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Modelling morpho-phonology: consonant replacements in Polish

Abstract

Gussmann (2007) put forward a morpho-phonological analysis of Polish palatalizations which is an alternative to traditional re-write rules promoting abstractness in phonology. The aim of this article is to turn Gussmann's descriptive tool into a coherent theory. In order to do that I propose a set of premises that regulate the working of the component of morpho-phonology. Among these premises the Minimalist Hypothesis (Kaye 1992) and the Locality Principle occupy the most prominent position. The former says that all morpho-phonological replacements work whenever their conditions are met (no (counter)bleeding or counterfeeding is possible), whereas the latter limits the scope of morpho-phonological replacements to nodes entering the relation of concatenation (Embick 2010). The last part of the article is devoted to the cases that apparently violate the Minimalist Hypothesis. These are the replacements that Gussmann (2007) subsumes under the label P(alatalization) R(eplacement) 7. The article shows that the problematic replacements presented as PR7 may be convincingly analysed as root-specific and thus do not constitute counterexamples to the Minimalist Hypothesis.

Key words:

morpho-phonology, palatalization, Government Phonology, consonant replacements, Distributed Morphology

Streszczenie

Morfofonologiczne podejście do mutacji spółgłoskowych w języku polskim.

Gussmann (2007) przedstawia morfofonologiczną analizę palatalizacji w języku polskim, która stanowi alternatywę dla podejść zakładających istnienie zasad operujących na abstrakcyjnych reprezentacjach fonologicznych. Jednym z celów artykułu jest przedstawienie opisowego podejścia Gussmanna jako spójnej teorii komponentu morfofonologicznego języka. Aby to osiągnąć, przedstawiamy założenia, których celem jest regulacja sposobów w jaki morfofonologia może wpływać na kształt reprezentacji morfemów. Konkretnie, postuluje się, iż wszystkie operacje morfo-fonologiczne muszą zachodzić zawsze gdy ich warunki są spełnione, oraz muszą być lokalne. Ostatnia część artykułu poświęcona jest przykładom palatalizacji wydającym się problematycznymi z punktu widzenia teorii morfofonologii przedstawionej w artykule. Kolejnym celem artykułu jest wykazanie, iż przykłady te powinny być postrzegane jako zmiany specyficzne dla danych rdzeni i nie stanowiące kontrprzykładów dla modelu postulowanego w artykule.

Słowa klucze:

morfofonologia, palatalizacje, fonologia rządu, morfologia dystrybuowana

1. Introduction

Gussmann (2007) forged a new tool for describing opaque sound patterns found in Polish segmental phonology, i.e. morpho-phonological replacements. The aim of this paper is to elaborate on Gussmann's idea by turning it into a general theory of morpho-phonology. The focus of the article is on consonant alternations, which form the bulk of the complicated allomorphic patterns found in Polish and which were analysed by Gussmann as triggered by diacritic markings constituting lexical load of certain inflectional and derivational affixes. I will present two principles, the aim of which is to constrain morpho-phonological replacements: the Minimalist Hypothesis proposed by Kaye (1992) and the Locality Principle adopted from the version of Distributed Morphology proposed by Embick (2010). I will show that the issue of conflicting diacritics, which is inherent in Gussmann's description and which seems problematic from the point of view of the Minimalist Hypothesis, is but a pseudo-problem and that the ill-behaved replacements are stem-specific and not affix-specific. The outline of the article is as follows: in section 2 I present an abstract, rule based approach to Polish consonantal phonology put forward by Gussmann (1980) and compare the derivational techniques proposed there with the solutions employed in Gussmann (2007). Section 3 is devoted to the outline of the presence of morpho-phonology in modern linguistic thinking from the second half of the 19th century. In section 4 I focus on the arbitrary nature of Polish morpho-phonological alternations and conclude that the replacement of entire segment is the optimal way of modelling these alternations. Sections 5 and 6 are devoted to the discussion of some salient properties of morpho-phonology and defining the domains of morpho-phonological activity. In section 7 I introduce two principles regulating morpho-phonological computation: the Minimalist Hypothesis (7.1) and the Locality Principle (7.2) and show how they limit the generative potential of morpho-phonological replacements. Section 8 focuses on the problem of conflicting diacritics marking the exponents of some morphemes in Polish. I will show that the conflicts between these markings are only apparent, mainly due to non-automatic nature of the relevant mutations. Section 9 concludes.

2. Gussmann's approach(es) to Polish consonant mutations

Gussamann's (2007) approach is an explicit and radical break with the traditional way of modelling Polish palatalizations within generative phonology. Works such as Laskowski (1975), Gussmann (1980), Rubach (1984, 2003) or Bethin (1992) assumed that complicated and opaque regularities according to which certain Polish consonants surface as palatalized result from the application of rewrite rules or level-ordered OT-type constraints turning highly abstract underlying and intermediate representations into surface phonetic representations. Let me exemplify this kind of an abstract analysis by providing several solutions postulated in Gussmann (1980).

Polish shows several patterns of palatalization of consonants. One of them is a change which Gussmann (1980: 15) calls *I-Anterior Palatalization*. *I-Anterior Pala-*

talization was claimed by Gussmann to be a productive and regular processes triggered by any front vowel and affecting non-velar consonants. Its effects are depicted in (1), where the vowels conditioning the change are the locative singular masculine desinence *-e* /ɛ/ and the first segment of a diminutive affix *-ik/yk-* /i‑ɨk/:

(1) *I-Anterior Palatalization*

	Non-palatalized form	Glosses[1]	Palatalized form in *-e* /ɛ/	Glosses	Palatalized form in *-ik/yk-* /ik‑ɨk/	Glosses
a.	*sklep* / sklɛp/	'shop, nom. sg.'	*sklepi-e* / sklɛpʲɛ /	'shop, loc. sg.'	*sklep-ik* / sklɛpʲik/	'shop, diminutive, nom. sg.'
	sposob-u / spɔsɔbu /	'method, gen. sg.'	*sposobi-e* / spɔsɔbʲɛ /	'method, loc. sg.'	*sposob-ik* / spɔsɔbʲik/	'method, dim. gen. sg.'
	paragraf / paragraf /	'paragraph, nom. sg.'	*paragrafi-e* / paragraf /	'paragraph, loc. sg.'	*paragraf-ik* / paragrafʲik /	'paragraph, dim. nom. sg.'
	staw-u / stavu /	'pond, gen. sg.'	*stawi-e* / stavʲɛ /	'pond, loc. sg.'	*staw-ik* / stavʲik /	'pond, dim. gen. sg.'
	system / sistɛm /	'system, nom. sg.'	*systemi-e* / sistɛmʲɛ /	'system, loc. sg.'	*system-ik* / sistɛmʲik /	'system, dim. nom. sg.'
b.	*okręt* / ɔkrɛnt /	'ship, nom. sg.'	*okręci-e* / ɔkrɛɲt͡ɕɛ /	'ship, loc. sg.'	*okręc-ik* / ɔkrɛɲt͡ɕik /	'ship, dim. nom. sg.'
	skład-u / skwadu /	'store, gen. sg.'	*składzi-e* / skwad͡zɛ /	'store, loc. sg.'	*składz-ik* / skwad͡zik /	'store, dim. gen. sg.'
	papieros / papʲɛrɔs /	'cigarette, nom. sg.'	*papierosi-e* / papʲɛrɔɕɛ /	'cigarette, loc. sg.'	*papieros-ik* / papʲɛrɔɕik /	'cigarette, dim. nom. sg.'
	woz-u / vɔzu /	'cart, gen. sg.'	*wozi-e* / vɔʑɛ /	'cart, loc. sg.'	*woz-ik* / vɔʑik /	'cart, dim. gen. sg.'
	dywan / divan /	'carpet, nom. sg.'	*dywani-e* / divaɲɛ /	'carpet, loc. sg.'	*dywan-ik* / divaɲik /	'carpet, dim. nom. sg.'
c.	*żubr* / ʒubr /	'wisent, nom. sg.'	*żubrz-e* / ʒubʑɛ /	'wisent, loc. sg.'	*żubrz-yk* / ʒubʒik /[2]	'wisent, dim. nom. sg.'
	diabeł / dʲabɛw /	'devil, nom. sg.'	*diabl-e* / dʲablɛ /	'devil, loc. sg.'	*diabl-ik* / dʲablik /	'devil, dim. nom. sg.'

[1] Throughout the article the examples quoted carry masculine gender unless otherwise indicated.

[2] The distribution of the front /i/ and retracted /ɨ/ in -ik/yk- /ik‑ɨk/ morpheme and elsewhere is regulated by purely phonological factors which need not concern us here (for analysis see Gussmann 2007: ch.3).

Items presented in (1a) undergo an additional rule of *J-Insertion* which is not relevent for the presentation. In terms of the manipulation of distinctive features, *I-Anterior Palatalization* turns the specification of affected consonant into [– back]. In the majority of cases the description of the process as the change in the value of the feature [back] is justified. However, the derivation of a lateral /l/ from a semivowel /w/ as in *diabe*[w]-*diab*[l]*e*-*diab*[l]*ik* and a fricative /ʒ/ from /r/ as in *żub*[r]-*żub*[ʒ]*e*-*żub*[ʒ]*yk* (1c in the table) are noted by Gussmann (1980) to require special comment. In order for *I-Anterior Palatalization* to derive /l/ the underlying representation of the segment must be the dental velarised lateral /ł/ that 'when phonologically palatalized emerges as /l/; when nonpalatalized it undergoes a context-free shift to /w/' (1980: 15). The relevant context-free shift is an absolutely neutralising rule whose only motivation seems to be to aid *I-Anterior Palatalization* by coping with the mismatch between one of its input segments and the way this segment is pronounced. The dental lateral /ł/ is not found in standard Polish at all.[3] A situation with /r/~/ʒ/ change is similar. A mere change of the value of feature [back] is not enough to derive the required output. Hence, the derivation must proceed through an intermediate stage of a palatalized rhotic /rʲ/, which is later turned into /ʒ/. The palatalized rhotic /rʲ/ is, however, unattested word-internally in native Polish vocabulary and is found only in a restricted group of recent borrowings, e.g. *jury* /ʒɨrʲi/ 'jury' or *trik* /trʲik/ 'trick', and as a result of sandhi palatalization which affects all Polish consonants before /i/ as in *Piotr i Paweł* /pʲɔtrʲipavɛw/ 'Peter and Paul'.

Yet another abstract solution that Gussmann (1980) adopts is *J-Palatalization* depicted in (2).

(2)　*J-Palatalization* (Gussmann 1980: 18)

Non-palatalised form	Glosses	Palatalised form	Glosses	Palatalised form	Glosses
opłat-a / ɔpwata /	'payment, nom. sg. fem.'	*opłac-ę* / ɔpwat͡sɛ̃ʷ /[4]	'I will pay'	*płac-a* / pwat͡sa /	'salary, nom. sg. fem.'
rod-u / rɔdu /	'family, gen. sg.'	*rodz-ę* / rɔd͡zɛ̃ʷ /	'I give birth'	*urodz-on-y* / urɔd͡zɔnɨ /	'born, nom. sg.'
kos-a / kɔsa /	'scythe, nom. sg. fem.'	*kosz-ę* / kɔʃɛ̃ʷ /	'I mow'	*kosz-on-y* / kɔʃɔnɨ /	'mowed, nom. sg.'
woz-u / vɔzu /	'cart, gen, sg.'	*woż-ę* / vɔʒɛ̃ʷ /	'I carry'	*woż-eni-e* / vɔʒɛɲɛ /	'carrying, nom. sg.'

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[3]　It is, however, a salient feature of non-standard varieties of Polish spoken in Lithuania and Belarus (see Grek-Pabisowa 2002: 93–94).

[4]　Gussmann (1980) consistently transcribes forms ending in orthographic <ę> as pronounced with a nasal diphthong here transcribed as /ɛ̃ʷ/ and notes that it appears in a free variation with an oral vowel /ɛ/. In fact, nowadays the nasal pronunciation is considered hypercorrect and hardly ever heard. Gussman (2007: 126) transcribes the same 1st person singular suffix as /ɛ/.

Since the alternations presented in (2) are different from the alternations triggered by front vowels and presented in (1b), Gussmann finds it unjustified to claim that it is the surface vowels that trigger the change. Instead, the relevant change takes place before a palatal glide, hence the name: *J-Palatalization*. It is, however, a wild-goose chase to look for forms of the words in (2) in which /j/ surfaces. Polish does not have native words in which /j/ follows coronal segments. The glide must be deleted at some stage of the derivation, after it has done its job as the trigger of palatalization. The relevant parts of the derivations are illustrated below.

