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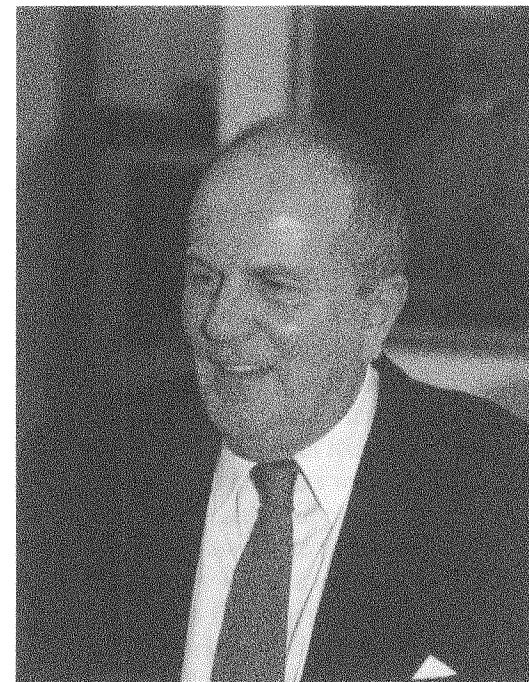
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## Contents

Preface .....	9
<i>Geert Booij</i> Phonology and the Dutch-Polish connection: a personal memoir .....	13
<i>Karolina Broś</i> Phrase-level obstruent voicing in Polish: a Derivational OT account .....	27
<i>Paweł Rydzewski</i> Canadian Raising and Flapping in Derivational Optimality Theory .....	47
<i>Anna Lubowicz</i> Vowel raising in Polish as contrast preservation.....	65
<i>Joanna Zaleska</i> On emergent underlying inventories in Optimality Theory .....	83
<i>Eugeniusz Cyran</i> Sonorant opacity without opaque segments.....	105
<i>Tobias Scheer</i> Western Slavic vowel lengthening before word-final sonorants and voiced obstruents.....	129
<i>Piotr Ruskiewicz</i> A tale of theagma in English.....	151
<i>Monika Opalińska</i> “Hearing the inaudible” – on scribal representations of phonological categories in medieval English verse.....	169
<i>Bartłomiej Czaplicki</i> Polish palatalisations: the role of frequency and phonological naturalness ...	185
<i>Christina Y. Bethin</i> Phonology-morphology interaction in Standard Belarusian: the a-stem common gender and masculine nouns.....	201

- Małgorzata E. Cavar*  
The elusive Polish [i]: partial results of an ultrasound imaging study.....215
- Iwona Kraska-Szlenk, Marzena Żygiś and Marek Jaskuła*  
Acoustic study of ĩ-vocalisation in Polish .....239
- Beata Łukaszewicz and Janina Mołczanow*  
Leftward and rightward stress iteration in Ukrainian: acoustic evidence  
and theoretical implications .....259



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Courtesy of Paweł Rubach

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## Western Slavic vowel lengthening before word-final sonorants and voiced obstruents

### Abstract

The article shows that there is a purely phonetic perspective on the Western Slavic instantiation of vowel lengthening before sonorants and voiced obstruents. This pattern is infamous for its lexical idiosyncrasy (at any diachronic stage, only an arbitrarily selected set of words show relevant alternations), and it is peculiar in that lengthening occurs only if the triggering consonants are word-final. In a study on English, Klatt (1973) documents that both conditioning factors, i.e. the presence of a voiced obstruent or a sonorant and the word-finality of these consonants, may be active in a purely phonetic conditioning. This makes an analysis viable where the process was never present in phonological computation of any diachronic stage: it was phonologized in such a way that phonetic length was recorded in the lexical entry of individual words. This lexicalization concerned individual words, i.e. covered the lexicon in an arbitrary way and triggered an allomorphic management of ensuing alternations. This analysis vaults the phonological computation stage of the canonical life cycle. It roots in the idea that spontaneous and non-spontaneous voicing are truly waterproof. In the phonetics any articulation that is pronounced with vibrating vocal folds is voiced. Therefore, phonetics is unable to make a difference between the voicing of sonorants/vowels and the voicing of obstruents. In the phonology, though, only obstruents are specified for voicing. The voicing of sonorants and vowels is irrelevant and invisible, and phonological computation takes it into account under no circumstances.

