Polish vowel backing: a feature geometric approach

Sławomir Zdziebko
The John Paul II Catholic University of Lublin
s.zdziebko86@gmail.com

ABSTRACT

Polish vowel backing involves the integration of the vocalic nodes marked for feature [open] into the structure of the stems. The floating vocalic nodes constitute the realization of the categorizing N-heads merged with the roots. The items which always possess front vowels in the context of the palatalized consonant are represented with their final vowel-consonant sequences sharing the V-place nodes, thus any instance of palatalization will always affect both the vowel and the consonant. Such items, as well as what Gussmann (1980) calls 'positive exceptions to Backing' (e.g. *kobi*/ɛt/+*a* 'woman, nom, sg.' and *bi*/ɛs/ 'devil, nom, sg.') realize the root and the N-head by means of the stem exponent. The items which show backing in spite of the presence of palatalizing suffixes (e.g. *śl*/ad͡ʑ/+*ik* 'trace, dim, nom, sg.') will be shown to be in fact complex words composed of the root, N-head realized as the backing autosegment, and an N-head realized as a palatalizing suffix.

Keywords: morphophonology, backing, Polish, feature geometry, Optimality Theory

1. Introduction

It is beyond any doubt that the term 'consonant-vowel interaction' in the context of the phonology of Polish brings to mind primarily the impressive amount of literature on the palatalization of prevocalic consonants (see Laskowski 1975, Gussmann 1980, Rubach 1984, 2003; Szpyra 1995, Ćavar 2004 among many others).

This paper, however, focuses on a different kind of consonant-vowel interaction in Polish. In particular, the following study provides an analysis of the alternation of Polish vowels, which is, at least in some cases, correlated with the quality of the following consonant.

Polish possesses sets of words in which the front non-high quality of the vowel is correlated with the palatal quality of the consonant. If the consonant is non-palatal the relevant set of words surfaces with an /a/ (1) or /ɔ/ (2).

(1)[1]

	Forms in /aC/	Forms in /ɛC'/
a.	*świ*/at/	*świ*/ɛt͡ɕ/*e*
b.	*obi*/ad/	*obi*/ɛd͡ʑ/*e*
c.	*j*/azd/+*a*	*j*/ɛʑd͡ʑ/+*e*, *j*/ɛʑd͡ʑ/+*i*+*ć*
d.	*gwi*/azd/+*a*	*gwi*/ɛʑd͡ʑ/+*e*, *roz*+*gwi*/ɛʑd͡ʑ/+*i*+*ć*
e.	*bi*/ał/+*y*[2]	*bi*/ɛl/+*i*+*ć*, *bi*/ɛl/

(2)[3]

	forms in /ɔC/	forms in /ɛC'/
a.	*kości*/ɔł/+*a*	*kości*/ɛl/+*e*
b.	*zi*/ɔł/+*o*	*zi*/ɛl/+*n*+*y*, *zi*/ɛl/+*nik*
c.	*l*/ɔt/	*l*/ɛt͡ɕ/+*e*+*ć*

Gussmann (1980) proposed two rules that account for the behaviour of the words in (1) and (2). The rules of Palatalization (Gussmann 1980: 20) and Backing (1980: 65) are presented in (3).

(3)

(a) [+cons] → [-back] / __ [-back]

(b)

$$\begin{bmatrix} +\text{syll} \\ -\text{high} \\ <+\text{tense}> \end{bmatrix} \rightarrow \begin{bmatrix} +\text{back} \\ <+\text{low}> \end{bmatrix} \; / \; \_\_ \; \begin{bmatrix} +\text{coron} \\ +\text{back} \end{bmatrix}$$

Rule (3a) is a general process that palatalizes consonants before front vowels and /j/. Rule (3b) derives a low vowel /a/ before non-palatal consonants if the input is the tense /ɛ/. If the input to rule (3b) is the lax /ɛ/, the output undergoes subsequent rule of Rounding Adjustment which derives /ɔ/. The application of rule (3a) precedes and bleeds the potential application of rule (3b), thus underlying /ɛ/ surfaces before palatalized consonants.

However, the correlation between the frontness of the vowels and the palatal quality of the consonant is at most sub-regular. There are many words in which the Backing rule overapplies. Consider the examples in (4).

---

[1] Glosses: (a) 'world, nom, sg.' - 'world, loc/voc, sg.'; (b) 'lunch, nom, sg.' - 'lunch, loc/voc, sg'; (c) 'ride, nom, sg.' - 'ride, dat/loc,sg.' - 'to ride', (d) 'star, nom, sg.' - 'star, dat/loc,sg.' - 'to cover with stars'; (e) 'white, nom/voc, sg.' - 'to whiten' - 'white colour'

[2] Following the majority of the literature on Polish morphophonology I assume the surface labio-velar semi-vowel to be undrlyingly a velarized lateral.

[3] Glosses: (a) 'church, gen, sg.' - 'church, loc/voc, sg.'; (b) 'herb, nom, sg.', - 'herbal, nom, sg.' - 'herbary, nom, sg.'; (c) 'flight, nom, sg.' - 'to fly'.

(4)[4]

	Form in /ɛ/	Adjective/Noun (Backing expected)	Adjective/Noun (Backing unexpected)
a.	*wy+bi*/ɛl/*+i+ć*	*bi*/ał/*y*	*bi*/al/*i*
b.	*o+świ*/ɛt͡ɕ/*+i+ć*	*o+świ*/at/*a*	*o+świ*/atɕ/*+e*
c.	*po+dzi*/ɛl/*+i+ć*	*podzi*/ał/	*podzi*/al/*+e*
d.	*strz*/ɛl/*+i+ć*	*strz*/ał/	*strz*/al/*+e*
e.	*za+mi*/ɛʒ/*+a+ć*	*za+mi*/ar/	*za+mi*/aʒ/*+e*
f.	*zi*/ɛl/*+n+y*	*zi*/ɔł/*+o*	*zi*/ɔl/*+e*
g.	*l*/ɛt͡ɕ/*+e+ć*	*l*/ɔt/	*l*/ɔt͡ɕ/*+e*
h.	*pszcz*/ɛl/*+arz*	*pszcz*/ɔł/*+a*	*pszcz*/ɔl/*+e*

The vowels in the third column of the table show the effects of backing despite the fact that the final consonant undergoes Palatalization.

As a matter of fact, alternating stems which surface with backed vowels only in the context of non-palatal consonants, such as *j*/azd/*+a* 'ride, nom, sg.' - *j*/ɛzd͡ʒ/*+e* - 'dat/loc, sg.' or *obi*/ad/ 'lunch, nom, sg.' - *obi*/ɛd͡ʒ/*e* 'loc/voc, sg', are few and far between. In order to account for their exceptionality Gussmann (1980: 67) proposes that such items should be marked in the lexicon by means of a diacritic.

Most words in Polish, Gussmann argues, undergo an alternative version of the Backing rule, which applies regardless of the backness specification of the coronal consonant, but is restricted to a specific morphological environment (see (5)).

(5)

$$\begin{bmatrix} +\text{syll} \\ -\text{high} \\ <+\text{tense}> \end{bmatrix} \rightarrow \begin{bmatrix} +\text{back} \\ <+\text{low}> \end{bmatrix} \; / \_\_ \; \begin{bmatrix} +\text{coron} \\ \text{N, Adj} \end{bmatrix}$$

According to rule (5), front non-high vowels in Polish are backed in the environment of coronal consonants in nouns and adjectives (but not verbs).

Gussmann (1980: 68-69) emphatically notes that rule (5) applies only to nonderived nouns and adjectives. Derivates are subject to the rule of Backing found in (3b): whether they undergo Backing or stay immune to it depends on the palatal quality of the following consonant. Let us refer to this contention as Gussmann's Generalization (6).

[4] Glosses: (a) 'to whiten' - 'white, nom/voc, sg.' - 'white, nom/voc, m-pers.'; (b) 'to enlighten' - 'education, nom, sg.' - 'education, dat/loc, sg.'; (c) 'to divide' - 'division, nom, sg.' - 'division, loc/voc, sg.'; (d) 'to shoot' - 'shot, nom, sg.' - 'shot, loc/voc, sg.'; (e) 'to intend' - 'intension, nom, sg.' - 'intension, loc/voc, sg.'; (f) 'herbal, nom, sg.' - 'herb, nom, sg.' - 'herb, loc, sg.'; (g) 'to fly' - 'flight, nom, sg.' - 'flight, loc/voc, sg.'.; (h) 'bee keeper, nom, sg.' - 'bee, nom, sg.' - 'bee, dat/loc, sg.'.

(6) Gussmann's Generalization

> (a) alternating stems surface with backed vowels when found in nonderived nouns and adjectives
>
> (b) in derived nouns and adjectives alternating stems surface with backed vowels only when the suffix does not palatalize the stem-final consonant

This is illustrated in (7).