(3)   The derivations of /ʒubʒɨk/ 'wisent, dim. nom. sg.' and /kɔʃɛ̃ʷ/ 'I mow'

Underlying Representations:	/ʒubr+ik/	/kɔs+j+ɔm/
J-Palatalization	*not applicable*	/kɔʃ+j+ɔm/
I-Anterior Palatalization	/ʒubrʲ+ik/	*not applicable*
J-Deletion	*not applicable*	/kɔʃ+ɔm/
Other rules	[ʒubʒɨk]	[kɔʃɛ̃ʷ]

It must be stated that the rule palatalising the rhotic to /rʲ/ and the rules of *J-Palatalization* and *J-Deletion* were shown by Gussmann to be independently justified in other derivations. Nevertheless, at some point the untrammelled abstractness of these as well as many other solutions put forward in Gussmann (1980) became unacceptable for many theoreticians, including Gussmann himself.

Instead of referring to abstract representations Gussmann (2007) assumes the existence of morpho-phonological regularities that manipulate entire segments whenever certain morpho-phonological or lexical conditions are met. An example of such manipulations, referred to as 'replacement relationships', is Palatalization Replacement 1 (PR1) presented below.

(4)   Palatalization Replacement 1 (Gussmann 2007: 128)

p	b	f	v	m	r	w	n	t	d	s	z
|	|	|	|	|	|	|	|	|	|	|	|
pʲ	bʲ	fʲ	vʲ	mʲ	ʒ	l	ɲ	t͡ɕ	d͡ʑ	ɕ	ʑ

In the majority of cases the outputs of PR1 correspond to the outputs of *I-Anterior Palatalization*; hence, it is justified to see PR1 as a more concrete equivalent of the latter. PR1 is a diacritic attached to a set of inflectional and derivational suffixes in Polish. When one of these suffixes is attached to a stem, the final consonant of this

stem is replaced with the consonant in the bottom row in (4). Below I present an exemplary set of suffixes triggering PR1 along with some endings similar in form but not triggering the change.

(5)   Palatalising and non-palatalising suffixes in Polish (Gussmann 2007: 141–142)

	Suffixes carrying PR1	Nominative	Gloss	Palatalised form	Gloss	Non-palatalised form	Gloss
a.	Dative singular feminine	*żab-a* / ʒaba /	'frog, fem.'	*żabi-e* / ʒabʲɛ /	'frog, dat. sg. fem.'	*żab-ę* / ʒabɛ /	'frog, acc. sg. fem.'
		sow-a / sɔva /	'owl'	*sowi-e* / sɔvʲɛ /	'owl, dat. sg.'	*sow-ę* / sɔvɛ /	'owl, acc. sg.'
b.	Locative singular masculine / feminine / neuter	*temat* / tɛmat /	'subject'	*temaci-e* / tɛmat͡ɕɛ /	'subject, loc. sg.'	*temat-em* / tɛmatɛm /	'subject, instr. sg.'
		rector / rɛktɔr /	'rector'	*rektorz-e* / rɛktɔʒɛ /	'rector, loc. sg.'	*rector-em* / rɛktɔrɛm /	'rector, instr. sg.'
		skał-a / skawa /	'rock, fem.'	*skal-e* / skalɛ /	'rock, loc. sg. fem.'	*skał-ę* / skawɛ /	'rock, acc. sg. fem.'
		siodł-o / ɕɔdwɔ /	'saddle, neu.'	*siodl-e* / ɕɔdlɛ /	'saddle, loc. sg. neu.'	*siodł-em* / ɕɔdwɛm /	'saddle, instr. sg. neu.'
c.	Adjectivalising *-an-*	*słom-a* / swɔma /	'straw, fem.'	*słomi-an-y* / swɔmʲani /	'made of straw, nom. sg'		
		wełn-a / vɛwna /	'wool, fem.'	*wełni-an-y* / vɛwɲani /	'made of wool, nom. sg.'		
d.	Nominalising *-nik-*	*głos* / gwɔs /	'voice'	*głoś-nik* / gwɔɕɲik /	'loudspeaker, nom. sg.'		
		sił-a / ɕiwa /	'force, fem.'	*sil-nik* / ɕilɲik /	'engine, nom. sg.'		

The set presented in (5) is far from being exhaustive and is aimed to serve as a general overview. (5a–b) show palatalization before suffixes beginning with a vowel /ɛ/. That the presence of this vowel is unnecessary for the regularity to take place is presented by examples (5c–d), the latter of which does not begin with a vowel in any form of the paradigm. Particularly revealing are the examples presented in (5b). Forms like /rɛktɔr/ and /tɛmat/ suggest that the presence of /ɛ/ is not enough to ensure that /t/ and /r/ will surface as palatalised, i.e. the change does not refer merely to surface-true phonological categories. At this point, one could claim that the rule

that derives /ʒ/ and /t͡ɕ/ is an absolutely neutralising or cyclic rule in the sense of Kiparski (1974) and Mascaró (1976), in which case it can work only in derived environments, i.e. not morpheme-internally. However, the lack of palatalization before the instrumental ending (/rɛktɔr-ɛm/ and /tɛmat-ɛm/ and not */rɛktɔʒ-ɛm/ and */tɛmat͡ɕ-ɛm/) shows that the rule does not work simply before /ɛ/s that constitute a derived environment. It seems that if one wants to adequately describe the set of changes presented in (4) as PR1, and at the same time avoid reference to imaginary segments and rules that neutralise them, one has to appeal to the morphological as well as phonological conditioning of PR1.

The second rule presented above, i.e. *J-Palatalization*, is handled by a set of replacements named PR3 in Gussmann (2007). It is presented below.

(6)   Palatalization Replacement 3 (Gussmann 2007: 128)

$$
\begin{array}{cccc}
t & d & s & z \\
| & | & | & | \\
\widehat{ts} & \widehat{dz} & \int & ʒ
\end{array}
$$

PR3 is regularly triggered, e.g. by a participial *-on-* /ɔn/ suffix and a derivational nominal suffix *-en(i)-* /ɛɲ/. The working of PR3 is exemplified in the table below in four Polish words: *obraz-a* /ɔbraza/ 'offence, nom. sg. fem.', *kos-a* /kɔsa/ 'scythe, nom. sg. fem.', *opłat-a* /ɔpwata/ 'payment, nom. sg. fem.' and *zdrad-a* /zdrada/ 'betrayal, nom. sg. fem.'

(7)   Suffixes triggering PR3

Participial suffix *-on-* /ɔn/	Glosses	Non-palatalized forms	Glosses	Nominalising *-en(i)-* /ɛɲ/ suffix	Glosses	Non-palatalized form	Glosses
obraż-on-y / ɔbraʒɔnɨ /	'offended, nom. sg.'	*obraz-o* / ɔbrazɔ /	'offence, voc. sg. fem.'	*obraż-eni-e* / ɔbraʒɛɲɛ /	'the act of offending, nom. sg. neu.'	*obraz-ę* / ɔbrazɛ /	'offence, acc. sg. fem.'
kosz-on-y / kɔʃɔnɨ /	'scythed, nom. sg.'	*kos-o* / kɔsɔ /	'scythe, voc. sg. fem.'	*kosz-eni-e* / kɔʃɛɲɛ /	'the act of scything, nom. sg. neu.'	*kos-ek* / kɔsɛk /	'scythe, dim. gen. pl. fem.'
opłac-on-y / ɔpwat͡sɔnɨ /	'paid, nom. sg.'	*opłat-ow-y* / ɔpwatɔvi /	'related to payment'	*opłac-eni-e* / ɔpwat͡sɛɲɛ /	'the act of paying, nom. sg. neu.'	*opłat-ek* / ɔpwatɛk /	'payment, dim. gen. pl. fem.'
zdradz-on-y / zdrad͡zɔnɨ /	'betrayed, nom. sg.'	*zdrad-o* / zdradɔ /	'betrayal, voc. sg. fem.'	*zdradz-eni-e* / zdrad͡zɛɲɛ /	'the act of betraying, nom. sg. neu.'	*zdrad-ę* / zdradɛ /	'betrayal, acc. sg. fem'

As in the case of PR1, phonology cannot be claimed to be the only player in the change unless one employs thoroughly abstract strategies. In Polish, dental obstruents may be followed by any vowel except for /i/. The claim that the change is triggered in derived environments cannot be easily defended as the inflectional vocative and accusative endings *-o* /ɔ/ and *-ę* /ɛ/ as well as the productive adjectival and diminutive morphemes *-ow-* /ɔv/ and *-(e)k-* /(ɛ)k/ do not trigger the change. Once again, a concrete solution calls for a reference to the morphological facts: PR3 seems to be a property of only some suffixes.

The data presented in (5) and (7) above illustrate the fundamental challenge that every approach to consonantal changes in Polish has to face. The same consonants /t/, /d/, /s/ and /z/ undergo different changes when followed by the same front vowel /ɛ/, when this /ɛ/ belongs to different morphemes. Thus, the /ɛ/ that is an exponent of a dative singular feminine and locative singular provokes a change of the relevant segments into /t͡ɕ/, /d͡ʑ/, /ɕ/ and /ʑ/ (see 5 above), whereas the /ɛ/ in the nominaliser *-en(i)-* /ɛɲ/ changes the relevant segments into /t͡s/, /d͡ʑ/, /ʃ/ and /ʒ/. Still, there are /ɛ/s which do not provoke any changes, like /ɛ/ in the instrumental singular *-em* /ɛm/ or accusative singular feminine *-ę* /ɛ/. The same is true about other vowels. Suffixes beginning with /a/ and /ɔ/ may or may not provoke palatalizations as exemplified by forms like *słom-a* /swɔma/ – *słomi-an-y* /swɔmʲanɨ/ (5 above) or *kos-o* /kɔsɔ/ – *kosz-on-y* /kɔʃɔnɨ/ (7 above). It is, therefore, an aim of any theory to represent palatalizations as properties of certain morphemes only. This may be done by abstract underlying and intermediate representations or by diacritic markings. The second solution, chosen in Gussmann (2007), avoids referring to absolutely neutralizing rules working arbitrarily in only small groups of selected derivations, promotes concreteness, and is compatible with an age-old tradition of distinguishing between phonological and morpho-phonological regularities. It is this tradition that I would like to briefly outline at this point.

3. Types of rules and morpho-phonology: a historical perspective

That segments of speech enter into several different kinds of paradigmatic interaction has been one the fundamental insights of modern linguistic thought. One of the first classifications of consonantal alternations was provided by two Polish phonologists working in the Russian city of Kazan in the second half of the 19th century: Jan Badouin de Courtenay and Mikołaj Kruszewski. Their classification, the first version of which was published as Kruszewski (1881) (reprinted in Polish in 1967), enumerated three categories of alternations: (i) exceptionless alternations in which the conditioning environment is clearly definable, in which no grammatical conditioning is present, and in which the alternants must be phonetically similar; (ii) alternations that may allow exceptions, in which conditioning environment is synchronically absent, which are partially determined by morphological factors and in which the alternants may not be phonetically close to each other, and (iii) alternations resembling the second type insofar as they do not have a direct phonetic motivation, the phonetic similarity

between alternants is not expected, and not all forms in the language show the alternation. The last type is different from the second category, in that the alternation is strictly connected with some morphological feature and obligatorily triggered by the presence of this feature. The division very similar to that found in Kruszewski (1881) came to be used later in generative approaches to alternations, e.g. Hudson (1974, 1980), who divides alternations into automatic phonological (Kruszewski's category (i)), automatic morpho-phonological (category (iii)) and non-automatic (category (ii)).

However, it must be made clear that recognising the fact that some alternations are sensitive to morphological information, while others are not should not be equated with recognising morpho-phonology as a separate area of study. Kruszewski (1881/1967), for instance, did not recognise a need to treat the first class of alternations as different from class (ii) and (iii). In fact, the majority of scholars working in the structuralist paradigm did not see reasons for separating alternations that were sensitive to morphological information from those that were not. The notable exceptions were N. Trubetzkoy and H. Ułaszyn, members of the Prague Linguistic Circle. The former in his two papers from 1929 and 1931 outlined the aims of morpho-phonology as 'the study of the morphological use of the language's phonological means' (Anderson 1985: 122). Trubetzkoyan morpho-phonology had three major objectives. The first of them was the study of the phonological structure of morphemes and should be regarded as the direct ancestor of Morpheme Structure Rules (see Kisseberth and Kenstowicz 1979: 424–436). The second objective was the investigation of sound changes observed within a morpheme when it is combined with other morphemes. The third domain of morpho-phonology was the study of the morphological role of sound alternations. The unit of morpho-phonological analysis was *a morphoneme*. A morphoneme was defined as a morphological entity composed of all the phonemes that participated in a given alternation. To illustrate this concept, Polish contains a following alternation series *zdrad-a* /zdrada/ 'betrayal, nom. sg. fem.'- *zdradzi-e* /zdrad͡ʑɛ/ 'betrayal, dat. fem. sg.'- *zdradz-on-y* /zdrad͡ʐɔnɨ/ 'betrayed'. Put in Trubetzkoyan terms, the relevant morpheme contains a morphoneme (/d/-/d͡ʑ/-/d͡ʐ/) accompanied by a suitable statement concerning the distribution of each alternant.

