such a candidate f' because ASSOC[-back] would prefer the

⁵I assume that backness is only acquired from the suffix due to a ban on rightward spreading for [$\pm\text{back}$].

⁶Candidate b. in (??) and (21) could be rescued and the violation of * $[\text{+cns}, \text{-h}, \text{-b}]$ avoided if [-high] is re-associated from the coronal consonant to the vowel and [+high] epenthesised, like in the winning candidate (21e). The derived structure b' would give rise to the sequence of a palatalised consonant followed by [ɔ], which would be wrongly chosen as optimal under the current hierarchy. Such a scenario could be avoided by assuming a Local Conjunction of DE[+b] and DEP[+h], which would make epenthesis of [+high] dependent on the successful sharing of [-back]. A similar can be seen in parasitic disharmony of Ikoma prefixes (Higgins 2012).

winner. The optimal candidate e. correctly surfaces with a palatal(ised) consonant followed by [ɛ].

(21) *Palatalisation is sharing of [-back] with a [0back] segment*

	C • -h	• ↓ F	* +cns -h	DE [-b]	UNIF [+b]	* • • ±h	* • • ±b	• ↑ -b	DE [+b]	• ↑ +b	UNIF [-b]
a.	C e -h			*!		*					
b.	? o -h		*!			*			*		
c.	C o -h		*!			*		*	*		
d.	C e -h		*!	*!		*				*	
e.	C e -h						*			*	
f.	C o -h					*!	*	*			

For this last case the ranking $*\text{SHARE}[\pm\text{high}] \gg *\text{SHARE}[\pm\text{back}] \gg \text{ASSOC}[-\text{back}]$ is crucial, which means that when sharing $[\pm\text{back}]$, it is preferred to not share $[\pm\text{high}]$ at the same time. In any case one feature must remain unrealised, and in the case of (21) it is $[\pm\text{back}]$. The illusion of palatalisation is achieved through of sharing of $[-\text{back}]$ between the consonant and the vowel and non-realisation of $[\pm\text{back}]$, in addition to reassociation of $[-\text{high}]$ to the vowel and epenthetic $[\pm\text{high}]$ on the consonant. By resorting to this interpretation, the palatalisation effect is derived as a consequence of floating $[-\text{back}]$, and without reference to $\text{PAL} / *[\pm\text{back}][-\text{back}]$ as a segmental co-occurrence restriction, which, if used here, would clash with the two previously avoided co-occurrence constraints and generate wrong results.

4.3 Exceptions

Three exceptional stems combine with [u] in the locative, even though [ʔɛ] would be expected, given that they end in /n/ and /m/. So far, such behaviour was interpreted as a consequence of some inherent property of the morpheme in question. The same logic can be applied to the exceptional stems – their URs must have some hidden properties.

Height of the vowel is always provided by the stem in LOC.M/N.SG . Exceptional stems end in $[-\text{high}]$ consonants, and are combined with [u], which implies that $[\pm\text{high}]$ must

come from the stem. The three stems thus behave exceptionally because they are underlyingly specified with floating [+high]. From the tableaux in (19) and (20) we have learned that [+back] can only be realised tautomorphemically if [-back] can be realised on the consonant (fusion) or if the consonant is [+back] and fusion needs to be avoided. Thus an assumption imposes itself, that the exceptionality of these stems is dual, and their final consonants fully specified as [+back,-high].

Stepping into the derivation (22), we see that the grammar derives [u] as the correct form of the suffix. The winning candidate b. realises floating [+high] heteromorphemically and floating [+back] tautomorphemically, while [-back] remains unrealised, similarly to (20). The stem-final consonant stays unaffected by the floating features.

(22) *Dual exceptionality as full and over-specification of the stem*

			DE [-b]	UNIF [+b]				DE [+b]		UNIF [-b]
a.			*!	*!						
b.							*	*		
c.				*!				*		

The realisation of floating [+high] is governed by ASSOCIATE[+high] and DE[+high], whose rankings are hard to determine straightforwardly, because colloquially, locative forms *o/po/w/na/przy synie, panie, domie* are present and quite frequent. Their frequency is lower in the *National Corpora of Polish Language* (see 23), but it does provide evidence for a pervasive change in the language moving towards eradication of exceptionality.⁷

(23) *Occurrences of exceptional locative forms in NKJP*

stem	LOC -u	LOC -ε	Proportion of ε-forms
/sin/	922	75	8.13
/pan/	79	9	11.39
/dom/	968	35	3.62

⁷Over the development of contemporary Polish the locative -u for these three nouns remained the only trace of the past, thus it is safe to predict that -u locative forms with these stems would with time be completely abandoned in Polish, i.e., overspecification lost. The interpretation of exceptional behaviour as overspecification could also be seen as the reason for the emergence of u-declension to begin with. In a world where there are no lexically determined inflectional classes, all masculine nouns could have operated with a single set of inflectional suffixes, which, combined with non-exceptional stems, in the phonological domain gave rise to the illusion of o/fo-declension, and combined with exceptional stems, gave rise to a paradigm which on the surface looks like the separate u-declension. In that case transition from one inflectional class of nouns to another would occur as a consequence of weakening DE and ASSOCIATE constraints until the overspecification is unlearned. I thank Petr Biskup for drawing my attention this matter.

Analogy could be one of the factors influencing this change as well, because the forms for locative and vocative are generally homophonous for all other nouns except for these three. Interestingly enough, in the case of vocative the exceptional stems fall into the expected pattern and only have ε -forms (Sadowska 2012). The vocative forms could be the contributing factor to the prevalence of regular locative ε -forms in the future.

5. Summary

In this paper, a single UR gives rise to three different outcomes, which on the surface look like three separate assimilative-dissimilative operations. The dissimilation effect is actually fusion of [-back] on the consonant and realisation of [+back] on the vowel. The retraction effect is actually non-realisation of [-back], followed by realisation of [+back] on the vowel. The palatalisation effect is actually sharing of [-back] between the consonant and the vowel, and non-realisation of [+back]. Thus the beforementioned inferiority of [+back] over [-back] noticed in Rubach (2003) is reflected in the grammar, as constraints referring to [-back] predominantly outrank those referring to [+back]. The emergence of [ɛ] is thus dependent on the success of palatalisation.

(24) *Constraint ranking (revised)*

SPECIFY(• → [F]); MAX(• → [±b]) >> DE[-back]; UNIF[+back]; >> *SHARE[±high]
>> *SHARE[±back]! >> ASSOC[-back]; DE[+back] >> ASSOC[+back]; UNIF[-back]

An abstract morpheme gives rise to an alternation, a concrete morpheme does not (cf. instrumental case exponent *-em*). The presence of palatalisation depends on the presence of floating [-back], and the absence of palatalisation depends on the absence of floating [-back].

A more technical advantage of the proposed analysis is that the observed PCA is derived without recourse to segmental co-occurrence marker constraints (PAL, OCP, CV-AGREE), showing that segmental co-occurrence does not operate on lexical strata in Polish. Moreover, the analysis makes no reference to morpheme-specific markedness or faithfulness, and provides evidence for a strict division of domains in which phonology cannot look back into morphology and access information about the morpho-syntactic features that morphemes express, but also cannot look forward into phonetics and access information about potential homophony. Such an interpretation suggests that Polish has only one real palatalisation as an active assimilative process, and that is the one that operates post-lexically and produces secondary articulations.

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