(7)[5]

	Non-derived nouns/adjectives	Derived nouns/adjectives (with palatalization)	Derived nouns/adjectives (without palatalization)
a.	*po+dzi*/al/*+e*	*po+dzi*/ɛl/*+n+y*, *po+dzi*/ɛl/*+nik*,	*po+dzi*/ał/*+k+a*
b.	*śl*/ad͡ʒ/*+e*	*śl*/ɛd/*+cz+y*	*śl*/ad/*+ow+y*
c.	*wy+mi*/aʒ/*+e*	*wy+mi*/ɛr/*+n+y*	*wy+mi*/ar/*+ow+y*
d.	*zi*/ɔl/*+e*	*zi*/ɛl/*+n+y*, *zi*/ɛl/*+nik*	*zi*/ɔł/*+ow+y*
f.	*pszcz*/ɔl/*+e*	*pszcz*/ɛl/*+arz*, *pszcz*/ɛl/*+i*	*pszcz*/uł/*+k+a*[6]

Words such as *śl*/ɛd/*+cz+y* 'investigative, nom, sg.' or *wy+mi*/ɛr/*+n+y* 'measurable, nom, sg.' seem to constitute counterexamples to the general claim about the correlation of the presence of /ɛ/ and the palatalized quality of the consonant. Gussmann (1980), following Laskowski (1975), attributes this surface effect to the later transparent rule of Depalatalization that applies in the environment of coronal segments. In what follows I will disregard the Depalatalization facts due to space restrictions.

Apart from the exceptional items found such as *obi*/ad/ 'lunch, nom, sg.' - *obi*/ɛd͡ʒ/*e* 'loc/voc, sg', there are two classes of words whose behaviour is not covered by Gussmann's Generalization. The first class is the set of alternating stems which do not undergo backing in underived forms, thus denying the validity of clause (a) of the Generalization. These, however, show soft (palatal or palatalized) stem-final consonants throughout their paradigms. Such soft-stemmed items show the effects of backing in diminutive and expressive forms (see 8 for selected examples).

[5] Glosses: (a) 'division, loc/voc, sg.' - 'divisible, nom, sg.' - 'cost allocator, nom, sg.' - 'gauge, nom, sg.'; (b) 'trace, loc/voc, sg.' - 'investigative, nom, sg.' - 'vestigial, nom, sg.'; (c) 'dimension, loc/voc, sg.' - 'measurable, nom sg.' - 'of appropriate size, nom, sg.'; (e) 'herb, loc, sg' - 'herbal, nom, sg.', 'herbary, nom, sg.' - 'herbal, nom, sg.'; (f) 'bee, dat/loc, sg.' - 'bee keeper, nom, sg.' - 'of bee, nom, sg.' - 'bee, dim, nom, sg.'.

[6] The diminutive undergoes a subsequent rule of *o*-Raizing deriving /u/ form a lax /ɔ/.

(8)[7]

	Soft-stemmed forms	Expressive forms
a.	*niedźwi*/ɛd͡ʑ/	*niedźwi*/ad/+*ek*
b.	*powi*/ɛɕt͡ɕ/	*powi*/ast/+*k*+*a*
c.	*si*/ɛt͡ɕ/	*si*/at/+*k*+*a*
d.	*jel*/ɛɲ/	*jel*/ɔn/+*ek*
e.	*pierści*/ɛɲ/	*pierści*/ɔn/+*ek*
f.	*kiesz*/ɛɲ/	*kiesz*/ɔn/+*k*+*a*
g.	*kmi*/ɛt͡ɕ/	*kmi*/ɔt/+*ek*
h.	*paci*/ɛʒ/	*paci*/ɔr/+*ek*
i.	*pi*/ɛɕɲ/	*pi*/ɔsn/+*k*+*a*

For Gussmann (1980) the Underlying Representations of the soft-stems consists of a non-palatal consonant and a palatalizing vowel or the glide /j/. Gussmann claims that the complete absence of Backing in these items follows from their being morphologically complex: the palatalizing agent forms a separate morpheme which undergoes deletion before the diminutive/expressive affix.

The second set of items apparently violates clause (b) of Gussmann's Generalization. These are morphologically complex items in which the final consonant undergoes palatalization, but the vowel is still backed (see 9a). (9b) presents the items formed with the same set of affixes but showing no effects of backing.

(9)[8]

Overapplication of Backing	No backing
mi/ɔtl/+*isk*+*o*	*mi*/ɛɕt͡ɕ/+*isk*+*o*
dzi/al/+*isk*+*o*	*popi*/ɛl/+*isk*+*o*
śl/ad͡ʑ/+*ik*	*niedźwi*/ɛd͡ʑ/+*isk*+*o*
l/ɔt͡ɕ/+*ik*	*powie*/ɛɕt͡ɕ/+*isk*+*o*
kwi/at͡ɕ/+*arz*	*kwi*/ɛt͡ɕ/+*ist*+*y*
gwi/aʑd͡ʑ/+*ist*+*y*	*gwi*/ɛʑd͡ʑ/+*ist*+*y*

To account for the behaviour of the items in the left-hand column, Gussmann (1980) assumes that in some cases it is not the Underlying Representation but rather the surface forms that constitutes the input to the word-formation rules.[9] In the relevant cases the

[7] Glosses: (a) 'bear, nom, sg.' - 'dim, nom, sg.'; (b) 'novel, nom, sg.' - 'expr, nom, sg.'; (c) 'net, nom, sg.' - 'expr, nom, sg.'; (d) 'deer, nom, sg.' - 'dim, nom, sg.'; (e) 'ring, nom, sg.' - 'dim, nom, sg.'; (f) 'pocket, nom, sg.' - 'dim, nom, sg.'; (g) 'peasant, nom, sg. - yokel, nom, sg.'; (h) 'prayer, nom, sg.' - 'expr, nom, sg.'; (i) 'song, nom, sg.' - 'expr, nom, sg'.

[8] Glosses (top-down): Overapplication of Backing: 'broom, aug, nom, sg.', 'division, aug, nom, sg.', 'trace, dim, nom, sg.', 'flight, dim, nom, sg.', 'florist, nom, sg.', 'covered with stars, nom, sg.'. No Backing: 'city, aug, nom, sg.', 'ash, aug, nom, sg.', 'bear, aug, nom, sg.', 'novel, aug, nom, sg.', 'floral, nom, sg.', 'covered with stars, nom, sg.'.

[9] This idea has been later developed in Szpyra (1989).

surface forms are the forms that underwent Backing. They are further concatenated with palatalizing affixes, thus surfacing with palatalized consonants. Gussmann contends that it is not possible to predict which items are going to make their surface forms available for word-formation processes. As illustrated by the doublet *gwi/azʲd͡ʒʲ/+ist+y* - *gwi/ɛzʲd͡ʒʲ/+ist+y* 'covered with stars, nom, sg.' (both attested in the National Corpus of Polish), even a single word must be assumed to sometimes be based on a surface form and sometimes on an underlying form.

The current study is going to address the following questions related to the facts concerning Polish vowel backing:

> 1. What is the nature of the lexical diacritic postulated by Gussmann in the case of the items which always show front vowel in the environment of palatal consonants such as *j*/azd/+*a* 'ride, nom, sg.' or *obi*/ad/ 'lunch, nom, sg'?
>
> 2. What does it mean to be a 'nonderived' noun or adjective in the light of the contemporary approaches to word formation?
>
> 3. In the light of contemporary approaches to word-formation, is it necessary or possible to postulate that certain words allow their surface phonetic forms to constitute the input to word-formation processes?

The lexical diacritic will be argued to be phonological in nature. I will argue that the items in which the palatal quality of the consonant always implies the front quality of the vowel will be represented with the vowel and the consonant sharing a V-place node. I will also show that palatalization involves the augmentation of the structure with features [coronal] and [-anterior], which attach to the V-place node and change the quality of the consonant and the vowel at the same time.

Within the syntactic approach to word-formation assumed in this study, there are no 'nonderived' words. The least complex words involve the merger of acategorial roots with categorizing heads N(oun), A(djective) or V(erb) (see Halle and Marantz 1993, Halle 1997, Embick and Noyer 2007 among others). The categorical heads may be realized phonologically by means of segmental material (stem or affixes) or by means of subsegmental material (features, autosegmental nodes). I will argue that the latter situation takes place in the case of what Gussmann (1980) refers to as 'nonderived' nouns and adjectives. The categorial heads N and A in the relevant items are realized as a vocalic node marked for feature [open] or features [lab] and [open]. The integration of those features into the structure of the relevant stems triggers the mutation of the front vowel into /a/ and /ɔ/, respectively. If the N and A-heads are realized by means of segmental material, no vowel mutation is expected.

I will also argue that the effects assigned by Gussmann (1980) to the availability of certain surface phonetic forms to affixation operations are in fact the consequence of the general assumptions of the syntactic approach to word-formation. In particular, I will show that the affixes which seem to impose backing in some but not other cases, as in (9), are NP-level affixes, i.e. are affixed to already categorized items. Thus, the relevant items undergo backing imposed by autosegments before the segmental suffixes are concatenated and have the chance to palatalize the stem-final consonant. The items in which the front /ɛ/ surfaces (e.g. *mi*/ɛcʲt͡ɕʲ/+*isk*+*o* 'city, aug, nom, sg.') are those items in which the vowel and the consonant share the V-place node: in such items palatalization is always accompanied by a fronting of the vowel.

The paper is organized as follows: section 2 is the outline of the phonological and morphological framework assumed for the purposes of this study. Section 3 discusses the problematic aspects of Gussmann's (1980) analysis of Backing, while section 4 presents the analysis of the data discussed above. Section 5 contains the conclusion of the paper.