As I mentioned above, morpho-phonology as a separate field of study was not accepted by the majority of Trubetzkoy and Ułaszyn's contemporaries. Their approach was especially criticised by European scholars, who attacked morpho-phonological investigations as indistinct from the phonemic and morphological investigations that had already been conducted and, therefore, lacking in original insight (see van Wijk 1934, 1939).

Whereas in Europe the study of the phonemic properties of morphemes did not gain wide popularity the situation was different in the USA, where the discipline of *morphophonemics* was the established approach to the study of language. Morphophonemics was defined by C.F. Hockett (1950: 63) in a following way:

> 'Morphophonemics subsumes every phase of the phonemic shape of morphemes: the typical shape of alternants, the types of alternation, and the various environmental factors (phonological and grammatical) which elicit one alternant or another of those morphemes which appear in more than one shape'

The definition provided by Hockett presents morphophonemics as very close to Trubetzkoy's enterprise, except perhaps for the lack of reference to the morphological role played by some alternations. Yet another feature that the two approaches shared was the presence of a basic unit of analysis, which for American morphophonemics was a *morphophoneme* characterised by Z. Harris (1951: 362–3) in a way that clearly resembles Trubetzkoy's *morphoneme*:

> 'Morphophonemes are classes of corresponding segments in stretches of speech...each morpheme is composed directly of a sequence of morphophonemes, each of which in turn is a class consisting of one or more complementary phonemes or components.'

Although the term morphophonemics was utilised in early generative writings (e.g. Chomsky 1951, Halle 1959), the domains of morphophonemics and phonemics were gradually conflated into a single level by abandoning the level of systematic phonemic representation and replacing it with a level of morphophonemic representation (see e.g. Chomsky 1964). The effect was that the distinction between morphophonemic and phonological alternations, recognised by virtually all phonologists since Badouin de Courtenay and Kruszewski, was blurred and abandoned in mainstream phonology.

Occasionally scholars not identified with the generative school criticised the tendency among generative phonologists to turn morpho-phonological statements into ever abstract rules referring to phonological categories and thus '...obscuring the role of morphophonemic alternations...a role which was so emphatically pointed out almost a hundred years ago by Badouin de Courtenay' (Stankiewicz 1966: 502).

Morpho-phonology, or more precisely, the separate status of morpho-phonological rules was reinstalled into the generative agenda in the 1970's in such projects as Natural Generative Phonology (Hooper 1976) and the non-transformational approach to alternations postulated by Hudson (1974, 1980). Dressler (1985) provides a thorough investigation of morpho-phonological rules with reference to external evidence within the framework of Natural Phonology. Despite these attempts to emphasise the distinct status of morpho-phonological alternations, the distinction between morpho-phonological and phonological rules has not been formally recognised in mainstream approaches to sound changes, where the former are treated as purely phonological processes (see Kiparky 1996).

Of the more recent works recognising the distinction between phonology and morpho-phonology one should mention the monograph by Kowalik (1997) in which the author describes consonantal changes without reference to atomic phonological rules of the type familiar from the works in generative phonology. Kowalik's work visibly inspired Gussmann's (2007) analysis of Polish. Among the generative approaches recognising the separate status of morpho-phonological regularities such as Hooper (1976), Hudson (1980) or Gussmann (2007), the last provides the most radical position in that his morpho-phonological statements have completely different format from his phonological statements. Precisely, in Hooper (1976) and Hudson (1980) the notation for morpho-phonological rules is not different from the notation for phonological rules. The only difference is that the former include morphologi-

cal features in the structural description or the environment. The only phonological processes recognised in Gussmann (2007) are spreading and delinking of features and segments and the change of the status of an elements from an operator to a head (see below). It is only morpho-phonology that is granted the right to replace segments with different segments. However, none of the generative approaches forces the blocks of morpho-phonological rules to be ordered in a fixed way with respect to phonological rules. This has some undesirable consequences which I will mention in section 5.

In what follows I will discuss some other important details of Gussmann's (2007) approach and the differences between Gussmann's approach to morpho-phonology and the approach advocated here.

4. The arbitrary nature of Polish consonantal changes

Although Gussmann's approach to Polish segmental changes may seem unsophisticated, especially when compared with his ingenuous 1980 abstract analysis, it must not be overlooked that the replacement analysis is probably the only possible way of handling Polish palatalizations which is compatible with the general architecture of the framework in which Gussmann (2007) is couched, i.e. Government Phonology (Kaye, Lowenstamm, Vergnaud 1990, Gussmann and Kaye 1993, Harris 1994). One of the main assumptions of Government Phonology (GP) is known as the Non-arbitrariness Principle (Kaye, Lowenstamm, Vergnaud 1990: 194). It states that a direct and tangible link must exist between a phonological process and the environment in which the process takes place. No insertion of segments or features is allowed and the only possible processes are spreading and delinking of features or segments. In the case of Polish palatalizations in general and PR1 and PR3 in particular, it is not possible to establish this kind of a non-arbitrary link. If a palatalization of the type PR1 involves the assignment of a feature value [- back] to a given segment, then, to comply with the Non-arbitrariness Principle, the change would have to take place only before segments carrying the feature [- back]. As demonstrated in (5), palatalized reflexes of relevant consonants emerge in Polish not only before segments which are unambiguously [- back] (e.g. *słom-a* /swɔma/ 'straw, nom. sg, fem.' - *słomi-any* /swɔmʲanɨ/ 'made of straw, nom. sg.'). Since the Non-arbitrariness Principle is also a constraint on language acquisition, it is not possible within GP to postulate lexical representations enriched with palatalising segments that are deleted having done their job.

The reviewer suggested to me that the Non-arbitrariness Principle does not disqualify traditional analyses employing abstract segments as one could assume the presence of floating palatalising agents even within Government Phonology. This solution was suggested by Rennison and Neubarth (2003: 127) as a strategy of handling umlaut changes in German. For Polish, this kind of analysis would require postulating floating palatal primes to constitute the lexical load of the suffixes that trigger palatalizations of preceding consonants. Indeed, in principle this solution is not at conflict with the Non-arbitrariness Principle. The problem would be, however, to come up with principled conventions according to which the floating palatal agents anchor on target

segments. Recall, for instance, that /d/ in the word *zdrad-a* /zdrada/ 'betrayal, nom. sg. fem.' can surface as a dental affricate /d͡z/ or as a post-alveolar /d͡ʑ/ depending on what suffix follows. The difference in the output might be attributed to the status of the palatalising agent. In Government Phonology, an architecture that employs unary distinctive features called elements, each element may have the status of a head or of an operator. One could assume that the palatal element I causes /d/ to surface as /d͡ʑ/ when it enjoys the status of a head and as /d͡z/ when it is an operator. In this type of analysis Polish palatalizing suffixes would be divided into two classes: the first of them would be represented with a floating I-head, while the second, complementary class, with I-operator. The situation is, however, far more complicated. Consider the possible outputs of the palatalization of velar plosives in Polish:

(8) Palatalization of velar stops:

		Non-palatalized form	Glosses	Palatalized form	Glosses
a.	/k/→/c/ /g/→/ɟ/	*wielk-a* / vʲɛlka /	'great, nom. sg. fem.'	*wielki-ej* / vʲɛlcɛj /	'great, gen./dat./loc. sg. fem.'
		dług-a / dwuga /	'long, nom. sg. fem.'	*długi-ej* / dwuɟɛj /	'long, gen./dat./loc. sg. fem.'
b.	/k/→/t͡s/ /g/→/d͡z/	*ręk-a* / rɛŋka /	'arm, nom. sg. fem.'	*ręc-e* / rɛnt͡sɛ /	'arm, dat. sg. fem.'
		nog-a / nɔga /	'leg, nom. sg. fem.'	*nodz-e* / nɔd͡zɛ /	'leg, dat. sg. fem.'
c.	/k/→/t͡ʃ/ /g/→/ʒ/	*rok* / rɔk /	'year, nom. sg.'	*rocz-ek* / rɔt͡ʃek /	'year, dim. nom. sg.'
		targ-u / targu /	'fair, gen. sg.'	*tarż-ek* / tarʒɛk /	'fair, dim. gen. sg.'
d.	no change	*ręk-ę* / rɛŋkɛ /	'arm, acc. sg. fem.'		
		nog-ę / nɔgɛ /	'leg, acc. sg. fem.'		

As illustrated by the examples in (8d) not all suffixes beginning with /ɛ/ trigger the palatalization of velars. The changes illustrated in (8a-c) are regular and productive. The *-ej* /ɛj/ desinence marking feminine oblique cases in adjectives turns velars into palato-velar stops. Dative feminine *-e* /ɛ/ causes affrication of /k/ and /g/, which surface as /t͡s/ and /d͡z/ respectively. Finally, the diminutive *-(e)k* /(ɛ)k/ triggers the change of the velars into an alveolar affricate /t͡ʃ/ and an alveolar voiced fricative /ʒ/.

In the light of these patterns, the analysis utilising floating primes would have to be considerably complex. Even if one assumes that floating I-head and I-operator are

responsible for the emergence of different outputs, the existence of three different palatalization patterns for velars forces the stipulation of complicated and arbitrary conventions that derive the output of the anchoring (linking) of floating primes. The situation is particularly convoluted in the cases in which different input segments are turned into the same output segment. For example, /ʒ/ can be derived from /r/ (see 5 above), /z/ (see 7 above), and /g/ depending on which suffixes are merged. It is hard to think of a non-ad-hoc set of phonological statements that could straightforwardly handle these changes in any framework, not only GP.

Since the arbitrariness of the relation between the inputs and outputs of palatalizations is unavoidable, the analysis employing floating palatalizing agents does not seem promising. An analysis that assumes that morpho-phonological processes involve the replacement of entire segments, and by doing so accepts the arbitrariness of the changes, seems much better suited for the description of the Polish data. This is the kind of analysis presented in Gussmann (2007). It will also be assumed for the purposes of this article. However, before the nature of Polish consonantal changes is further explored, let us focus of the nature of morpho-phonology.

5. Some core properties of morpho-phonology

The arbitrary nature of morpho-phonological replacements is one of the points that the approach presented in this paper shares with Gussmann (2007). Still, some assumptions about morpho-phonology made implicitly or explicitly by Gussmann will not be shared here. The assumptions given in (9) constitute a summary of the salient properties of morpho-phonology as understood in this article.

(9)　The properties of morpho-phonology
a.　Morpho-phonology is a part of the interpretative sub-component of grammar, particularly the Phonological Form (PF)
b.　Morpho-phonology works prior to phonology and may refer to lexical, phonological and morpho-syntactic categories
c.　All operations within PF work whenever their conditions are satisfied and are strictly local.

(9a) denies morpho-phonology the right to concatenate morphemes and their projections and is in accordance with a general assumption that the operation merge falls exclusively within the domain of morpho-syntax. Point (9b) precludes the possibility of morpho-phonology appealing to other than lexical properties of morphemes and allows it to refer to lexical diacritics, syllabic positions, phonological and morpho-syntactic features, terminal nodes and their content, and the notion of c-command.[5]

Finally, (9c) appeals to the main assumption about phonological computation shared by many Government Phonologists (see e.g. Kaye 1992, 1995) according to

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[5]　In this paper I assume a fairly simple definition of c-command: node α c-commands node β if the first projection that dominates α, dominates β.

which phonological operations take place at all times when their input and environment are met. This article expands the scope of this principle on morpho-phonological computation. The consequences of this assumption for certain morpho-phonological derivations in Polish will be presented in the sections to come. The claim that morpho-phonology is strictly local will also be clarified and supported later on.

Points (9b) and (9c) are clearly more controversial than point (9a) and at the same time constitute the contribution of this article to the debate concerning the nature of morpho-phonology and its place in the grammar.

(9b) stands in opposition to the assumptions found in various versions of Lexical Phonology and Morphology (Kiparsky 1982, Hargus 1993, McMahon 2000), which assume that morphological and morpho-phonological processes may refer to derived properties of morphemes. However, it is also at odds with approaches such as Hooper (1976) and Gussmann (2007), which allow, or at least do not preclude, the possibility of phonological and morpho-phonological rules to be intermingled.