**Keywords:** vowel lengthening, sonorant voicing, Laryngeal Realism, Polish and Czech back vowel raising, Polish nasal vowels

### 1. The plot: phonological specification of voicing in sonorants and vowels?

So-called Cracow voicing (or Cracow-Poznań voicing) is a well-studied phenomenon (Bethin 1984, 1992, Gussmann 1992, Rubach 1996, Cyran 2011, 2012, 2014) whereby word-final voiceless obstruents (such as in *jak* “how”) are voiced when the following word begins with a voiced obstruent (*ja[g] dobrze* “how well”), a sonorant (*ja[g] mozesz* “how can you”) or a vowel (*ja[g] oni* “how they”).

This is unexpected, given the distinction between spontaneous (sonorants and vowels) and non-spontaneous (obstruents) voicing (Chomsky & Halle 1968: 300f): the non-phonological character of voicing in sonorants and vowels, as opposed to phonologically controlled voicing in obstruents, sits on a solid empirical record that is consensual in all phonological quarters.<sup>1</sup> For example, sonorants and vowels do not undergo final devoicing because their voicing is phonologically irrelevant, while the voicing of obstruents is subject to manipulation by phonological processes. Hence sonorants and vowels should be unable to transmit their voicing to obstruents – which is what they do in Cracow voicing, though.

The Cracow voicing pattern is not isolated: it occurs in a number of other languages (always in external sandhi) such as Catalan (Wheeler 1986, Bermúdez-Otero 2006), West Flemish (De Schutter & Tældeman 1986), Breton (Krämer 2000) and Durham English (Gussenhoven & Jacobs 2011: 196). Beyond this specific pattern, cases where sonorants (and vowels) appear to have phonologically active voicing are documented by, among others, Rice & Avery (1989), Piggott (1992), Rice (1993), Avery & Idsardi (2001) and Clements & Osu (2002: 338). Botma (2011) provides a comprehensive overview of the issues at hand.

The standard analysis (on which more in section 2 below) introduces the voicing of sonorants and vowels into the phonological representation of these segments, and then allows for it to be subject to phonological computation. On the pages below, it is first recalled that there is an alternative analysis by Cyran (2014) based on Laryngeal Realism whereby the transmission of voicing does not occur in the phonology but is phonetic in kind. On this view, sonorants and vowels are never phonologically specified for voice. In a second step, a different phenomenon is introduced where like in Cracow voicing the voicing of sonorants has phonological consequences, although it is not transmitted to obstruents: vowel lengthening before voiced obstruents and sonorants. This pattern is illustrated by a case found in Western Slavic which has the peculiarity that vowels are lengthened by following sonorants and voiced obstruents only if these are word-final. Remnants of this process are o-u alternations in Polish and Czech (*noż* / *nůž* [nuʃ] - *noż-e* / *nož-e* [noʒɛ] “knife Nsg, Gsg”) and nasal vowel alternations in Polish (*zqb* [zɔmp] - *zqb-u* [zɛmbu] “tooth Nsg, Gsg”).

1 The distinction is also at the origin of the largely consensual idea that the “natural (or unmarked) state” of sonorants and vowels is to be voiced, while the archetypical obstruent is voiceless. This view is also supported by evidence from first language acquisition: children acquire voiceless before voiced obstruents (e.g. Major & Faudree 1996: 71).

Vowel lengthening before voiced obstruents and sonorants occurs in many languages: it is well documented in the phonetic literature and possibly universal (Chen 1970, Delattre 1962, Maddieson 1996: 164f, 1999). It therefore does not make sense to duplicate in the phonology what phonetics provides for anyway. When phonetic variation produces category-changing, i.e. phonemic alternations, though, it must somehow be present in the phonology. This is the case for the Western Slavic pattern, at least since phonetic length was converted into vowel height when long oo was raised to uu (but short o remained unchanged) and into a front-back distinction when short ą was fronted to ę in Polish (while long ąa was not modified) through independent diachronic processes.

I argue below that the way the original phonetic trigger was carried into phonology is through phonologization of phonetic length in the lexical entries of items, rather than by devising a phonological process  $o \rightarrow u / \_C_{+voice} \#$ . Such a process, it is contended, was never present in the synchronic phonological computation of any diachronic stage. That is, the random coverage of the lexicon and unpredictable exceptions to the alternation at hand which is observed since the oldest records (Old Polish and Old Czech) witness lexical idiosyncrasy. The difference between modern Polish *rząd* - *rzęd-u* “row Nsg, Gsg” and *rząd* - *rząd-u* “government Nsg, Gsg” is thus lexical in kind and synchronically managed by allomorphy (or maybe suppletion) within inflectional paradigms: two allomorphs are stored for “row”, /*rząd*/ and /*rzęd*/. The former is selected in Nsg and Asg, while the latter is implemented elsewhere. In Old Polish and Old Czech where the alternations were slightly more regular but just as unpredictable, the same allomorphic (or suppletive) workings were in place.