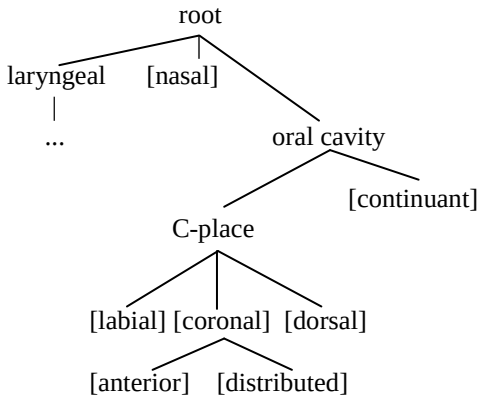
2. Basic architectural assumptions

The following section introduces certain basic assumptions concerning the representations of Polish vowels and consonants and the integration of autosegmental material (2.1) as well as the approach to morphology-phonology interface (2.2).

2.1. The basic phonology of backing

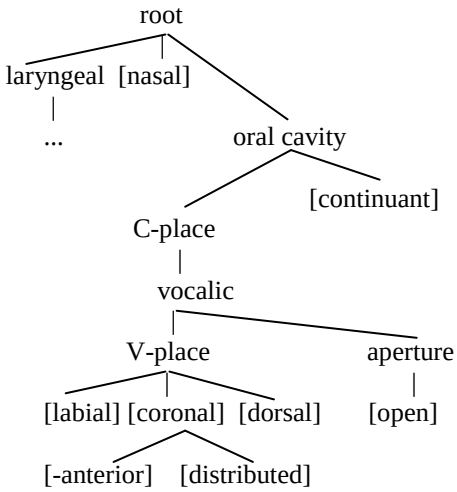
For the purposes of this study I assume the constriction based feature geometric system proposed by Clements and Hume (1995). (10) presents the representation of a consonant as postulated by Clements and Hume (1995).

(10)



(11), on the other hand, is the representation of a vocoid postulated within the constriction based framework.

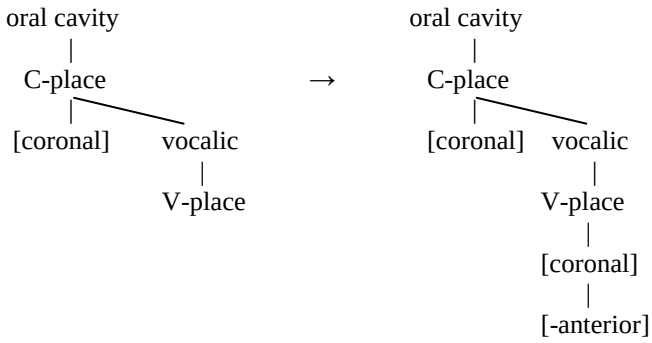
(11)



As in the case of most feature geometry systems (e.g. Sagey 1986, Clements 1985, Harris 1994, Halle et al. 2000, van der Hulst 2005 among others), the system postulated by Clements and Hume (1995) proposes very similar sets of nodes and features to be found in both consonants and vowels. A notable exception is the aperture node hosting feature [open] that forms part of non-high vowels. The aperture node and feature [open] are licensed in vocoids but not in consonants.

The aspect of Clements and Hume (1995) model which is of special interest from the point of view of the subject matter of this paper is the architectural characterization of secondary articulation, in particular the palatalization of segments. Clements and Hume (1995) propose that secondary place features are introduced on consonants by means of a vocalic node subsumed under the C-place node, which itself contains the primary place features. Thus an exemplary palatalization of /d/ to /d͡ʒ/ as in *obia*/d/ 'lunch' - *obie*/d͡ʒ/+*e* 'loc/voc, sg', involves the enrichment of a structure of the plosive with features [coronal] and [-anterior]. The relevant parts of the representation are found in (12).

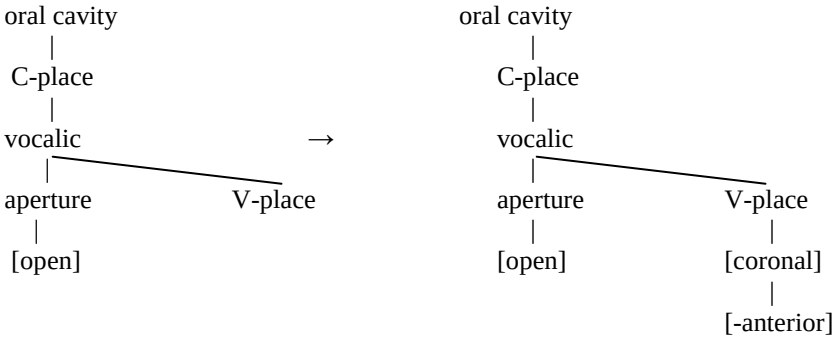
(12) /d/ → /d͡ʒ/



Although the articulation of Polish prepalatal /d͡ʑ/ is clearly distributed, the feature [distributed] is non-contrastive in Polish affricates, hence it may well be the case that Polish does not utilize this feature at all.[10]

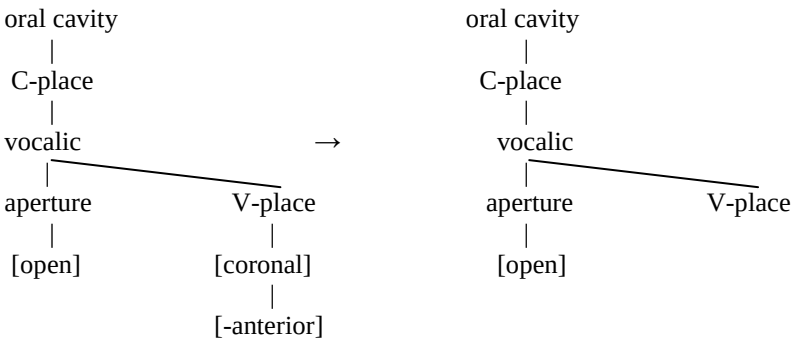
Importantly the second alternation that constitutes the focus of this study, i.e. the alternation of /a/ and /ɛ/, may also be analyzed as involving the coronalization of the input segment. (13) presents the relevant structural change.

(13) /a/ → /ɛ/



The mapping presented in (13) above illustrates the alternation attested in pairs such as *obi*/ad/ 'lunch' - *obi*/ɛd͡ʑ/*+e* 'loc/voc, sg' on the assumption that it is /a/ that constitutes the input to the change. Although this is not the traditional assumption made e.g. in Gussmann (1980), this direction seems the most natural in all the items in which the vowel must undergo the mutation when the consonant is palatalized. At the same time, in the items in which the vowel does not have to mutate together with the consonant, e.g. *śl*/ad/ - *śl*/ad͡ʑ/*e* - *śl*/ɛd͡ʑ/*ić* 'trace, inst, sg. - loc/voc, sg. - to track, follow' the direction of the alternation will be assumed to go from /ɛ/ to /a/. Below I present the structural change of the alternation from /ɛ/ to /a/.

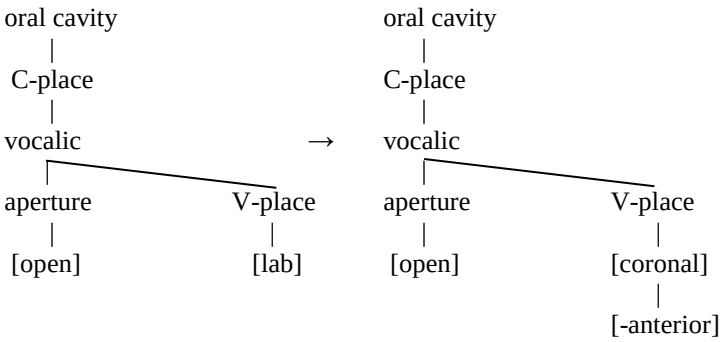
(14) /ɛ/ → /a/



[10] I follow Rubach's (2003) suggestion whereby Polish post-alveolar series /ʃ/, /ʒ/, /t͡ʃ/ and /d͡ʒ/ is labio-coronal (contain feature [lab]). The dental affricates /t͡s/ and /d͡z/ are anterior segments, i.e. involve the articulation in front of the palato-alveolar region.

The alternation of the back rounded vowel /ɔ/ with /ɛ/ involves very similar mappings. I will argue that in the case of the alternation attested in the diminutives such as *jel*/ɛɲ/ - *jel*/ɔn/*ek* ‘deer, nom, sg. - dim, nom, sg.’ it is the form with /ɔn/ that is actually the lexical representation. The alternation between /ɔ/ and /ɛ/ is represented in (15).

(15) /ɔ/ → /ɛ/



On the other hand, the alternation within triplets such as *zi*/ɔɬ/*em* - *zi*/ɔl/*e* - *zi*/ɛl/*nik* ‘herb, inst, sg. - loc, sg. - herbarium, nom, sg.’ will be argued to show the reverse alternation, from /ɛ/ to /ɔ/.

All the alternations illustrated above will be analyzed as the integration of autosegmental affixes (floating nodes or features) into the underlying representations of the stem. The said autosegments will be argued to constitute the realization of morpho-syntactic material. The attested mutations are, therefore, understood as the result of the concatenation of (the exponents) of morphemes.

Even without going into the details of such a solution, it is quite clear that this interpretation of facts does not work equally naturally with all the changes schematized above. While the palatalization and the alternation of /a/ to /ɛ/ clearly involve the addition of material to the lexical structure, the same cannot be said about the mutation of /ɛ/ to /a/, which rather involves the subtraction of the material. Similarly, the alternations of /ɔ/ to /ɛ/ and /ɛ/ to /ɔ/ seem to involve a replacement of the material found under the V-place node: features [labial] and [coronal[-anterior]].