The validity of the claim that some morpho-phonological processes may be sensitive to derived phonological properties of morphemes depends on what one considers to be 'derived properties' and if one believes in the derivational character of phonology at all. The derived properties that are usually invoked as influencing morpho-phonology are prosodic properties. The classic example of a morpho-phonological generalisation that is claimed to refer to derived prosodic properties of words is the distribution of English nominalising suffix *-al*. According to Ross (1972) and Siegel (1974), *-al* is attached almost exclusively to verbs which are stressed on the final syllable (the only exception is *burial*). Thus one finds nouns like *arrival, betrothal, betrayal, dismissal etc.* On the other hand, **edital, *promissal,* or **developal* are ungrammatical.[6] Now, even if one assumes that stress is indeed a derived property of English words, the question is if it is a phonologically or morpho-phonologically determined property. Numerous pairs of words in which stress placement seems to be determined by the morpho-syntactic category such as *ally (v.) - ally (n.), transport (v.) - transport (n.), perfect (v.) - perfect (a.), permit (v.) - permit (n.) etc.* seem to indicate that the letter option is true. If this is indeed the case, the claim made in (9b) is unchallenged: morpho-phonological processes may feed other morpho-phonological processes. Of course one can always recur to '...marking certain words as exceptions to a specific rule...' (Halle 1998: 553) in order to explain away what seems to be a contrastive stress assignment like *antecedent vs. precedent* or *anecdote vs. electrode.* This, however, only strengthens the point: whether the contention that morpho-phonological processes are sensitive to derived phonological properties is right depends on the theory of phonology that

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[6]   In fact the distribution of *-al* is regulated by several factors. Final stress is just one of them. Siegel (1974: 164–168) observes that *-al* attaches only to verbs ending in vowels, clusters formed by coronal sonorants and obstruents (but not e.g. /st/) and /v/. Unattested forms like **dispensal, *convinceal, *cursal* or **derival* must be treated as accidental gaps. This could suggest that the distribution is in fact determined in the lexicon and phonology does not play a great role in it. What is more, the phonological formulation provided by Siegel overlooks the dearth of verbs ending in a lateral or an /l/+consonant clusters and nominalised by means of *-al*: **appealal, *meltal* and **scoldal etc.* are clearly out.

one assumes. If one is in favour of abstract solutions and extrinsically ordered rules in phonology, one can handle the relevant data inside phonology as it is done e.g. in Chomsky and Halle (1968) or Halle (1998). The price to pay is that there is hardly any restriction on what this kind of phonology can do. The position taken without further debate in this study is that phonology is much less powerful and much of the work assigned to it in studies like Chomsky and Halle (1968) or Gussmann (1980) is done by morpho-phonology and the lexicon.

This is also the position taken in Hooper (1976) and Gussmann (2007). As a consequence of specific assumptions made in those works, the only interaction between processes they allow for is feeding. Still, the fact that no phonological process is ever ordered before morpho-phonological regularities to feed them has to be seen as an accident in both works. Within the approach outlined here, this fact is accounted for by ordering all morpho-phonological regularities before all phonological regularities. However, this ordering should not be seen as arbitrary and extrinsic, but rather as following from the nature of morpho-phonological regularities. This nature is distinct from the nature of phonological rules. As will become clear in the following section, the difference in the nature of phonological and morpho-phonological alternations lies in the type of information that these two kinds of alternations are sensitive to. Since morpho-phonology must refer to morpho-syntactic or lexical information (diacritics), it is allowed to work only at the stages of derivation where this sort of information is present: before the phonology proper.

6. The domain of morpho-phonology

Phonological processes manipulate phonological representations in environments provided by phonological representations. For example, the neutralisation of voice distinction in Polish affects obstruents in positions defined in purely phonological terms: at the end of a (phonological) word and before obstruents (see Bethin 1984, Gussmann 2007, Cyran 2011). Morpho-phonology, on the other hand, may affect phonological representations of morphemes in the contexts provided by morpho-lexical representations and may do it in more than one way. Before I discuss the sets of phenomena identified with morpho-phonology, let me present to the reader some basic assumptions of the theory of morphology in which the discussion will be couched, i.e. Distributed Morphology.

The basic assumption of Distributed Morphology (DM) is that there is a level of derivation of sentences at which all morphemes are represented as features occupying terminal nodes of syntactic trees. Importantly, the terminal nodes do not contain phonological features. These are supplied only after all syntactic and morphological operations have been performed. The relevant operations are allowed to, e.g. merge two nodes under one terminal node, fuse two nodes into one node, split one node into several separate nodes or delete some features from a given node (for detail see Halle and Marantz 1993, 1994). When all morphological operations have been completed, the derivation reaches the point at which phonological features are supplied. This point is known as Vocabulary Insertion.

A basic morphological unit in DM is a Vocabulary Item. A Vocabulary Item is composed of a set of morphological, syntactic and semantic features associated with some phonological features. Vocabulary Items are typically underspecified, i.e. they are composed of a subset of features found in the terminal nodes of syntactic trees. It is also typical to have several Vocabulary Items that compete for insertion into one node. This type of competition is regulated by, what Halle and Marantz (1993: 123) call '...the Pāṇinian principle understood here as giving precedence to the allomorph appearing in the most complex, most highly specified context over allomorphs appearing in less complex contexts.' In other words, this Vocabulary Item wins the competition, which contains relatively the greatest number of features matching the specification of the relevant syntactic node. The exact details of the competition need not concern us here (see Siddiqi 2009 for a neat illustration). What is of interest for the purpose of defining morpho-phonology, is that the phonological content of a Vocabulary Item realising a set of features in a given node may be determined by the content of some other node. The way the properties of one node may influence the realisation of some other node are regulated by locality conditions which will be discussed shortly. Now let me present how morpho-phonology can be defined in the DM architecture.

As it was mentioned at the beginning of this section, there are several ways in which morpho-phonology may affect phonological representations of morphemes. The first kind of morpho-phonological activity that I would like to point out will be referred to as *Morpho-phonologically Conditioned Allomorphy*. There are two basic types of Morpho-phonologically Conditioned Allomorphy. The first of them involves regular and productive changes triggered by morpho-phonological features or by lexical representations of exponents of some morpho-syntactic nodes. For example, changes summarised in (4) above are productively triggered by the PR1 diacritic, which forms the lexical load of the exponents of locative singular masculine (see 5). The second type of Morpho-phonologically Conditioned Allomorphy (MCA) is the mechanism of Readjustment Rules (Embick and Halle 2005, Embick 2010), which also manipulate phonological representations on the basis of morpho-lexical factors. Unlike the first type of MCA, Readjustment Rules are unproductive and affect only lexically selected sets of morphemes. The classic example here is the vowel mutation found in English verbs like *sing*, *ring*, *bring* or *begin*. The stressed vowels in those forms surface as /æ/, when the verb is in the past. The description of the /ɪ/→/æ/ change requires the reference to the triggering feature [Past] as the environment of the change, and to the diacritic that marks the relevant roots as the structural description.

The first type of MCA may be identified with type (iii) of alternations found in Kruszewski (1881/1967) (see section 3) or with automatic morpho-phonological alternations described in Hudson (1980). Readjustment Rules are non-automatic alternations that come very close to Kruszewski's type (ii) alternations.

The second major kind of morpho-phonological activity is *Allomorph Selection*. This also comes in two kinds. Firstly, morpho-phonology may decide about the phonological shape of some morphemes on the basis of some purely phonological properties of

other morphemes, e.g. the distribution of exponents of dative singular feminine in Polish depends on phonological properties of a root and is illustrated in (10).

(10) The exponents of dative singular feminine in Polish nouns:[7]

a.			b.		
Dative in -e /ɛ/		Glosses	Dative in -i/y /i-ɨ/		Glosses
Nominative	Dative		Nominative	Dative	
bab-a / baba /	babi-e / babʲɛ /	'woman'	stułbi-a / stuwbʲa /	stułb-i / stuwbʲi /	'hydra'
map-a / mapa /	mapi-e / mapʲɛ /	'map'	kopi-a / kɔpʲa /	kop-i / kɔpʲi /	'copy'
law-a / lava /	lawi-e / lavʲɛ /	'lava'	rewi-a / rɛvʲa /	rew-i / rɛvʲi /	'revue'
szaf-a / ʃafa /	szafi-e / ʃafʲɛ /	'wardrobe'	biografi-a / bʲɔgrafʲa /	biograf-i / bʲɔgrafʲi /	'biography'
koz-a / kɔza /	kozi-e / kɔʑɛ /	'nanny-goat'	buzi-a / buʑa /	buz-i / buʑi /	'face'
kos-a / kɔsa /	kosi-e / kɔɕɛ /	'scythe'	Kasi-a / kaɕa /	Kas-i / kaɕi /	'Kate'
bud-a / buda /	budzi-e / buʥɛ /	'kennel'	gładź / gwaʨ /	gładz-i / gwaʥi /	'plaster'
grot-a / grɔta /	groci-e / grɔʨɛ /	'cave'	nać / naʨ /	nac-i / naʨi /	'tops'
kur-a / kura /	kurz-e / kuʒɛ /	'hen'	burz-a / buʒa /	burz-y / buʒɨ /	'storm'
stuł-a / stuwa /	stul-e / stulɛ /	'stole'	kul-a / kula /	kul-i / kuli /	'sphere'
mam-a / mama /	mami-e / mamʲɛ /	'mom'	ziemi-a / zɛmʲa /	ziem-i / zɛmʲi /	'earth'
stron-a / strɔna /	stroni-e / strɔɲɛ /	'side'	niani-a / ɲaɲa /	Nian-i / ɲaɲi /	'nanny'
fok-a / fɔka /	foc-e / fɔʦɛ /	'true seal'	prac-a / praʦa /	prac-y / praʦɨ /	'work'
much-a / muxa /	musz-e / muʃɛ /	'fly'	kasz-a / kaʃa /	kasz-y / kaʃɨ /	'groats'
nog-a / nɔga /	nodz-e / nɔʣɛ /	'leg'	sadz-a / sadza /	sadz-y / sadzɨ /	'soot'

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[7] Apart from the two dative singular feminine endings presented in the table, Polish has also: (i) -ej /ɛj/ ending found in a narrow, semantically and syntactically specific group of nouns treated as de-adjectival and in surnames, e.g. woźn-ej 'bedel, dat. sg. fem.' or Kowal-ski-ej /kɔvalskʲiɛj/ 'surname, dat. sg. fem.', and (ii) a zero ending found in unassimilated borrowings such as gnu-ø /gnu/ 'wildebeest, dat. sg. fem.' or whisky-ø /wɨskʲi/ 'whisky, dat. sg. fem.'. For details see Orzechowska (1998: 270–327). Of course, the distribution of these two exponents is not driven by phonological factors. The distribution of the front /i/ and retracted /ɨ/ is regulated by phonology and need not concern us here.

Nouns in the first column take *-e* /ɛ/ as the exponent of dative singular. As visible in the second column, this *-e* /ɛ/ triggers PR1 in nouns ending in non-velar consonants. Additionally, velars undergo the change already illustrated in (8b) and called by Gussmann (2007: 128) PR2. The nouns in part (b) of the table select the same nominative singular ending as the nouns in the first column, i.e. *-a* /a/. Crucially, the root-final consonants of the nouns in (10b) are stable throughout their paradigm and no palatlization changes affect them. The same consonants are found in nouns in (10a) only in the context of palatalization, e.g. before dative singular.
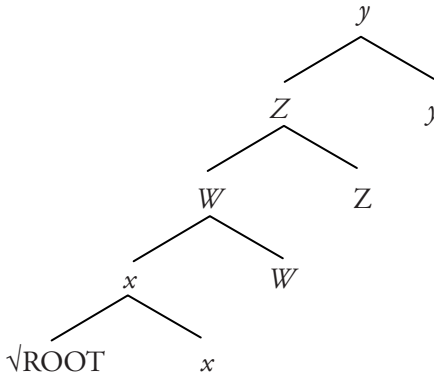
Nouns is (10b) are known in Polish linguistic tradition as *soft stemmed* nouns. Their final consonants are palatalized or are treated as palatalized for the purposes of morphophonological selection. Gussmann (2007: 48–49) assumes that the representations of the final consonants in soft stemmed nouns contain the palatalizing element I. The selection of *-i/y* /i~ɨ/ and *-e* /ɛ/ as the exponent of dative singular feminine depends on whether the root-final consonant contains the relevant phonological prime (I), in which case *-i/y* /i~ɨ/ is selected. Therefore, the selection of the exponent of dative singular feminine is a cardinal example of *Phonologically Conditioned Allomorphy* (Embick 2010: II), i.e. a situation in which the selection of an exponent of a syntactic node hinges upon a phonological property of an exponent of a different node.

The second type of Allomorph Selection is known as *Contextual Allomorphy* (see Embick 2010: I). Contextual Allomorphy is different from the Phonologically Conditioned Allomorphy (PCA) in that in the former the selection of an allomorph is determined only on the basis of lexical or, less often, morpho-syntactic factors. Phonological properties of the conditioning morphemes are not involved. A relevant example is the distribution of the allomorphs of Past Tense morpheme in English. The exponents of Past Tense are zero /ø/, as in *hit-ø*, *-t* /t/, as in *ben-t*, and *-ed* /d/, which should be regarded as the default case. The distribution of these allomorphs is clearly independent of phonological factors (*wet-wett-ed vs. whet-whet*) but also of semantic or syntactic criteria, e.g. whether a verb is an unaccusative (*remain-remained vs. arise-arose*) or whether it licenses Exceptional Case Marking (*belive-believ-ed vs. teach-taugh-t*) but sensitive to lexical criteria. Contextual Allomorphy is very often treated in the literature as part of the theory of morphology and as separate from morpho-phonology or phonology (see e.g. Embick 2010: 6–8, 97–108). However, there are two reasons why it is justified to see Contextual Allomorphy as part of morpho-phonology. Firstly, morpho-phonology is considered in this article to be the part of the grammar in which morpho-syntactic and lexical properties of morphemes influence and interact with formal properties of morphemes, i.e. their phonological shape. Contextual Allomorphy is an example of this kind of an influence or interaction as much as Phonologically and Morpho-phonologically Conditioned Allomorphy, in that it is one of the ways in which morpho-syntactic and lexical features decide about the phonological shape of exponents of some morphemes.

The second, and no less important, reason for which Contextual Allomorphy should be regarded as a one set of phenomena with Phonologically and Morphophonologically Conditioned Allomorphy is that the three seem to obey very similar morpho-syntactic locality conditions.

The relevant locality conditions are defined in Embick (2010: ch. 2). According to Embick, Contextual Allomorphy and Readjustment Rules are sensitive to the presence of cyclic spell-out domains. Embick assumes that spell-out, a part of which is Vocabulary Insertion (VI), takes place whenever a cyclic head (a *(v)erb*, a *(n)oun* or an *(a)djectival*) is merged with a cyclic domain. A cyclic domain constitutes the complement of an outer cyclic head and is typically composed of a root, an inner cyclic head and, optionally, of a number of non-cyclic heads. A relevant structure is presented in (11), where *x* and *y* are cyclic heads, while *W* and *Z* for non-cyclic heads.
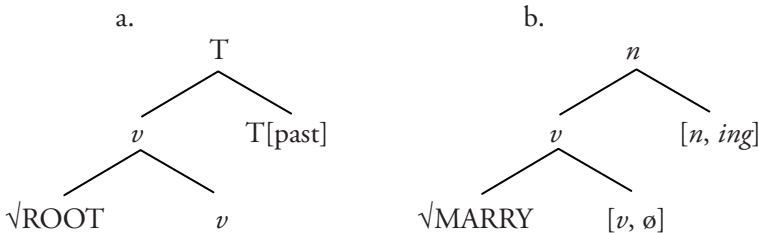
(11)