It is nevertheless possible to argue that the observed changes are the result of concatenation of exponents. It will be shown that the apparent subtraction or replacement of features are the reaction of the grammar to the integration of the autosegments. The said reaction is the direct consequence of the application of general phonological well-formedness conditions in Polish such as the ban on consonants to host aperture nodes, ban on C-place nodes to host more than one vocalic node and the incompatibility of features [coronal] and [labial] in Polish vowels. Such well-formedness conditions are often incompatible with the requirements to integrate floating autosegments and to keep the features present in the lexical representations associated with their mother nodes.

Such contradictory tendencies within the phonology of a single language are best represented in frameworks which assume that constraints are violable, e.g. Prince and Smolensky’s (2004) Optimality Theory. I will therefore assume that the integration of autoregments is subject to optimality theoretic evaluation. To illustrate how such an evaluation works let us consider the integration of an autosegmental vocalic node

marked for feature [open] into the structure of a stem containing vowel /ɛ/. Such an integration is attested in the case of the noun *śl*/ad/ 'trace, nom, sg.' which possesses a lexical /ɛ/ as evidenced by the verbal form *śl*/ɛd͡ʑ/*ić* 'to track, follow'. The constraints that play a role in the integration are summarized in (16)

(16)

(a) MAX FLT: a floating autosegment in the input must be linked to its mother node

(b) *aperture;C: an aperture node must not be dominated by feature [+consonantal]

(c) *2voc: vocalic nodes cannot be sisters

(d) *SPREAD: an association line in the output must have an input correspondence

(e) MAX voc: a vocalic node in the input must remain linked to a C-place node

(f) MAX [cor]: feature [coronal] in the input must remain linked to a C/V-place node

(17) presents a sample evaluation. As will be clarified later on, the floating vocalic node is the realization of the categorizing N-head.

(17) *śl*/ɛd/ → *śl*[ad]

	/ɛd/ + voc_i ap_i $V\text{-}pl_i$ [open]$_i$	MAX FLT	*aperture;C	*2voc	MAX [cor]	*SPREAD	MAX voc
a.	[ɛd]	*!					*
b.	[d] voc_i ap_i $V\text{-}pl_i$ ...		*!			*	*
c.	[ɛ] voc voc_i			*!		*	
d.	[ɛ] voc_i $V\text{-}pl_i$ [cor]					**!	*
e.	☞[ad]					*	*

Candidate (a) does not integrate the floating vocalic node, which results in a fatal violation of MAX FLT. The integration of the floating vocalic node under the consonant results in a structure in which aperture node is part of the consonant. This is not possible in Polish, and probably universally, thus candidate (b) violates *aperture;C. Candidate (c) illustrates the case of the integration of the floating autosegment without the delinking of the lexical vocalic node. This candidate is eliminated as it violates *2voc. Candidate (d) integrates the floating vocalic node and relinks feature [coronal] under the newly integrated V-place node. Note that the delinking of the lexical vocalic node does not violate the faithfulness constraint MAX [cor] (its high ranking will be justified shortly), as the feature [coronal] is still integrated under the V-place node. The promiscuous relinking of [cor] causes the additional violation of *SPREAD. Candidate (e) integrates the floating vocalic node and delinks the lexical vocalic node thus triggering the mutation of /ɛ/ to /a/.

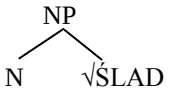
Most segmental mutations attested in Polish are the consequence of exactly the same mechanism: floating autosegments are forced to integrate but their integration must be accompanied with structural repairs. It is ultimately the available repairs that decide about the output shape of the affected stems.

2.2. Morphology and the spell-out machanism

The approach to the structure of the word assumed here shares most of its assumptions with the theory of Distributed Morphology (Halle and Marantz 1993, Halle 1997, Embick and Noyer 2007, Embick 2010 among others). The core lexical meaning of words is contributed by acatagorial roots which merge with categorizing heads to form nouns, verbs or adjectives. This is illustrated in (18) on the example of a Polish root √ŚLAD.

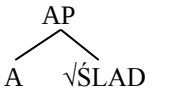
(18)

(a)



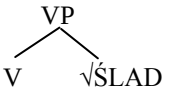
= *ślad* ‘trace’

(b)



= *śled+cz+(y)* ‘investigative’

(c)



= *śledz+(i+ć)* ‘to track’

Distributed Morphology is characterized by a late insertion approach to realization. This means that the structures such as the ones resented in (18) undergo syntactic and morphological derivation without the presence of phonological material. The phonological realization of the morpho-syntactic nodes is decided at the stage of the derivation known as Vocabulary Insertion. Only then is the morpho-syntactic material re-written as the phonological features.

An exemplary statements (vocabulary items) realizing the structures found in (18) are found below.

(19)

(a) {√ŚLAD} ↔ /ɕlɛd/

(b) N ↔ voc
|
aperture
|
[open]

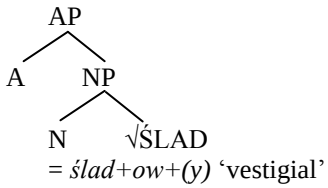
(c) A ↔ /t͡ʃ/ / LIST __

(d) V ↔ [cor]
|
[-ant]

Vocabulary item (19a) realizes the root by means of the stem exponent. Exponent (19b) is responsible for the backing of the stem vowel in Polish nouns. Its integration into the structure of the stem has been discussed in the previous section (see 17 above). (19c) is one of the exponents of the adjectival head. It is inserted in the context of a particular list of roots. Since the class of verbs to which the verb *śledz+i+ć* 'to track' belongs show palatalization in all the forms of the paradigm, it is justified to claim that the palatalizing autosegment is the realization of the verbalizing head (19d).

It is agreed that Vocabulary Insertion applies cyclically, i.e. it is subject to some version of Chomsky's (2001) derivation by phase. The details of the approach to cyclic spell-out assumed in this study have been presented in Embick (2010). Embick (2010) proposes that the each categorizing head triggers the spell-out of the cyclic domain it its complement. A cyclic domain is composed of the lower categorizing head, its complement and the non-categorizing nodes intervening between the lower and the higher categorizing heads. At spell-out the complement of the spell-out triggering head receives its phonological realization and undergoes phonological and semantic interpretation. Importantly, the spell-out triggering head does not undergo interpretation at the same cycle as its complement. This mechanism is clearly observed in the case of the de-nominal adjective *ślad+ow+y* 'vestigial, nom, sg.' whose structure is illustrated in (20).

(20)



As the A-head is merged its complement undergoes spell-out. The N-head and the root receive their phonological realization, which undergo concatenation and phonological processing. Under such an approach, the selection of the exponent of the A-head in (20) must never be sensitive to the indiosyncratic properties of the root. In the case of most 'derived' adjectives in Polish the realization of the A-head is the default exponent *-ow-* /ɔv/. Neither can the A-head influence the semantic interpretation of the root: the

meaning of adjectives in *-ow-* are mostly semantically transparent and clearly denominal.

Most importantly, under the approach presented above words such as *ślad* 'trace, nom, sg.' cannot be considered to be proper 'nonderived' nouns. All words involve the merger of at least two morphemes: the root and the categorizer. Similarly, the absence of backing in the 'root' adjectives such as *śled+cz+y* 'investigative, nom, sg.' and its presence in phrase-based adjectives such as *ślad+ow+y* 'vestigial, nom, sg.' are simply the consequence of the complex structure of the latter class.

Note that the affix *-ow-* is not an example of a palatalizing affix. However, in those words in which one finds palatalizing exponents of phrase-based nouns (e.g. the augmentative affix *-isk-*), adjectives or verbs, the expected effect may in fact be the presence of backing *and* the palatalization of the stem-final consonant. This is the case, it will be argued, with many items that seem to display the overapplication of backing (see 9 above and section 4.3.).

3. The problems of the traditional analysis

As I have mentioned in the introduction, the traditional analysis of the mutation of the vowel /ɛ/ with /a/ and /ɔ/ relies on the interaction of the rule of Palatalization (Gussmann 1980: 20) and Backing (Gussmann 1980: 67). Both rules are repeated in (21).

(21)

$$[+\text{cons}] \rightarrow [-\text{back}] \,/\, \_\_\, [-\text{back}] \qquad \text{(a)}$$

$$\begin{bmatrix} +\text{syll} \\ -\text{high} \\ <+\text{tense}> \end{bmatrix} \rightarrow \begin{bmatrix} +\text{back} \\ <+\text{low}> \end{bmatrix} \,/\, \_\_ \left\{ \begin{array}{ll} \begin{bmatrix} +\text{coronal} \\ \text{N, Adj} \end{bmatrix} & \text{(b)} \\ \begin{bmatrix} +\text{coron} \\ +\text{back} \end{bmatrix} & \text{(c)} \end{array} \right\}$$

Recall that for most derived forms as well as for a diacritically marked set of 'nonderived' items sub-clause (21c) is the proper formulation of the rule of Backing. On the other hand, most 'nonderived' nouns and adjectives undergo Backing regardless of the value of feature [back] on the following consonant (21b).

The two rules derive attested outputs on the assumption that rule (21a) applies before rule (21c) and bleeds it.