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                            y
                          /   \
                        Z       y
                      /   \
                    W       Z
                  /   \
                x       W
              /   \
          √ROOT     x
```

With reference to (11), spell-out and VI are triggered only when *y* is merged. When this happens, the nodes forming the cyclic domain are supplied with their phonological features. Two further assumptions are important for the working of Contextual Allomorphy. Firstly, *y* is not part of the cyclic domain, which means that it is not spelled-out in the cycle it triggers but in the subsequent cycle. Secondly, after the spell-out, the root is deactivated. Only the inner cyclic head *x* and non-cyclic heads *W* and *Z* are present in further derivation as a *phase edge*.

Under a condition that Contextual Allomorphy and Readjustment are possible only within cyclic spell-out domains, Embick's approach explains many patterns of allomorphy, e.g. the conditions governing the selection of the exponents of the Past Tense morpheme and gerunds in English. Consider representations in (12).

(12)

a.
```
              T
            /   \
          v       T[past]
        /   \
    √ROOT     v
```

b.
```
              n
            /   \
          v       [n, ing]
        /   \
  √MARRY     [v, ø]
```

Vocabulary Insertion and PF processing always work within a domain from the most embedded node (here *v* and its sister) to the least embedded one. The representation (12a) shows a part of a syntactic tree representing an English verb in the Past Tense. As the root in this structure undergoes PF computation in the same cycle as the Past Tense morpheme undergoes VI,[8] it is possible for the root to influence the selection of the exponent of this morpheme, i.e. to select /ø/ or /t/ (/d/ surfaces with verbs that do not select any exponent).

(12b) represents the structure of a gerund *marrying*. In this representation *n* is the outer cyclic head that triggers the spell-out of the cyclic domain but does not undergo VI until the subsequent cyclic head is merged. However, when this takes place, the root √MARRY is no longer available. As a consequence, English roots never decide about the form of the gerund morpheme.

Embick (2010) contends that Contextual Allomorphy and Readjustment Rules are restricted by cyclic spell-out. Additionally, Contextual Allomorphy is claimed to be only possible when two morphemes are concatenated, i.e. when they are in a relation of linear adjacency. Linear adjacency is not relevant for the working of Readjustment Rules (see Embick 2010: 3.4). Phonologically Conditioned Allomorphy is claimed to be sensitive to concatenation but not to cyclic spell-out. In particular, Embick claims that the phonological material present in roots may see outer nodes for the purposes of PCA. In section 7 I will demonstrate that the part of MCA that corresponds to morpho-phonological replacements is sensitive only to linearity conditions. This demonstration will be followed by the discussion of some seemingly problematic cases of phonological replacements in Polish and preceded by the discussion of another principle restricting morpho-phonological activity, i.e. the Minimalist Hypothesis.

7. Constraining morpho-phonology

Morpho-phonology as presented in Gussmann (2007) is clearly too powerful a tool of description. This is the case as, on the representational side of the grammar, morpho-phonological replacements may replace any number of segments for any other number of segments. On the procedural side, there are not enough structural conditions that could hold morpho-phonological computation in check. In particular, important questions that we are faced with are: what can constitute a trigger of a morpho-phonological change, what morpho-phonological changes are allowed to follow one another and in what relations to each other can they stand (feeding, bleeding, counterfeeding, counterbleeding). In this section I would like to focus on structural constraints that reduce the generative power of morpho-phonological replacements in their procedural aspects.

7.1. The Minimalist Hypothesis

I have already pointed to one constraint that can effectively preclude a number of morpho-phonological derivations. In particular, in point (9c) in section 5 I claimed

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8   Roots do not undergo VI and do not compete in most versions of DM, but see Siddiqi (2009).

that all morpho-phonological operations must take place whenever their conditions are met. This condition has been present in Government Phonology literature since the early stages of the development of the framework and has been known as the Minimalist Hypothesis. The original formulation of the claim is quoted here after Kaye (1992: 141):

(13) The Minimalist Hypothesis[9]
      Processes apply whenever the conditions that trigger them are satisfied.

As it was also mentioned in section 5, although the Minimalist Hypothesis was meant to be a constraint on phonological computation, it will be treated as a constraint on computation working in the entire Phonological Form and restricting the operations of both morpho-phonology and phonology.

The Minimalist Hypothesis (MH) requires that all processes take place whenever their conditions are satisfied and reapply until the input string does not undergo any changes anymore. There is a number of derivational strategies which MH eliminates. Consider the two following replacement rules:

(14)

    a.   b.

$$\text{/t/} \rightarrow \text{/d/} \_\_ \, \emptyset_N \qquad\qquad \text{/t/} \rightarrow \text{/s/} \_\_ \, [\text{pl}]$$

The two rules in (14), presented in a conventional Chomsky and Halle (1968)-style notation, should be read as follows: replace a voiceless coronal stop with either /d/ or /s/ when a relevant root is c-commanded by a zero nominal morpheme (14a) or a [plural] value of a #(number)-head (14b). In a language in which nominals are dominated by a #P, all other things being equal, the two processes are said to be in a bleeding relationship. Under MH version of computation, however, the two processes are at conflict and simply must not be found in a single derivation. Thus, the Minimalist Hypothesis excludes any bleeding relationship between replacement rules. What is important is that it does not matter if the bleeding relationship between (14a) and (14b) is an attested or a potential one (i.e. a counterbleeding). MH precludes any rule configuration that leads to conflicts.

Similarly, assuming rule (15) and the existence of denominal verbs in a hypothetical language, one has to do with a feeding relationship between (14a) and (15). In that case, all other things being equal, MH forces a derivation in which /t/ → /d/ and /d/ → /z/, i.e. no counterfeeding opacity may exist.

(15)

$$\text{/d/} \rightarrow \text{/z/} \_\_ \, \emptyset_V$$

To sum up, the only rule interaction that MH predicts to exist is a plain feeding interaction.[10] In section 8 I will point to certain derivations and diacritic combinations that constitute problems for the Minimalist Hypothesis as a constraint on morpho-phonological computation. I will also show that these problems are only apparent.

7.2. Structural conditions on morpho-phonology

Whereas the Minimalist Hypothesis is a constraint on replacement rules interaction, it is necessary to postulate certain purely structural conditions under which morpho-phonological operations, including replacements, are allowed to apply. This section is devoted to investigating this kind of structural constraints.

Firstly, let us assume that morpho-phonological processes apply under the relation of c-command, i.e. c-command is a universal and necessary condition under which replacements, readjustments and allomorphy take place. In the remaining part of the paper, all replacements are assumed to take place under this structural relation, even if this is not stated or demonstrated explicitly. Additionally, let us assume that it is only the terminal nodes, never projections, that can participate in morpho-phonological processes. The effect is that, assuming that vP and CP are phases and the complements of their heads are subject to Phase Impenetrability Condition (Chomsky 2000), in the simplified representation of a TP *John houses the thieves* in (16) only ϕ_N, number and determiner heads may enter into some sort of morpho-phonological relationship with the root $\sqrt{thief}$. The root $\sqrt{house}$, on the other hand, may enter into such a relationship only with ϕ_V as well as the head of TP.

(16)   *John houses the thieves*

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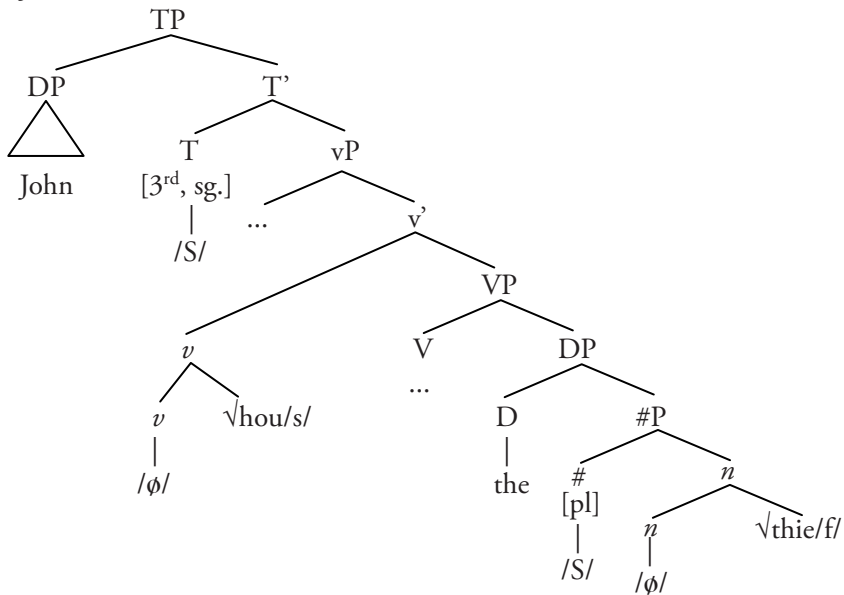
[10]   The third type of derivational technique that MH precludes is the Duke of York gambit (see Pullum 1976), which lead to mutual feeding of two rules *ad infinitum* (for details see Zdziebko 2012: 173–179).

The requirement of c-command between terminal nodes precludes the possibility of any node constituting the DP *John* located in the Spec TP to interact with any segment inserted into head T or v. However, morpho-syntactic representations supplied for interpretation may be much more complex that what (16) shows. As a consequence the condition of c-command may not be enough to derive correct outputs in some derivations. As an example, let us consider yet another set of Polish data in (17).

(17)

	a.		b.		c.		d.	
	Noun in nominative	Gloss.	Diminutive in *-(e)k-* (nom. sg.)	Gloss.	Noun in *-ist-* (nom. sg.)	Gloss.	Noun in *-ist-(e)k-* (nom. sg.)	Gloss.
	sztang-a / ∫taŋga /	'barbell, fem.'	*sztanż-k-a* / ∫tãʷ∫ka /	'barbell, dim, fem.'	*sztang-ist-a* / ∫taŋɟista /	'weight-lifter'	*sztang-ist-k-a* / ∫taŋɟistka /	'female weight-lifter, fem.'
	czołg / t͡ʃɔwk /	'tank'[11]	*czołż-ek* / t͡ʃɔwʒɛk /	'tank, dim.'	*czołg-ist-a* / t͡ʃɔwɟista /	'tank-man'	*czołg-ist-k-a* / t͡ʃɔwɟistka /	'tank-woman, fem.'
	York / jɔrk /	'surname'	*Yorcz-ek* / jɔrt͡ʃɛk /	'York, dim.'	*jork-ist-a* / jɔrcista /	'Yorkist'	*jork-ist-k-a* / jɔrcistka /	'female Yorkist, fem.'
	SOK / sɔk /	'Railroad Guards'	*SOCZ-ek* / sɔt͡ʃɛk /	'Railroad Guards, dim.'	*SOK-ist-a* / sɔcista /	'railroad guard'	*SOK-ist-k-a* / sɔcistka /	'female railroad guard, fem.'

(17b) shows PR5-type of replacement that affects velars and is productively triggered by the *-(e)k-* /(ɛ)k/ suffix. (17c) shows the relevant roots merged with a nominalising *-ist/yst-* /i~ɨst/ morpheme. These nouns may serve as basis for deriving feminine nouns by means on *-(e)k-* /(ɛ)k/ morpheme (17d). Importantly, *-(e)k-* /(ɛ)k/ is not the only exponent of the femininizing morpheme in Polish. Grzegorczykowa and Puzynina (1998: 4.1.1) offer an overview of such morphemes (they call *-(e)k-* /(ɛ)k/ *-ka* morpheme). Crucially, exponents of morphemes deriving feminine nouns are clearly subject to Contextual Allomorphy. *-(e)k-* /(ɛ)k/ should be seen as default in this function as it is productive and most common. There are, however, other exponents, whose distribution is driven by some idiosyncratic properties of

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[11]   The presence of the voiceless consonant is the effect of final-devoicing which is a phonological process. Hence, it does affect the morpho-phonological regularities we are interested in.

roots. For example, *-yc/ic-* /ɨ~i͡ts/ is used, among other things, to derive names of females of animals and is accompanied by PR1 as in *tygrys* /tɨgrɨs/ 'tiger, nom. sg.' → *tygrys-ic-a* /tɨgrʲici͡tsa/ 'tigeress, nom. sg. fem.', *komar* /kɔmar/ 'mosquito, nom. sg.' → *komarz-yc-a* /kɔmaʒɨ͡tsa/ 'female mosquito, nom. sg. fem.', and PR5 as in *rak* /rak/ 'shellfish, nom. sg' → *racz-yc-a* /ratʃi͡tsa/ 'female shellfish, nom. sg. fem.'. Yet another exponent is a zero morpheme /ø/ as in *markiz* /marcis/ 'marquis, nom. sg.' → *markiz-ø-a* /marciza/ 'marchioness, nom. sg. fem.' or *kum* /kum/ 'godfather, nom. sg.' → *kum-ø-a* /kuma/ 'godmother, nom. sg. fem.'. In this case the conditions of distribution are completely idiosyncratic to roots. The fact that the exponent of the feminine morpheme is subject to root-specific selection shows clearly that the node it occupies in non-cyclic. In terms of Embick's cyclic spell-out approach, it must undergo VI at the same level as the root. In order to demonstrate what this means for the working of morpho-phonological replacements, let me provide the representation of the word *czołg-ist-k-a* /t͡ʃɔwɟistka/ 'tank-woman, nom. sg.'

(18)
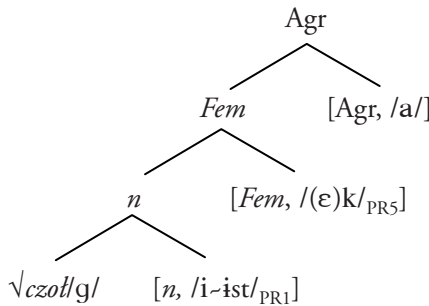
(18) presents the relevant structure after VI at the outer cycle. What (18) is meant to demonstrate is that c-command cannot be the only condition on replacements. Were this the case, the exponent of the *Fem* morpheme, i.e. *-(e)k-* /(ɛ)k/, would trigger the PR5 replacement of the final consonant in the root √*czołg* giving an ungrammatical construct **czołł*ʒ*/ystka*. Since, *Fem* is not a cyclic node, one cannot claim that the replacement does not take place because the exponent of *Fem* that carries the relevant diacritic is supplied only in the later cycle. What the model of morpho-phonology argued for in this article needs is a condition limiting the scope of application of morpho-phonological replacements. A relevant condition is formulated in (19).

(19)   The Locality Principle
         A morpho-phonologemic replacement of the material in a terminal node α triggered by a terminal node β may take place iff :
         a)   β c-commands α, and
         b)   α and β are concatenated, i.e. they are in the most local linear relationship possible.

The notion of concatenation is crucial in accounting for the apparent underapplication of PR5 in (17) and (18). It has been adopted here from Embick (2010: 12), for

whom it is also a condition on Contextual Allomorphy.[12] Under (19) the only node that PR5 could affect is [*n*, /i-ɨst/$_{PR1}$], which does not meet the structural description of PR5, i.e. does not end in a velar.

In the following section, I would like to address a different problem that the approach presented in this section faces, i.e. the problem of conflicting diacritics in Polish.

8. Conflicting diacritics: towards a solution

Gussmann (2007: 128–129) enumerates seven different patterns that replace non-palatalised consonants with palatalised objects. Among the seven PRs, one can find sets that replace the same consonants with different ones. To illustrate the point let me present three PRs that involve the same segments in different ways.

(20) PR2, PR5 and PR7 (Gussmann 2007: 128–129)

a) PR2			b) PR5				c) PR7			
k	g	x	k	g	zg	x	t͡s	d͡z	t	ʃ
|	|	|	|	|	|	|	|	|	|	|
t͡s	d͡z	ʃ	t͡ʃ	ʒ	ʒd͡ʒ	ʃ	t͡ʃ	ʒ	t͡ʃ	ɕ

The working of PR2 is most often visible as a result of the merging of roots and other morphemes with a dative and locative feminine singular ending *-e* /ɛ/ (see 10 above). Thus one gets *fok-a* /fɔka/ 'true-seal, nom. sg. fem.' – *foc-e* /fɔt͡sɛ/ 'true-seal, dat/loc. sg. fem.'; *nog-a* /nɔga/ 'leg, nom. sg. fem.' – *nodz-e* /nɔd͡zɛ/ 'leg, dat/loc. sg. fem.' and *much-a* /muxa/ 'fly, nom. sg. fem.' – *musz-e* /muʃɛ/ 'fly, dat/loc. sg. fem.'. PR5 is most productively triggered by the diminutive *-(e)k-* /(ɛ)k/ ending as in *fok-a*/fɔka/ – *focz-ka* /fɔt͡ʃka/ 'true-seal, dim.nom.sg.fem.'; *nog-a* /nɔga/ – *nóż-ka* /nuʃka/ 'leg, dim. nom. sg. fem.'; *mózg* /musk/ 'brain, nom. sg.' – *móźdż-ek* /muʒd͡ʒɛk/ 'brain, dim. nom. sg.' and *much-a* /muxa/ – *musz-ka* /muʃka/ 'fly, dim. nom. sg. fem.'. PR7 is illustrated by examples such as *zając* /zajɔnt͡s/ 'hare, nom.sg.' – *zając-ek* /zajɔnt͡ʃɛk/ 'hare, dim. nom. sg.'; *mosiądz-u* /mɔɕɔndzu/ 'brass, gen. sg.' – *mosięż-n-y* /mɔɕɛ̃ʷʒnɨ/ 'of brass, nom. sg.', *pląt-ać* /plɔntaɕ/ 'confuse' – *plącz-ę* /plɔnt͡ʃɛ/ 'I confuse' as well as *grosz* /grɔʃ/ 'a penny, nom.sg.' – *gros-ik* /grɔɕik/ 'a penny, dim. nom. sg.'.

As can be seen in (20), some replacements triggered by PR2 are also triggered by PR5. Hence, by MH, we would not expect them to be attached to the same affix in Polish. This prediction is borne out. Polish does not possess an affix that would replace /k/ with /t͡ʃ/ in one set of morphemes and with /t͡s/ in a complementary set of morphemes. In fact, the vast majority of diacritics that trigger conflicting replacements in Polish are not attached to the same affixes. A very intriguing case from the

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[12] One thing that should be mentioned here is that nodes with empty exponents have to either be treated as transparent for the purposes of MCA and Contextual Allomorphy, or, as assumed by Embick (2010: 2.3.3), deleted by the operation called Pruning.

point of view of the framework put forward in this paper is the set of replacements subsumed by Gussmann under a label PR7.

In his survey of fourteen derivational affixes and diacritics they carry, Gussmann (2007: 141–142) presents five affixes which carry contradictory PRs. All of them are marked for PR1, PR5 and PR7. The relevant affixes are presented in the table below along with the examples of changes they provoke (taken mainly from Gussmann 2007: 141–142).

(21)[13]

		PR1		PR5		PR7	
		Non-palatalised form	Palatalised form	Non-palatalised form	Palatalised form	Non-palatalised form	Palatalised form
a.	Diminutive *-ik/yk-* /i‿ik /	*okręt* / ɔkrɛnt /	*okręc-ik* / ɔkrɛɲt͡ɕik /	*hak* / xak /	*hacz-yk* / xat͡ʃik /	*kapelusz* / kapɛluʃ /	*kapelus-ik* / kapɛluɕik /
b.	Adjectival *-ist/yst-* /i‿ist /	*złot-y* / zwɔtɔ /	*złoc-ist-y* / zwɔt͡ɕisti /	bark / bark /	*barcz-yst-y* / bart͡ʃisti /	*ojciec* / ɔjt͡ɕɛt͡s /	*ojcz-yst-y* / ɔjt͡ʃisti /
c.	Adjectival *-ast-* /ast /	*kwiat* / kvʲat /	*kwiaci-ast-y* / kvʲat͡ɕasti /	*bułk-a* / buwka /	*bułcz-ast-y* / buwt͡ʃasti /	palec / palɛt͡s /	*palcz-ast-y* / palt͡ʃasti /
d.	Nominal *-nik-* /ɲik /	głos / gwɔs /	*głoś-nik* / gwɔɕɲik /	*bieg* / bʲɛk /	*bież-nik* / bʲɛʒɲik /	*miesiąc* / mʲɛɕɔnt͡s /	*miesięcz-nik* / mʲɛɕɛnt͡ʃɲik /
e.	Agentive *-arz-* /aʒ /	*młot* / mwɔt /	*młoci-arz* / mwɔt͡ɕaʒ /	*mlek-o* / mlɛkɔ /	*mlecz-arz* / mlɛt͡ʃaʒ /	*owc-a* / ɔft͡sa /	*owcz-arz* / ɔft͡ʃaʒ /

As illustrated in the table, PR1 replaces /t/ with a palato-alveolar affricate /t͡ɕ/. At the same time, (20) above says that the same consonant may be replaced with /t͡ʃ/, in line with PR7. If /t/ is indeed part of the structural description of both PR1 and PR7, then we have to do with a conflict of diacritics. Precisely, PR7 and PR1 mutually bleed each other. Such a situation is impossible from the point of view of the Minimalist Hypothesis, which says that all replacements apply whenever their conditions are met.

In addition to the fact that the five affixes lead to a conflict between PR1 and PR7 an interesting situation takes place in cases where the adjectivalising morphemes *-n-* /n/, *-ist-/-yst-* /i‿ist/ and *-ast-* /ast/ and the familiar diminutive *-(e)k-* /(ɛ)k/ morpheme are added to roots ending in a velar fricative /x/. According to Gussamann, the *-n-* morpheme is marked for three replacements: PR4, PR5 and PR7. Let us omit replacements triggered by PR4 as irrelevant to the discussion and focus on the

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13   Glosses (from left to right, all nom. sg. masc.): a) 'warship', 'warship, dim.', 'hook', 'hook, dim.', 'hat', 'hat, dim.'; b) 'golden', 'of the colour of gold', 'shoulder', 'broad-shouldered', 'father', 'paternal'; c) 'flower', 'floristic', 'roll', 'roll-like', 'finger', 'fingerlike'; d) 'voice', 'loudspeaker'; 'run', 'tread of a tyre', 'month', 'a monthly'; e) 'hammer', 'hammer-thrower', 'milk', 'milk-man', 'sheep', 'sheppard'.

interaction of PR5 and PR7. These diacritics also constitute the lexical load of *-ist-/-yst-* /i-ɨst/, *-ast-* /ast/ and *-(e)k-* /(ɛ)k/ morphemes. When the relevant morphemes are merged with roots terminating in /x/, PR5 replaces the velar fricative with /ʃ/, so that one gets *strach* /strax/ 'fear, nom.sg.' – *strasz-n-y* /straʃnɨ/ 'scary, nom.sg.'; *puch* /pux/ 'down, nom.sg.' – *pusz-yst-y* /puʃistɨ/ 'fluffy, nom. sg.'; *brzuch* /bʒux/ 'belly, nom.sg.' – *brzusz-ast-y* /bʒuʃastɨ/ 'crescent-shaped, nom. sg.' and *dach* /dax/ 'roof, nom. sg.' – *dasz-ek* /daʃɛk/ 'roof, dim. nom. sg.'.

As has been mentioned above, all the suffixes also seem to be marked for PR7. The examples of PR7 replacements triggered by *-ist-/-yst-* /i-ɨst/, *-ast-* /ast/ have been presented in (21). Alternations that show PR7 type of replacements triggered by *-n-* /n/, and diminutive *-(e)k-* /(ɛ)k/ are, e.g. *granic-a* /ɡraɲitsa/ 'border, nom. sg.' - *granicz-n-y* /ɡraɲitʃnɨ/ 'border, adj. nom. sg.', *piwnic-a* /pʲivɲitsa/ 'cellar, nom. sg. fem.' – *piwnic-n-y* /pʲivɲitʃnɨ/ 'cellar, adj. nom. sg.' or *zajac* /zajɔnts/ 'hare, nom. sg' – *zajacz-ek* /zajɔntʃɛk/ 'hare, dim. nom. sg.', *ulic-a* /ulitsa/ 'street, nom. sg. fem.' *ulicz-k-a* /ulitʃka/ 'street, dim. nom. sg. fem.'.

Coming back to the roots ending in /x/, if the relevant diacritics trigger the replacements assumed by Gussmann (2007), the outputs that one expects under the application of morpho-phonology argued for in this paper are **strać-n-y* /straɕnɨ/, **pus-ist-y* /puɕistɨ/, **brzus-iast-y* /bʒuɕastɨ/ and **das-iek* /daɕɛk/. This is the case as the PR5 replacement of /x/ with /ʃ/ should feed the PR7 replacement of /ʃ/ with alveo-palatal fricative /ɕ/ (see 20c above). However, instead of feeding one clearly observes a counterfeeding relationship between the two replacements triggered by those diacritic marking: a situation precluded by the Minimalist Hypothesis. Let me present the predicted derivation of **strać-n-y* /straɕnɨ/ for clarity of exposition.

(22) The derivation of **strać-n-y* /straɕnɨ/
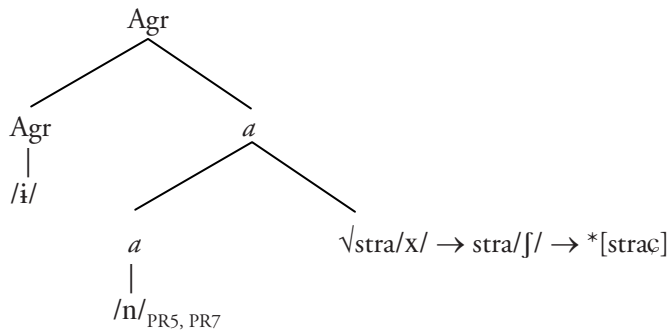
As the replacements triggered by PR7 appear to blatantly contradict the mode of application of morpho-phonology postulated in section 7, I think it is necessary to address them in detail. In what follows I would like to go through the replacement patterns triggered by PR7 and demonstrate that, although it is neither possible nor desirable to entirely get rid of PR7, it is possible to make a successful attempt at setting this replacement in line with the general architecture argued for in this article.

8.1. The replacement of /ʃ/ with /ɕ/

Let me start with the replacements of the alveolar fricative /ʃ/ with the alveo-palatal spirant /ɕ/. After the inspection of the problematic derivational affixes it appears that the only one that triggers this replacement is the diminutive morpheme *-ik-/-yk-* /i-ɨk/. This is illustrated by examples such as *grosz* /grɔʃ/ 'a penny, nom. sg.' - *gros-ik* /grɔɕik/ 'a penny, dim. nom. sg.'; *kapelusz* /kapɛluʃ/ 'hat, nom. sg.' - *kapelus-ik* /kapɛluɕik/ 'hat, dim. nom. sg.' or *arkusz* /arkuʃ/ 'sheet, nom. sg.' - *arkus-ik* /arkuɕik/ 'sheet, dim. nom. sg.'. The change is, however, not exceptionless in Polish as exemplified by words such as *kosz-yk* /kɔʃɨk/ 'basket dim. nom. sg.', derived from *kosz* /kɔʃ/ 'basket, nom. sg.', as well as pairs such as *zamsz* /zamʃ/ 'suede, nom. sg.' - *zamsz-yk* /zamʃɨk/ 'suede, dim. nom. sg.' or *farsz* /farʃ/ 'stuff, nom. sg.' - *farsz-yk* /farʃɨk/ 'stuff, dim. nom. sg.'. In general terms, it looks as if the presence of *-ik-/-yk-* /i-ɨk/ morpheme is not enough for the /ʃ/∼/ɕ/ alternation to take place. The change seems to be confined only to certain roots. This fact, along with the radical restrictiveness of the occurrence of the alternation (only *-ik-/-yk-* triggers it), allows one to doubt if the /ʃ/∼/ɕ/ alternation should be seen as part of PR7 in the way postulated by Gussmann (2007). Concretely, in order to express the regularity behind the *grosz* /grɔʃ/-/*gros-ik* /grɔɕik/-type alternation one needs both to define the environment in which the mutation takes place (c-commanded by *-ik-/-yk-*) and to isolate the (very restricted) set of roots that undergo the change. A putative replacement generalisation would probably look as follows:

(23) /ʃ/ → /ɕ/_PR7-*ik-/-yk-*

According to (23) the alveolar fricative is replaced with the alveo-palatal one if it is marked for PR7 and locally c-commanded by the *-ik-/-yk-* diminutive morpheme.

Placing a diacritic on root-final consonants as opposed to the affix, we are making the alternation idiosyncratic to a given set of roots. As a consequence, the status of the alternation is changed. It is no longer an automatic morpho-phonological alternation triggered obligatorily in a particular morphological context and signalling the presence of some morphological property like the third-type alternations described in Kruszwski (1881/1967). It rather becomes a Readjustment Rule which affects a lexically defined set of morphemes in a particular morpho-phonological or morphological setting.

An alternative interpretation would be to claim that the items of the *gros-ik* /grɔɕik/-type have two roots, one ending in /ʃ/ and playing the role of the 'default case' and one in ending in /ɕ/ and marked as diminutive. These roots may then compete for insertion in just like other morphemes do and be placed in a given root-node on the basis of 'the Pāṇinian principle' described by Halle and Marantz (1993). This kind of competition between roots has been suggested in Siddiqi (2009: ch.4) as an alternative to Readjustment Rules.

The aim of this article is not to argue for or against any of the solutions mentioned above. What is crucial is that the fricative mutation discussed above cannot form part of PR7 as it was presented in Gussmann (2007) and in (20) above. This, in turn, has very desirable implications for the model of morpho-phonology outlined in previ-

ous sections. In particular, the problematic derivations of roots ending in /x/ cease to threaten the approach that takes the Minimalist Hypothesis to be the principle regulating morpho-phonological computation. If the replacement of /ʃ/ with /ɕ/ no longer belongs with the replacements triggered automatically by *-ik-/-yk-* /i‑ɨk/, *-n-* /n/, *-ist-/-yst-* /i‑ɨst/, *-ast-* /ast/ and *-(e)k-* morphemes, PR5 will no longer be expected to feed the change.

Outside of the group of the derivational affixes inspected by Gussmann (2007: 141–142) the alternation between /ʃ/ and /ɕ/ seems to be attested in the verbal system of Polish. Consider the infinitives and imperatives and the 1st person singular and the 3rd person plural present tense forms of certain verbs.

(24)[14]

Infinitive	*Imperative*	*1st person singular*	*3rd person plural*
pros-ić /prɔɕit͡ɕ/	*proś* /prɔɕ/	*prosz-ę* /prɔʃɛ/	*prosz-ą* /prɔʃɔ̃ʷ/
głos-ić /gwɔɕit͡ɕ/	*głoś* /gwɔɕ/	*głosz-ę* /gwɔʃɛ/	*głosz-ą* /gwɔʃɔ̃ʷ/
kis-ić /ciɕit͡ɕ/	*kiś* /ciɕ/	*kisz-ę* /ciʃɛ/	*kisz-ą* /ciʃɔ̃ʷ/
dus-ić /duɕit͡ɕ/	*duś* /duɕ/	*dusz-ę* /duʃɛ/	*dusz-ą* /duʃɔ̃ʷ/
gas-ić /gaɕit͡ɕ/	*gaś* /gaɕ/	*gasz-ę* /gaʃɛ/	*gasz-ą* /gaʃɔ̃ʷ/

It is not my intention to discuss the extremely convoluted morpho-phonology of the verbal system of Polish. However, a word is due when it comes to the apparent alternations between /ʃ/ and /ɕ/ presented in (24).

To be precise, there are reasons to doubt whether the direction of motivation in the case of the verbal alternations is indeed from the alveolar /ʃ/ to the palato-alveolar /ɕ/. Firstly, in the case of the paradigms of the verbs presented above and very many other verbs it is /ɕ/ that is the most prevalent segment as it occurs in the rest of the present tense paradigm, e.g. *pros-isz* /prɔɕiʃ/ 'you ask (for)' *pros-imy* /prɔɕimɨ/ 'we ask (for)' *etc.*, as well as in the past and the majority of the future tense paradigms. Gussmann (2007: 129–130) argues against postulating non-palatalised segments as underliers in cases where the palatalised consonants are more frequent e.g. in the case of a root *śmierć* 'death, nom. sg. fem.' that occurs with a non-palatalised plosive /t/ only in the denominal adjective like *śmiert-el-n-y* 'lethal' and certain derived nouns. The case of the verbal forms in (24) may seem to be parallel to the cases like this one.

On top of that, very many verbs are connected derivationally with other forms which often end in segments other than either /ʃ/ or /ɕ/. For that instance, the verb *głos-ić* /gwɔɕit͡ɕ/ 'to preach' is related to the noun *głos* /gwɔs/ 'voice, nom.sg.', while the verb *gas-ić* /gaɕit͡ɕ/ 'extinguish' to its intransitive countarpart *gas-ną-ć* /gasnɔɲt͡ɕ/ 'extinguish (intr.)'. In such cases, as suggested by Gussmann (2007: 170), it is possible to postulate suitable diacritics as exponents of relevant inflexional categories. Consequently, PR1 may be postulated as an exponent of the imperative, in which case underlying root-final /s/ would be replaced with /ɕ/. Following this path, PR3 could be suggested for those verbs as the exponent of the 1st person singular and 3rd person