However, there are considerations which speak against Backing being a synchronic rule of Polish phonology. Firstly, Backing involves an undesirable degree of abstractness. Note that the rule makes an explicit assumption that Polish distinguishes between tense and lax vowels. The reference to feature [tense] in the structural description of the rule is necessary as some instances of /ɛ/ surface as /a/, while other alternate with /ɔ/s. It was assumed that [+tense] vowels will undergo additional Lowering, while [-tense] vowels are rounded. Importantly, the tense-lax distinction is not phonetically real in Polish.

As a matter of fact, there is no reason to assume that lowerable /ɛ/s are marked as [+tense], while the instances of /ɛ/ eligible for Rounding are [-tense]. The specification could well be reversed as there is no cross linguistic evidence for tense vowels to be more likely to undergo height adjustments than lax vowels. In the same way, lax vowels are not more likely to be rounded. In sum, there is no phonetic or phonological reality behind the claim that it is tense /ɛ/s that undergo Backing and Lowering, while lax /ɛ/s to be susceptible to rounding.

On top of that, there is a considerable number of words in Polish in which /ɛ/ surfaces before non-palatal coronal consonants. A fraction of such examples is presented in (22).

(22)

kobi/ɛt/+*a* 'woman, nom, sg.'	*dzi*/ɛł/+*o* 'work of art, nom, sg.'
maki/ɛt/+*a* 'model, nom, sg.'	*prz*/ɛz/ 'through'
bi/ɛd/+*a* 'poverty, nom, sg.'	*tl*/ɛn/ 'oxygen, nom, sg.'
ści/ɛr/+*a* 'cloth, exp, nom, sg.'	*c*/ɛn/+*a* 'price, nom, sg.'
bi/ɛs/ 'devil, nom, sg.'	*cz*/ɛs/+*a*+*ć* 'to comb'

Under the abstract analysis found in Gussmann (1980) the instances of the front non-high vowels in these items should be affected by one of the versions of the Backing statement and surface as /a/ or /ɔ/, depending on the value of feature [tense]. This, however, does not happen. As a matter of fact, vowel backing is not attested in the majority of words which could fall prey to the rule and affects only a small part of the Polish lexicon.

Gussmann (2007) presents an account in which the /ɛ/ - /a/ alternation is denied any synchronic phonological or morphophonological reality and is expressed through relatedness statements encoded within lexical entries of words by means of diacritic markings. Non-alternating items, such as the ones found in (22) simply do not have any entry with /a/ to be related to.

Such a solution is not available to the current approach, which notably does not recognize the existence of the lexical entries of words. All words are built from acategorial roots and pieces of functional vocabulary which merge in the syntax: the only 'engine' of the grammar.

At the same time, I think that Gussmann (2007) was on the right track in recognizing the role of the specific information encoded in lexical entries for the application of the backing in Polish. In section 4.1. I will claim that the non-application of backing in the case of most Polish words is the consequence of the root and the N-head being spelled out by the stem. As will be shown below, such a strategy blocks the insertion of the backing autosegment (19b) and makes backing inapplicable.

Similar empirical problems are encountered in the case of Polish palatalization. Rule (21a) is not surface true in Polish. Polish has productive affixes which begin in the front vowel /ɛ/ but do not trigger palatalization (see 23).

(23)

Underapplication of Palatalization

a.	*tema*/t/ 'topic, nom, sg.'	*tema*/t/+/ɛ/*m* 'inst, sg.'
	premie/r/ 'prime minister, nom, sg.'	*premie*/r/+/ɛ/*m* 'inst, sg.'
	chle/b/ 'brad, nom, sg.'	*chle*/b/+/ɛ/*m* 'inst, sg.'
b.	*gru*/b/+*y* 'fat, sg, nom/voc, masc.'	*gru*/b/+/ɛ/ 'nom/voc, non-m-pers.'
	czys/t/+*a* 'nom/voc, sg, fem.'	*czys*/t/+/ɛ/ 'nom/voc, non-m-pers.'
	cho/r/+*e* 'nom/voc, sg, neu.'	*cho*/r/+/ɛ/ 'nom/voc, non-m-pers.'
c.	*krzy*/v/+*y* 'crooked, nom/voc, sg. masc.'	*krzy*/v/+/ɛ/*go* 'gen/acc, masc.'
	chu/d/+*y* 'skinny, nom/voc, sg, masc.'	*chu*/d/+/ɛ/*go* 'gen/acc, masc.'
	sta/r/+*y* 'old, nom/voc, sg, masc.'	*sta*/r/+/ɛ/*go* 'gen/acc, masc.'
d.	*mło*/d/+*a* 'nom/voc, sg, fem.'	*mło*/d/+/ɛ/*j* 'gen/dat/loc, sg, fem.'
	ły/s/+*a* 'bald, nom/voc, sg, fem.'	*ły*/s/+/ɛ/*j* 'gen/dat/loc, sg, fem.'
	ca/ɬ/+*a* 'whole, nom/voc, sg, fem.'	*ca*/ɬ/+/ɛ/*j* 'gen/dat/loc, sg, fem.'
e.	*ko*/t/ 'cat, nom, sg.'	*ko*/t/+/ɛ/*k* 'dim, nom, sg.'
	pa/s/ 'belt, nom, sg.'	*pa*/s/+/ɛ/*k* 'dim, nom, sg.'
	ku/r/+*a* 'chicken, nom, sg.'	*ku*/r/+/ɛ/*k* 'dim, gen, pl.'

In addition to that, Polish has many affixes which do not begin in front vowels but trigger palatalization. Some examples are presented in (24).

(24)

Overapplication of Palatalization

a.	*pa*/s/+/a/ 'belt, gen, sg.'	*pa*/ɕ/+/a/*st*+*y* 'striped, nom/voc, sg, masc.'
	bul/v/+/a/ 'bulb, nom, sg.'	*bul*/vʲ/+/a/*st*+*a* 'bulb-shaped, nom/voc, sg, fem.'
	kan/t/+/a/*mi* 'side, inst, pl.'	*kan*/t͡ɕ/+/a/*st*+*e* 'angular, nom, sg, neu.'
b.	*tłu*/st/+/ɔ̃/ 'fat, acc/inst, sg, fem.'	*tłu*/ɕt͡ɕ/+/ɔ/*ch* 'fatso, nom, sg.'
	czy/st/+/ɔ/ 'clean (adv)'	*czy*/ɕt͡ɕ/+/ɔ/*ch* 'sticker for cleanness, nom, sg.'
c.	*za mło*/d/+/u/ 'in sb's youth'	*mło*/d͡ʑ/+/u/*ś*+*i* 'young, expr, nom/voc, sg/pl.'
	po ma/ɬ/+/u/ 'gradually'	*ma*/l/+/u/*ś*+*i* 'small, expr, nom/voc, sg/pl.'
	piek/n/+/u/ 'beauty, dat, neu.'	*piek*/ɲ/+/u/*ś*+*i* 'pretty, expr, nom/voc, sg/pl.'

The response to the data presented in (23) and (24) were multiple. The early generative literature postulated that the non-palatalizing front vowels are underlyingly back (see Gussmann 1978, Rubach 1984) and undergo fronting after Palatalization had the chance to apply. For data in (24) an abstract front vowels were postulated e.g. in Gussmann (1978). Such vowels were subject to deletion after they induced palatalization.

Dressler (1985), Czykowska-Higgins (1988) and Gussmann (2007) postulated that palatalization of a consonant does not have to do with the front quality of the following vowel but is induced by a diacritic carried by an affix. Thus solution is completely arbitrary in nature but accounts for the cases of underapplication as well as overapplication of palatalizations.

The analysis postulated in this study might well be claimed to take the middle ground between the two approaches described above. That Polish palatalization is arbitrary with respect to the environment in which it take place is an undeniable fact. Still, the structural changes involved in palatalization should be modelled as a uniform set of operations. In order to account for these two basic properties of the alternations in question I will analyze palatalizations as involving the integration of autosegments which form part of suffixes concatenated with stems.[11] Whether a given affix contains an autosegment is, of course, a lexical property of that affix and has nothing to do with the quality of the vowel that affix contains. On the other hand, the set of changes affecting coronal consonants in the environment of a given affix is expected to show required uniformity due to the fact that one has to do with the integration of one and the same autosegment into the structure of all the relevant consonants.

4. A feature geometric analysis of backing

The following section presents the detailed analysis of the data concerning backing discussed in the introduction and subsequent sections. In section 4.1. I concentrate on those items which surface with the unbacked vowels throughout their paradigms. Section 4.2. is devoted to the analysis of the items in which the front quality of the vowel is strictly connected with the palatal quality of the following consonant. Section 4.3. focuses of the items in which backed vowels may be followed by palatalized consonants.

4.1. Non-alternating items

As I mentioned above the existence of 'non-derived' items such as *kobi*/ɛt/+*a* 'women, nom, sg.' or *bi*/ɛs/ 'devil, nom, sg.' in which vowel /ɛ/ consistently precedes non-palatal consonants is problematic for Gussmann's Backing-based account (see 22 above for more such cases).

Given that feature [tense] bifurcates the instances of /ɛ/ into vowels available for Backing and Lowering and vowels eligible for Backing and Rounding, all such words should contain either /a/ or /ɔ/.

At the same time, it must be admitted that at this point the existence of the data found in (22) is equally problematic for the current approach to backing. Note that the morphological analysis of nouns such as *kobiet+a* 'woman, nom, sg.' and *bies* 'devil, nom, sg.' must necessarily involve the merger of the root with the categorizing head N. Note also that the only exponent of the N-head proposed so far is the autosegment (19b) repeated below as (25)

[11] See Gussmann (1992) and Szpyra (1995) for a similar analysis of palatalizations.

(25)

N ↔ voc
|
aperture
|
[open]

The concatenation of (25) with the stem containing vowel /ɛ/ will inevitable provoke backing.

Gussmann (1980: 143) took notice of the problematic status of the items with stable /ɛ/ and claimed that such words must be marked as 'positive exceptions to Backing'.

Instead of marking the stems with diacritics that make them invisible to the application of the relevant rule, let me propose that the absence of backing in the items under investigation is that their stems realize both the roots and the N-head. In (26) the entry for *bies* 'devil, nom, sg.' is compared with the entry for *ślad* 'trace, nom, sg.'.

(26)

(a) {√BIES, (N)} ↔ /bʲɛs/

(b) √ŚLAD ↔ /ɕlɛd/

According to entry (26a) the stem /bʲɛs/ realizes the root √BIES and the N-head, if it is present in the structure. On the other hand, according to the entry (26b) = (19a), the stem /ɕlɛd/ realizes only the root. Since Vocabulary Insertion universally applies in a bottom-up or root-outward fashion, the entry (26a) will bleed the insertion of entry (25). Consequently, nouns such as *bies* 'devil, nom, sg.' will never be eligible for backing.

What I propose is, therefore, two lexical classes of nominals with no overt suffixes: in one, considerably larger class, the stem realizes the root and the N-head, while in the other class the stem realizes only the root. It is only the latter class that is eligible for backing.[12]

[12] Note that the existence of root-based derivates of items such as *bies* is not problematic for the present account so long as the root-based derived nouns belong to different gender or declension classes than the affixless nominal. Thus in *biesi+ad+a* 'beanfeast, nom, sg, fem.' sharing the root with *bies* 'devil, nom, sg, masc.', affix *-ad-* realizes the N-head specified for feminine gender:

i. N_{fem} ↔ /ad/ / √BIES __

If entry (i) is to take effect, the more precise entry for *bies* should be formulated that makes reference to the gender features of the N-head:

ii. {√BIES, (N_{masc})} ↔ /bʲɛs/

If the structure does not contain a masculine N-head, the stem will realize only the root.

4.2. V-place sharing items

In this subsection I propose an analysis of the items which display completely regular behaviour with respect to backing: they show /ɛ/ if the following consonant is palatalized and /a/ or /ɔ/ if the consonant is not palatalized.

As I have already mentioned the number of such stems is rather restricted. (27) shows a selection of the relevant words.

(27)[13]

	forms in /aC/ and /ɔC/	forms in /ɛC'/
a.	*świ*/at/	*świ*/ɛt͡ɕ/+*e*
b.	*kwi*/at/	*kwi*/ɛt͡ɕ/+*e*, *kwi*/ɛt͡ɕ/+*eń*, *kwi*/ɛt͡ɕ/+*ist*+*y*,
c.	*obi*/ad/	*obi*/ɛd͡ʑ/+*e*
d.	*j*/azd/+*a*	*j*/ɛʑd͡ʑ/+*e*, *j*/ɛʑd͡ʑ/+*i*+*ć*
e.	*gwi*/azd/+*a*	*gwi*/ɛʑd͡ʑ/+*e*, *gwi*/ɛzd/+*n*+*y*, *roz*+*gwi*/ɛʑd͡ʑ/+*i*+*ć*
f.	*ci*/ał/+*o*	*ci*/ɛl/+*e*, *w*+*ci*/ɛl/+*i*+*ć*, *ci*/ɛl/+*esn*+*y*
g.	*wi*/ar/+*a*	*wi*/ɛʒ/+*e*, *wi*/ɛr/+*n*+*y*, *wi*/ɛʒ/+*y*+*ć*
h.	*kości*/ɔł/+*a*	*kości*/ɛl/+*e*, *kości*/ɛl/+*n*+*y*
i.	*popi*/ɔł/+*u*	*popi*/ɛl/+*e*, *popi*/ɛl/+*nik*

The main difference between the items in (27) and most alternating stems is that only the items in (27) appear with /ɛ/ in the palatalized inflectional forms. Words presented in (4) above and analysed in section 4.3. below undergo backing in their inflectional paradigms even in the forms which display palatalization. Compare the behaviour of the nouns *obiad* 'lunch, nom, sg.' and *ślad* 'trace, nom, sg' as well as *kościół* 'church, nom, sg.' and *zioł*+*o* 'herb, nom, sg.'

[13] Glosses: (a) 'world' - 'world, loc/voc, sg.'; (b) 'flower, nom, sg.' - 'flower, loc/voc, sg.' - 'April, nom, sg.' - 'flowery, nom, sg.'; (c) 'lunch, nom, sg.' - 'lunch, loc/voc, sg.'; (d) 'ride, nom, sg.' - 'ride, dat/loc, sg.' - 'to ride'; (e) 'star, nom, sg.' - 'star, dat/loc, sg.' - 'astral, nom, sg.' - 'to cover with stars, nom, sg.'; (f) 'body, nom, sg.' - 'body, loc, sg.' - 'to incorporate' - 'bodily, nom, sg.'; (g) 'faith, nom, sg.' - 'faith, dat/loc, sg.' - 'faithful, nom, sg.' - 'to believe'; (h) 'church, gen, sg.' - 'church, loc/voc, sg.' - 'ecclesial, nom, sg.'; (h) 'ash, gen, sg.' - 'ash, loc/voc, sg.' - 'ash pan, nom, sg.'

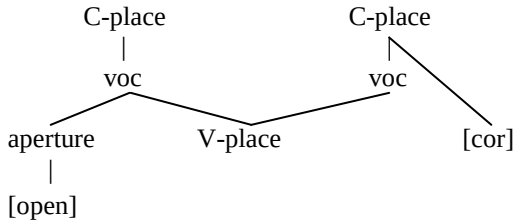
(28)

Nom, sg.	Loc/Voc. sg.
obi/ad/	*obi*/ɛd͡ʒ/+*e*
śl/ad/	*śl*/ad͡ʒ/+*e*
Gen, sg.	**Loc/Voc, sg.**
kości/ɔɬ/+*a*	*kości*/ɛl/+*e*
zi/ɔɬ/+*a*	*zi*/ɔl/+*e*

Since the items that behave like *obiad* and *kościół* are less numerous than the items such as *ślad* and *zioł+o*, Gussmann (1980) postulated that they should be marked in the lexicon as undergoing the version of Backing which is not sensitive to the morphological information (21c).

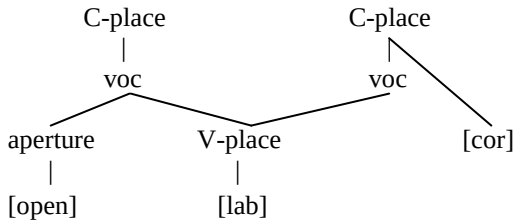
Under the current approach the *obiad*-class will be assumed to differ from the *ślad*-class in three respects. First of all, all the items in (27) will be assumed to posses the /a/ and /ɔ/ in their lexical representations. Second of all, they will be assumed to utilize the stem exponent to realize the root and the N-head. The consequence of such an assumption is that they will not be forced to integrate the backing autosegment into their structure. Thirdly, the sequences of final vowels and consonants in all the items in (27) will be analyzed as sharing the V-place node. (29) shows the relevant part of the representation of the word *obiad* 'lunch, nom, sg.'.

(29) *obi*/ad/ 'lunch, nom, sg.'



The representation of the final sequence in the items such as *kościół* 'church, nom, sg.' differs from the one in (29) in the presence of feature [lab] under the V-place node (30).

(30) *kości*/ɔɬ/+*a* 'church, gen, sg.'



Let us assume that the affixes that trigger coronal palatalization in Polish possess the floating feature [coronal] dominating feature [-anterior] in their representation. The representation of the exponent of the Locative and Vocative in the relevant declension classes in presented in (31).

(31)

/[cor] ɛ/
|
[-ant]

Apart from the constraints MAX FLT and MAX [cor], the following set of constraints is employed in the integration of the autosegment with the representations in (29) and (30).

(32)

(a) *2[cor]: two instances of feature [coronal] cannot be sisters

(b) *[lab,cor];V: do not be a front rounded vowel

(c) MAX [lab]: feature [labial] in the input must remain linked to by a V-place node or a C-place node

The following tableau shows the evaluation of candidates generated by the integration of fetures [cor[-ant]] into the structure presented in (30).

(33) *kości*/ɔɬ/ → *kości*/ɛl/+*e*

	/ɔɬ/ + [cor]$_i$ | [-ant]$_i$	MAX FLT	*2[cor]	MAX [cor]	*[lab,cor];V	*SPREAD	MAX [lab]
a.	[ɔɬ]	*!		*			
b.	[ɬ] | C-pl ⌜ ⌝ [cor] [cor]$_i$ …		*!			*	
c.	[ɬ] | C-pl | [cor]$_i$ …			*!		*	
d.	V-pl ⌜ ⌝ [lab] [cor]$_i$ ...				*!	*	
e.	☞V-pl | [cor]$_i$ ...					*	*

Almost exactly the same evaluation is observed the case of the integration of the floating features into the representations of all other items found in (28) above. The effect of the integration is that words such as *obiad* ‘lunch, nom, sg.’ (29) end up with the mutation of the vowel and the palatalization of consonant. In items such as *ślad* ‘trace, nom, sg’ and *zioł+o* ‘herb, nom, sg.’ the final segments have separate V-place nodes. The floating features [cor[-ant]] will anchor on the first available V-place node, causing palatalization of the consonant. The vowel, which itself underwent backing by integration, will not undergo mutation.