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14   Glossary to (15): 'to ask (for)', 'to preach', 'to pickle', 'to strangle', 'to extinguish'.

plural, replacing /s/ with /ʃ/. The forms in which no non-palatalised final segments appear such as *pros-ić* /prɔɕiʨ/ 'ask (for)' or *dus-ić* /duɕiʨ/ 'strangle' may be said to select for PR6, which replaces underlying /ʃ/ with /ɕ/. In any case, the reference to PR7 is unnecessary to account for the data in (24).

As I mentioned above, this paper is not a place to discuss the details of the morphophonology of Polish verbs. What I want to underline, is that the presence of a form ending in /ʃ/ within a given paradigm along with a form terminating in /ɕ/ within the same paradigm does not have to point to the alternations whose input is the former and the output is the latter segment.

8.2. Replacement of /t/ with /t͡ʃ/

The second alternation that needs to be discussed in some detail is /t/~/t͡ʃ/. Recall that if this mutation is indeed part of PR7, then the affixes marked for PR1 and PR7 compete for the input /t/ as the former replaces the dental plosive with /t͡ɕ/. Needless to say, the notion of 'competition' is incompatible with the basic principle of morphophonology, i.e. the Minimalist Hypothesis according to which all processes must take place whenever their conditions are met.

To begin with, it is important to ascertain that none of the derivational affixes presented in (21) triggers the replacement of /t/ with /t͡ʃ/. Neither does any inflectional desinence provoke the replacement of the dental plosive with the alveolar affricate. The /t/~/t͡ʃ/ alternation in Polish seems to be present only in two cases: (i) in few nominal and adjectival zero derivations and (ii) in the verbal system of the language. These very facts give reasonable grounds for suspicion as to enlisting this mutation next to the mutations like PR1 or PR5 triggered by inflectional and derivational suffixes merged with nouns.

Gussmann (2007: 129) exemplifies the /t/~/t͡ʃ/ alternation with an infinitive *plą-tać* /plɔntaʨ/ 'to confuse' and the 1ˢᵗ person present tense form of the same verb i.e. *plącz-ę* /plɔnt͡ʃɛ/. In fact the alveolar affricate is present in the entire paradigm of the present tense (but not the past tense) of this verb. The alternation is also well attested in the present tense paradigms of denominal onomatopoeic verbs like *chich-ot-ać* / ɕixɔtaʨ/ 'to giggle', *gruch-ot-ać* /ɡruxɔtaʨ/ 'to crash' or *łop-ot-ać* /wɔpɔtaʨ/ 'to flap', which surface as *chich-ocz-ę* /ɕixɔt͡ʃɛ/, *gruch-ocz-ę* /ɡruxɔt͡ʃɛ/ and *łop-ocz-ę* /wɔpɔt͡ʃɛ/ in the 1ˢᵗ person singular present tense.

Turning to the examples of the /t/~/t͡ʃ/ mutation attested in adjectival zero derivations, the relevant cases that I know are not numerous. These are *rob-ot-a* /rɔbɔta/ 'work, nom. sg. fem.' – *rob-ocz-a* /rɔbɔt͡ʃa/ 'connected with work, nom. sg. fem.' and *och-ot-a* /ɔxɔta/ 'willingness, fem.' – *och-ocz-a* /ɔxɔt͡ʃa/ 'willing, nom. sg. fem.', in both cases it is an intermorph -ot- that undergoes the change. That the replacement of /t/ with /t͡ʃ/ is yet another instance of morpheme-specific alternation is evidenced by the existence of roots which, when merged with the zero adjectival morpheme and relevant number-gender-case endings, show different mutations from the /t/~/t͡ʃ/ mutation under investigation. These are, e.g. *kret* /krɛt/ 'mole, nom.sg.' - *kreci-a* /krɛʨa/ 'adj, nom. sg. fem.' showing PR1, *kobiet-a* /kɔbʲɛta/ 'woman, nom. sg. fem.'

– *kobiec-a* /kɔbʲɛt͡sa/ 'feminine, nom. sg. fem.' or *sierot-a* /ɕɛrɔta/ 'orphan, nom. sg. fem.' – *sieroc-a* /ɕɛrɔt͡sa/ 'adj, nom. sg. fem.', in which Gussmann's PR3 is observed.

Interestingly enough, there also exist cases of noun-adjective pairs in which it is the former category that terminates in the alveolar affricate, whereas the latter has /t/. These are *brod-acz* /brɔdat͡ʃ/ 'bearded man, nom. sg.' – *brod-at-y* /brɔdatɨ/ 'bearded, nom. sg.', *bog-acz* /bɔgat͡ʃ/ 'richman, nom.sg.' – *bog-at-y* /bɔgatɨ/ 'rich, nom.sg.', *sęk-acz* /sɛŋkat͡ʃ/ 'tree cake, nom. sg.' – *sęk-at-y* /sɛŋkatɨ/ 'gnarled, nom. sg.', *kudł-acz* /kudwat͡ʃ/ 'mophead, nom. sg.', *kudł-at-y* /kudwatɨ/ 'tousle-haired, nom.sg.', *rog-acz* /rɔgat͡ʃ/ 'stag, nom. sg.', *rog-at-y* /rɔgatɨ/ 'horned, nom.sg.' and *wąs-acz* /vɔ̃ʷsat͡ʃ/ 'moustached man, nam. sg.', *wąs-at-y* /vɔ̃ʷsatɨ/ 'moustached, nom. sg.'. As is visible from the examples, the alternation does not concern the root-final consonant but the final segment of the *-acz-/-at-* /at͡ʃ～at/ affix, if anything.

In fact it can be the case that the data at hand do not illustrate a genuine alternation between /t/ and /t͡ʃ/ but simply show a set of roots from which nouns and adjectives are derived by means of two separate endings: *-acz-* /at͡ʃ/ and *-at-* /at/. This may be argued for as there exist roots that are nominalised by means of *-acz-* /at͡ʃ/ but do not have adjectives in *-at-* /at/. Within this group fall *grzyw-acz* /gʒɨvat͡ʃ/ 'whitecap, nom. sg.', *sił-acz* /ɕiwat͡ʃ/ 'strongman, nom. sg.', *warg-acz* 'Sloth bear, nom.sg.', *głow-acz* /gwɔvat͡ʃ/ 'Bullhead, nom. sg.'. To this group one could also add a panoply of examples in which *-acz-* /at͡ʃ/ serves as an agentive suffix added to roots which are intuitively 'of verbal nature'. These are *kop-acz* /kɔpat͡ʃ/ 'digger, nom. sg.', *miot-acz* /mʲɔtat͡ʃ/ 'pitcher, nom. sg.', *tk-acz* /tkat͡ʃ/ 'weaver, nom.sg.', *bieg-acz* /bʲɛgat͡ʃ/ 'runner, nom. sg.', *łam-acz* /wamat͡ʃ/ 'breaker, nom. sg.', *woł-acz* /vɔwat͡ʃ/ 'vocative, nom. sg.' as well as many others.

If one assumes that in all these items a mutation of underlying /t/ to /t͡ʃ/ takes place, one is compelled to claim that in the overwhelming majority of cases *-at-* is subject to a free ride as there is absolutely no evidence for the presence of /t/ at any level of derivation.

Similarly, one finds examples of adjectives in *-at-* /at/ the bases of which are not nominalised with the use of *-acz-* /at͡ʃ/. These are *usz-at-y* /uʃatɨ/ 'long-eared, nom.sg.', *puch-at-y* /puxatɨ/ 'fluffy, nom. sg.', *łaci-at-y* /wat͡ɕatɨ/ 'patchy, nom. sg.', *szczerb-at-y* /ʃt͡ʃɛrbatɨ/ 'gap-toothed, nom. sg.' and many others. These are, however, much less frequent than the nominals in *-acz-* /at͡ʃ/, which follows naturally from the fact that whereas *-acz-* is classified as productive in Polish by Grzegorczykowa and Puzynina (1998: 400–401), *-at-* is non-productive according to Kallas (1998: 494).[15] This is rather unexpected under the assumption that both suffixes share the same underlying representation ending in /t/.

In sum, /t/ to /t͡ʃ/ alternation is a morpheme-specific change attested only in a handful of examples outside the verbal system of Polish. In fact its very existence

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[15] Here it is necessary to mention the case of what seems to be a complex adjectival suffix *-ow-at-* as in *pieg-ow-at-y* 'freckled, nom.sg.' which is classified as separate from *-at-* by Kallas (1998: 494) due to its specific semantic characteristics and productivity. What is important, in Polish there are no examples of *-ow-a*[t]- ~ *-ow-a*[t͡ʃ]- alternation.

may be called into question as the majority of nouns in *-acz-* /t͡ʃ/ do not have adjectives in *-at-* /at/ and a substantive number of adjectives in *-at-* do not show nominals in *-acz-*. This fact puts into doubt the interpretation by which speakers postulate one underlying representation for *-acz-/-at-* having very little evidence for it. Postulating two separate morphemes seems at least as much plausible.

To sum up, the investigation of the two problematic replacement patterns casts serious doubt on their status as parts of the PR7 set. The replacement of /ʃ/ with /ɕ/ is not triggered automatically by a diminutive *-ik-/-yk-* but is either a function of lexically marked segments c-commanded by this affix or is enlisted in the lexical representation of the handful of roots in which it is attested. Its presence within verbal paradigms is also far from unproblematic as the roots which show the relevant fricative mutation terminate in /ɕ/ in the vast majority of forms and show different alternations when merged e.g. with nominal morphemes (c.f. *głos-ić* /ɡwɔɕit͡ɕ/ 'to preach' – *głos* /ɡwɔs/ 'voice, nom.sg.'). Similarly, the second alternation which is problematic for the model of morpho-phonology advocated here, i.e. the replacement of /t/ with /t͡ʃ/, is highly restricted outside the verbal system of Polish. In the set of zero-derived adjectives it is confined to a small set of items like *rob-ot-a* /rɔbɔta/ 'work, nom.sg.fem.' – *rob-ocz-a* /rɔbɔt͡ʃa/ 'adj. nom.sg.fem.'. The alternation between *-acz-* and *-at-* may be called into question as the number of roots to which both these morphemes may be attached is extremely limited.

8.3. Replacements of /t͡s/ with /t͡ʃ/ and /d͡z/ with /ʒ/

Turning to the last two replacements enlisted by Gussmann under PR7 let me mention that their existence is not a counterexample to the mode of application of morpho-phonology argued for in this paper. To remind the reader, /t͡s/ ~ /t͡ʃ/ and /d͡z/ ~ /ʒ/ are triggered by the diminutive *-ik-/-yk-* /i ~ ɨk/ and *-(e)k-* /(ɛ)k/ morphemes, adjectival *-n-* /n/, *-ist-/-yst-* /i ~ ɨst/ and *-ast-* /ast/ morphemes as well as the nominalising *-nik-* /ɲik/ and agentive *-arz-* /aʒ/ suffix. In none of these affixes do the relevant replacements trigger a conflict of diacritics or feed a replacement leading to ungrammatical outputs. At the same time, the two changes are exceptionless only in the case of two adjectival endings: *-ist-/-yst-* /i ~ ɨst/ and *-ast-* /ast/ so that sequences like *-c-yst-, *-dz-yst-, *-c-ast- and *-dz-ast- are systematically absent from Polish. In the case of the rest of the affixes the replacements are root-specific as evidenced by numerous examples in which the replacement does not take place. Here belong *kuc-yk* /kut͡sɨk/ 'pony, nom. sg.', *rydz-yk* /rɨd͡zɨk/ 'saffron milk cap, dim. nom. sg.', *kloc-ek* /klɔt͡sɛk/ 'block dim. nom. sg.', *s-chadz-ek* /sxad͡zɛk/ 'tryst, gen. pl. fem.', *po-moc-n-y* /pɔmɔt͡sni/ 'helpful, nom. sg.', *nędz-n-y* /nɛnd͡zni/ 'miserable, nom. sg.', *noc-nik* /nɔt͡sɲik/ 'potty, nom. sg.', *nędz-nik* /nɛnd͡zɲik/ 'scoundrel, nom. sg.' as well as *moc-arz-e* /mɔt͡saʒɛ/ 'strongmen, nom. sg.' and *przędz-arz-e* /pʃɛnd͡zaʒɛ/ 'spinners, nom. sg.' and several more. Those roots in which /t͡s/ and /d͡z/ are replaced by /t͡ʃ/ and /ʒ/ when merged with *-ik-/-yk-* /i ~ ɨk/, *-(e)k-* /(ɛ)k/, *-n-* /n/, *-nik-* /ik/ and agentive *-arz-* /aʒ/ have to be marked for the appropriate replacements. Consequently, the relevant replacement statements are similar to the one presented in (23).

Finishing off, one fact that must be highlighted here is that the verbal person-number endings that may be said to trigger the /t/ ~ /t͡ʃ/ alternation in verbs like *pląt-ać* /plɔntat͡ɕ/ 'to confuse' or *chich-ot-ać* / ɕixɔtat͡ɕ/ 'to giggle' do not trigger any other change that Gussmann subsumes under PR7. To be precise, they do not trigger the replacements of /t͡s/ with /t͡ʃ/ and /d͡z/ with /ʒ/, e.g. *śmiec-ę* /ɕmʲɛt͡sɛ/ 'I litter' and *siedz-ę* /ɕɛd͡zɛ/ 'I sit' surface with /t͡s/ and /d͡z/ respectively. Still more interesting, the derivational affixes that trigger these replacements do not trigger the replacement of /t/ with /t͡ʃ/. In other words, it looks as if the /t/ ~ /t͡ʃ/ and /t͡s/ ~ /t͡ʃ/ and /d͡z/ ~ /ʒ/ replacements are never triggered by the same morphemes. In light of this observation, grouping them together under PR7 seems ill-grounded.

The situation of the replacement of /ʃ/ with /ɕ/ (or /ɕ/ with /ʃ/), is different as the mutation is triggered by the *-ik-/-yk-* ending but, still, only in some roots, and by some verbal person-number categories (see 23, 24 and discussion above). These facts, however, do not point to /ʃ/ ~ /ɕ/ being part of PR7, especially since except for *-ik-/-yk-*, no derivational suffix triggers this fricative replacement.

On the other hand, since *-ist-/-yst-* /i-ɨst/ and *-ast-* /ast/ affixes regularly provoke /t͡s/ ~ /t͡ʃ/ and /d͡z/ ~ /ʒ/ mutations, it is undesirable to dispense with PR7 as presented by Gussmann altogether. However, the set of replacements presented in (20c) should be revised and given a form presented in (25).

(25) PR7 (revised version)

$$\begin{array}{cc} \text{/t͡s/} & \text{/d͡z/} \\ | & | \\ \text{/t͡ʃ/} & \text{/ʒ/} \end{array}$$

If the revised version of PR7 is accepted, the problems of the conflict between PR7 and PR1 over the input /t/ attested in *-ik-/-y-* /i-ɨk/, adjectival *-ist-/-yst-* /i-ɨst/ and *-ast-* /ast/, and nominal *-nik-* /ik/ and *-arz-* /aʒ/ affixes is eliminated. Similarly, one no longer has to do with a feeding between the PR5 /x/ with /ʃ/ and PR7 /ʃ/ with /ɕ/ replacement that led to unattested outputs of the **straś-n-y* /straɕnɨ/-type.

Although, the question of the exact identity of the two replacements eliminated from the PR7 has to be left for future research, it is safe to say that the solution is lexical. At this point let me only emphasise that the aim of this section was to show that there are no cogent reasons to treat /ʃ/ ~ /ɕ/ and /t/ ~ /t͡ʃ/ alternations as belonging together with the replacements presented in (25).

5. Conclusion

To finish off, one of the aims of this paper was to introduce principles limiting the expressive power of the replacement techniques. Although much work is still to be done, it may be said that the Minimalist Hypothesis and the Locality Principle are satisfactory solutions in that they place restrictions on what may be the trigger of

a segment replacement as well as what types of replacements are allowed to follow each other. It has to be emphasised, however, that the theory of morpho-phonology as outlined here still requires a device that would be capable of constraining what sets of segment is allowed to be replaced with what sets. In order to achieve that, a better understanding of the relations between the representational and procedural part of grammar as well as between the diachrony and the synchrony of the language is required.

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