Another large subclass of items that show regular behaviour with respect to backing are the soft-stemmed nouns presented in (8) and repeated in (34).

(34)[14]

	Soft-stemmed forms	Expressive forms
a.	*niedźwi*/ɛd͡ʒ/	*niedźwi*/ad/+*ek*
b.	*si*/ɛt͡ɕ/	*si*/at/+*k*+*a*
c.	*pierści*/ɛɲ/	*pierści*/ɔn/+*ek*
d.	*kiesz*/ɛɲ/	*kiesz*/ɔn/+*k*+*a*
e.	*kmi*/ɛt͡ɕ/	*kmi*/ɔt/+*ek*
f.	*paci*/ɛʒ/	*paci*/ɔr/+*ek*

As in the case of words found in (27) I will analyze the soft-stemmed items as possessing underlying /a/ and /ɔ/ that share the V-place node with the following consonants. The only difference between the examples found in (27) and the stems in (34), is that the latter do not realize the categorizing head. Rather the N-head is realized as a palatalizing autosegment in the environment of a specific list of roots.

(35)

N ↔ [cor] / LIST ___
|
[-ant]

LIST = √NIEDŹWIEDŹ, √SIEĆ, √PACIERZ etc.

The palatalizing autosegment anchors onto the V-place node shared by the non-front vowel and the consonant and triggers the mutation of both segments.

The expressive forms found in the column to the right in (34) differ from the non-expressive forms in the specification of the N-head. Let me assume that the expressive quality of the relevant items introduced as a marking on the N-head. Such an N_{expr}-head, in unmarked cases is realized as affix *-(e)k-* found in the expressive forms in (34). Since the entry of affix *-(e)k-* is more specific than the entry (35), the node N_{expr} will be realized as *-(e)k-* rather than and the palatalizing autosegment.

4.3. Irregularly mutating items

Unlike the items found in (27) and (34) above, most alternating stems show the effects of backing throughout the simplex nominal/adjectival paradigms and in some derivates. It is these cases that Gussmann's Generaliztion (6) applies to in the first place. Some relevant items are repeated in (36).

[14] Glosses: (a) 'bear, nom, sg.' - 'dim, nom, sg.'; (b) 'net, nom, sg.' - 'expr, nom, sg.'; (c) 'ring, nom, sg.' - 'dim, nom, sg.'; (d) 'pocket, nom, sg.' - 'dim, nom, sg.'; (e) 'peasant, nom, sg. - yokel, nom, sg.'; (f) 'prayer, nom, sg.' - 'expr, nom, sg.'.

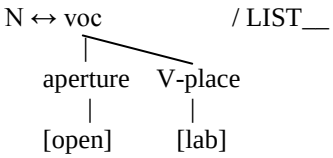
(36) [15]

	Non-derived nouns/adjectives	Derived nouns/adjectives (with palatalization)	Derived nouns/adjectives (without palatalization)
a.	*po+dzi*/al/+*e*	*po+dzi*/ɛl/+*n+y*, *po+dzi*/ɛl/+*nik*,	*po+dzi*/ał/+*k+a*
b.	*śl*/ad͡z/+*e*	*śl*/ɛd/+*cz+y*	*śl*/ad/+*ow+y*
c.	*wy+mi*/aʒ/+*e*	*wy+mi*/ɛr/+*n+y*	*wy+mi*/ar/+*ow+y*
d.	*zi*/ɔl/+*e*	*zi*/ɛl/+*n+y*, *zi*/ɛl/+*nik*	*zi*/ɔł/+*ow+y*
e.	*pszcz*/ɔl/+*e*	*pszcz*/ɛl/+*arz*, *pszcz*/ɛl/+*i*	*pszcz*/uł/+*k+a*

The first taste of the analysis of such items has been provided in section 2, where I postulated that backing in 'nonderived' items is the integration of the vocalic node marked for feature [open] into the structure of the stem. The said floating vocalic node was argued to be the realization of the categorizing head.

A marginally different analysis must be postulated for the few stems in which /ɛ/ alternates with /ɔ/. In such items the N-head is realized as a vocalic node marked for features [open] and [lab] (see 37).

(37)



LIST = √ZIEŁ, √PSZCZEŁ etc.

The integration of the autosegment presented in (37) is regulated by the constraint ranking presented in (17). The winning candidate integrates the autosegment into the structure of the vowel whose lexical vocalic node must be delinked. This provokes the violation of low ranked faithfulness constraints *SPREAD and MAX voc.

The last set of data that must be addressed here comprises the derivates based on alternating stems and formed by means of palatalizing affixes. The data, first presented in (9) and repeated in (38), are problematic for Gussmann's (1980) analysis as they show a clear overapplication of the Backing rule. More generally speaking, the relevant data are problematic for Gussmann's Generaliztion as they illustrate the application of backing in words derived by means of palatalizing affixes.

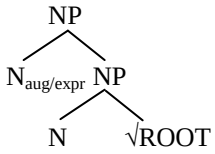
[15] Glosses: (a) 'division, loc/voc, sg.' - 'divisible, nom, sg.' - 'cost allocator, nom, sg.' - 'gauge, nom, sg.'; (b) 'trace, loc/voc, sg.' - 'investigative, nom, sg.' - 'vestigial, nom, sg.'; (c) 'dimension, loc/voc, sg.' - 'measurable, nom sg.' - 'of appropriate size, nom, sg.'; (e) 'herb, loc, sg' - 'herbal, nom, sg.', 'herbary, nom, sg.' - 'herbal, nom, sg.'; (f) 'bee, dat/loc, sg.' - 'bee keeper, nom, sg.' - 'of bee, nom, sg.' - 'bee, dim, nom, sg.'.

(38)[16]

	Overapplication of Backing	No backing
a.	*mi*/ɔtl/+*isk*+*o*	*mi*/ɛɕt͡ɕ/+*isk*+*o*
b.	*dzi*/al/+*isk*+*o*	*popi*/ɛl/+*isk*+*o*
c.	*śl*/ad͡ʑ/+*ik*	*niedźwi*/ɛd͡ʑ/+*isk*+*o*
d.	*l*/ɔt͡ɕ/+*ik*	*powie*/ɛɕt͡ɕ/+*isk*+*o*

From the point of view of the current approach the items in table (38) are not problematic at all. The augmentative affix *-isk-* and the diminutive affix *-ik-* may be analysed as NP-attaching affixes as they are found only with nouns and never trigger root allosemy (the derivates in *-isk-* and *-ik-* are semantically transparent). The structure of the derivates in *-isk-* and *-ik-* is given in (39).

(39)



The head(s) $N_{aug/expr}$ will be realized as *-isk-* and *-ik-* at Vocabulary Insertion. The two affixes trigger palatalization due to the presence of a palatalizing autosegment in their representation. The phonological shape of the two exponents is presented in (40) for clarity.

(40)

(a) /[cor]isk/ (b) /[cor]ik/

[-ant]

[-ant]

Note that the items in the right hand column in (38) are based on stems which show backing only before non-palatal consonants, i.e. their final segments share a V-place node (see section 4.2). This is not true about the stems found in the items to left in (38). Within the account presented in this study, the items showing the (apparent) overapplication of backing and the items to the right in (38) differ in one more respects. The items to the left realize the N-head (the sister of the root) as the vocalic node which triggers the backing. The items to the right realize the N-head by means of the stem exponent, e.g. *mi*/ɛɕt͡ɕ/+*isk*+*o* 'city, aug, nom, sg.' (c.f. *mi*/ast/+*o* - *mi*/ɛɕt͡ɕ/+*e* 'city, nom, sg. - loc, sg.') or the palatalizing autosegment, as in the soft-stemmed *niedźwi*/ɛd͡ʑ/+*isk*+*o* 'bear, aug, nom, sg.'. These two differences, one representational and one morphological, account for the seeming irregularity witnessed in (38).

Under the current analysis, the phonological derivation of items such as *śl*/ad͡ʑ/+*ik* 'trace, dim, nom, sg.' proceeds in two steps. The N-head is realized as the vocalic node

[16] Glosses (top-down): Overapplication of Backing: 'broom, aug, nom, sg.', 'division, aug, nom, sg.', 'trace, dim, nom, sg.', 'flight, dim, nom, sg.'. No Backing: 'city, aug, nom, sg.', 'ash, aug, nom, sg.', 'bear, aug, nom, sg.', 'novel, aug, nom, sg.'.

marked for feature [open] (and [lab]) whose integration triggers backing but does not affect the final consonant (see 17 above). Further, the concatenation of the affix *-ik-* triggers the palatalization of the stem-final consonant.

In items such as *mi*/ɛc͡tɕ/*+isk+o* the vowel mutation and palatalization of the consonant is achieved in a single step by the integration of the palatalizing autosegment under the shared V-place node.

The items presented in (41) below are more problematic for the analysis pursued here.

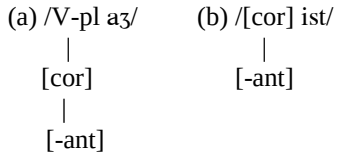
(41)[17]

Overapplication of Backing	No backing
kwi/at͡ɕ/*+arz*	*kwi*/ɛt͡ɕ/*+ist+y*
gwi/azd͡ʑ/*+ist+y*	*gwi*/ɛzd͡ʑ/*+ist+y*

The pairs of derivates found in (41) are based on the same stems. Since in the inflectional paradigms the relevant items possess /ɛ/ when palatalized (c.f. *kwi*/ɛt͡ɕ/*+e* 'flower, loc/voc, sg.' and *gwi*/ɛzd͡ʑ/*+e* 'star, dat/loc, sg.'), they must be analyzed as V-place sharing stems that realize the N-head by means of the stem exponent. All this means that the relevant stems should show backing only when the final consonant is non-palatal. *kwi*/at͡ɕ/*+arz* 'florist, nom, sg.' and *gwi*/azd͡ʑ/*+ist+y* 'covered with stars, nom, sg' should behave like *kwi*/ɛt͡ɕ/*+e* 'flower, loc/voc, sg.' and *gwi*/ɛzd͡ʑ/*+e* 'star, dat/loc, sg.' and surface with /ɛ/.

One possible solution is to assume that the palataliztion triggering autosegment is not always feature [coronal] and [-anterior]. If we assume, that the palatalizing autosegment forming part of affix *-arz-* is the V-place node marked for features [coronal] and [-anterior], the vowel will not be affected by the integration. (42a) shows the proposed representation of affix *-arz-* and the representation of the adjectival affix *-ist-*.

(42)



The concatenation of the affix (42a) into the structure of the stem is regulated by the evaluation presented in (43).

[17] Glosses (top-down): Overapplication of Backing: 'florist, nom, sg.', 'covered with stars, nom, sg.'. No Backing: 'floral, nom, sg.', 'covered with stars, nom, sg.'.

(43) *kwi*/at/ → *kwi*[at͡ɕ]+*arz*

	/at/ + V-pl $_i$ | [cor]$_i$ | [-ant]$_i$	MAX FLT	*2V-pl	*SPREAD	MAX V-pl
a.	[at]	*!			*
b.	[t] | voc ⌜ ⌝ V-pl V-pl$_i$ ... …		*!	*	
c.	☞ [t] | voc | V-pl$_i$ …			*	*

The faithful candidate (a) will violate the high ranked constraint MAX FLT. The V-place node will link to the closest available vocalic node, which is the node dominated by the consonant /t/. Since one vocalic node may host only one V-place node (*2V-pl), the lexical link between the vocalic node and the V-place node must not survive. The output is the palatalized /t/, which no longer shares the V-place node with the preceding vowel.

The concatenation of the affix -*ist*-, on the other hand, provokes the integration of the feature [cor] into the V-place shared by the final segments of stem. Thus *kwi*/ɛt͡ɕ/+*ist*+*y* 'flowery, nom, sg.' Show the mutation of the vowel as well as the consonant palatalization.

It is for this reason the same solution cannot be extended to the case of *gwi*/azd͡ʑ/+*ist*+*y* 'covered with stars, nom, sg.' which should behave like *kwi*/ɛt͡ɕ/+*ist*+*y* 'flowery, nom, sg.'. The case of the doublet *gwi*/azd͡ʑ/+*ist*+*y* - *gwi*/ɛzd͡ʑ/+*ist*+*y* is, however, different in nature from the case of *kwi*/at͡ɕ/+*arz* in that it is a clear example of variability. Variability of the relevant kind is problematic for any formal approach to morphophonology. At this point I am forced into one of two inconvenient contensions: (i) that the sequence {√GWIAZD, N} possesses two realizations: one in which the vowel and the following sequence share the V-place node and one in which the vowel and /zd/ have separate V-place nodes or (ii) that for some speakers in some structures the stem /gvʲazd/ may realize only the root, while for other speakers the same stem realizes the sequence {√GWIAZD, N}. In the former case, the N is realized as a backing vocalic node (18b), whose seemingly vacuous integration results in that the vowel and the /st/ sequence end up with separate V-place nodes. Although the second solution seems easier to formalize, the choice between the two options cannot be made at this point.

5. Conclusion

This paper offered a novel approach to the complex and superficially irregular aspect of the vowel-consonant interaction in Polish: vowel backing. The conclusion of the above considerations is that there are sever lexical properties of Polish words which decide about a given item being available for backing. First of all, it is the phonological representation of the stem that decides whether the vowel will always follow the consonant in being specified as coronal and non-anterior. This is the case in items in which the vowel and the following consonant share the V-place node such as *obi*/ad/ 'lunch' - *obi*/ɛd͡ʑ/*e* 'loc/voc, sg'. In fact, this is not the case in most items. In those alternating stems in which the vowel and the following consonant do not share a V-place node, the quality of the lexical vowel is usually /ɛ/, as in *ślad* - *śl*/ad͡ʑ/*e* - *śl*/ɛd͡ʑ/*ić* 'trace, inst, sg. - loc/voc, sg. - to track, follow'. The said vowel is backed by the integration of the autosegment (19b) or (37). The relevant autosegments realize the categorizing N-head. The N-head will be realized as a backing autosegment only in those items which do not realize the root *and* the N-head by means of the stem exponent. As a matter of fact most stems with underlying /ɛ/ in Polish are what Gussmann (1980: 143) calls 'positive exceptions to Backing' exactly by virtue of realizing the N-head by means of the stem.

One should also conclude that Gussmann's Generalization found in (6) above is descriptively correct once such notions as 'nonderived words' and 'derived words' are clarified and replace with 'root-based derivates' and 'phrase-based derivates'. It also seems that the existence of what Gussmann (1980) referred to as 'word-formation processes which take surface forms as their input' are the consequence of the complex morphological and morphophonological structure of his 'nonderived' words. Whenever it takes effect, backing applies at the level of root-based derivates on which phrase-based derivates are constructed.

References:

Chomsky, N. 2001. Derivation by phase. In M. Kenstowicz (ed.), *Ken Hale: A life in language*, 1–52. Cambridge, MA: MIT Press,

Clements, G. (1985). The geometry of phonological features. *Phonology Yearbook* 2:225–252.

Clements G. and E. Hume. 1995. The internal organization of speech sounds. In J. Goldsmith (ed.), *The handbook of phonological theory*. 245–306. Cambridge, MA. and Oxford: Basil Blackwell.

Czaykowska-Higgins, E. 1988. Investigations into Polish morphology and phonology. Unpublished PhD dissertation, Massachusetts Institute of Technology.

Ćavar, M. 2004. Palatalization in Polish. An interaction of articulatory and perceptual factors. Unpublished PhD dissertation, University of Potsdam.

Dressler, W. U. 1985. *Morphonology: The Dynamics of Derivation.* Ann Arbor: Karoma Publishers.

Embick, D. 2010. *Localism vs Globalism in Morphology and Phonology.* Cambridge, MA: MIT Press.

Embick, D. and R. Noyer. 2007. Distributed Morphology and the Syntax-Morphology Interface. In G. Ramchand and C. Reiss (eds.), *The Oxford Handbook of Linguistic Interfaces*, 289–324. Oxford: Oxford University Press.

Gussmann, E. 1978. *Contrastive Polish-English Consonantal Phonology*. Warsaw: Państwowe Wydawnictwo Naukowe.

Gussmann, E. 1980. *Studies in Abstract Phonology*. Cambridge, MA: MIT Press.

Gussmann, E. 1992. Back to front: non-linear palatalisations and vowels in Polish. In Jacek Fisiak, Stanisław Puppel (eds.), *Phonological Investigations*, 5–66. Amsterdam: John Benjamins.

Gussmann, E. 2007. *The Phonology of Polish.* Oxford: Oxford University Press.

Halle, M. 1997. Distributed Morphology: Impoverishment and Fission. In B. Breuning, Y. Kang and M. McGinnis (eds.), *Papers at the Interface*. 425–450. Cambridge, MA: MIT Press.

Halle, M. and A. Marantz. 1993. Distributed Morphology and the pieces of inflection. In K. Hale, S. J. Keyser (eds.), *The View from Building 20: Essays in Linguistics in Honor of Sylvain Bromberger*. 111–176. Cambridge, MA: MIT Press.

Halle, M, B. Vaux and A. Wolfe, 2000. On Feature Spreading and the representation of Place of Articulation. *Linguistic Inquiry* 31(3): 387–444.

Harris, J. 1994. *English sound structure.* London: Blackwell.

Hulst, H.G. van der. 2005. The molecular structure of phonological segments. In: P. Carr, J. Durand and C. Ewen (eds.), *Headhood, elements, specification and contrastivity*. 193–234. Amsterdam: John Benjamins.

Laskowski, R. 1975. *Studia nad morfonologią współczesnego języka polskiego*. Wrocław: Ossolineum.

Prince, A. and P.Smolensky. 2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Oxford: Blackwell.

Rubach, J. 1984. *Cyclic and Lexical Phonology: The Structure of Polish.* Dordrecht: Foris.

Rubach, J. 2003. Polish palatalization in derivational optimality theory. *Lingua* 113: 197–237.

Sagey, E. (1986). The representation of features and relations in nonlinear phonology. Ph.D. dissertation, MIT.

Szpyra, J. 1989. *The Phonology-Morphology Interface. Cycles, Levels and Words.* London and New York: Routledge.

Szpyra, J. 1995. *Three Tiers in Polish and English phonology.* Lublin: Wydawnictwo UMCS.