Finally, the extra condition concerning the right word edge looks like a phonological ingredient of the pattern. How could vowel lengthening be phonetic in these circumstances, i.e. when it occurs only before word-final (voiced) consonants? It turns out that this pattern may also be produced by the phonetics: in English,  $V_x$  in  $CV_x C\#$  is significantly longer in duration than it is in  $CV_x CV\#$  (Klatt 1973).

In conclusion, the Western Slavic pattern was born in the phonetics and then recorded in the phonological makeup of morphemes on a lexically idiosyncratic basis. The alternations were allomorphic (or suppletive) in kind from day one. As a consequence, sonorants (and vowels) are not (and have never been) phonologically specified for voice, and phonological computation does not (or rather: cannot) make reference to the voicing of sonorants (and vowels). This suggests that Cyran’s purely phonetic analysis of Cracow voicing where voiceless obstruents are assimilated may be on the right track: the voicing of sonorants and vowels does bear on their environment, but never in the phonology.

## 2. Obstruents voiced by sonorants and vowels in the phonology

The standard way of expressing the phonological relevance of the voicing in sonorants and vowels is laid out in Rice (1993): there are two distinct (phonological) primes, [voice] and [sonorant voice]. The former is found only in obstruents, while the latter is present in sonorants and vowels as well as in certain obstruents – in those, precisely, whose voicing interacts with sonorants and vowels. Rice (1993) has coined the term *sonorant obstruent* for these. Voicing in sonorants and vowels can then be transmitted to (sonorant) obstruents simply by spreading [sonorant voice]. There is also an Element-based version of this take: Botma (2004: 56f) argues that L is the head in sonorants, but only an operator in sonorant obstruents (also Botma & Smith 2006). Honeybone (2002: 232, 2005) also uses unary primes but happily implements laryngeal specifications into sonorants (which are then spread onto obstruents).

Another way of making both types of voicing distinct in principle but combinable in the phonology when needed is exposed by Itô & Mester (1986: 59f). On their account, there is only one feature [ $\pm$ voice]. Redundant values of this feature are absent lexically and only come into being at the end of the derivation by default-filling. Since [+voice] is redundant for sonorants, it is absent until the end of the derivation and therefore cannot be spread to obstruents. Obstruents on the other hand are unspecified for [-voice], which is only filled in by default when no voice value is present at the end of the derivation. This makes spontaneous and non-spontaneous voicing waterproof (only obstruents are lexically specified for [voice]), but modifying the stage in the derivation (in a rule-ordering environment) where default filling of redundant features occurs will allow for both worlds to interact. Hence, if [+voice] is filled into sonorants before the end of the derivation and a voice assimilation rule applies after that, the voicing of sonorants will be able to spread to obstruents. Default filling of [+voice] into sonorants is also an ingredient of Bethin's (1992) and Rubach's (1996) analyses of Cracow voicing.

These approaches uphold the distinction between spontaneous and non-spontaneous voicing in one way or another (distinct features, lexical presence vs. absence of a feature), but allow for sonorants and vowels to be phonologically specified for voicing, and this voicing then undergoes phonological computation. In other words, there are two types of voicing which in principle both qualify for participating in phonological computation but usually do not mix. On some occasions, though, they do.

## 3. Obstruents voiced by sonorants and vowels in the phonetics: Laryngeal Realism, modular spell-out

An alternative view is expressed by Cyran (2011, 2012, 2014) and Scheer (2015, in press): sonorants and vowels never bear any phonological specification for voicing, and their voicing is never taken into account by phonological computation. Since they do impact obstruents, though, the communication with other segments can only be phonetic in kind: at the phonetic level there is only one type of voicing (voicing of obstruents, sonorants and vowels is the same), and hence sonorant/vowel voicing can bear on obstruents.

The difference between phonetic and phonological voicing has been central since the 90s when it was understood that there are two types of laryngeal systems:<sup>2</sup> one where voiced obstruents are phonologically specified as such (while voiceless obstruents have no phonological specification), another where voiceless obstruents bear a phonological instruction to be voiceless (while voiced obstruents are phonologically unspecified for voicing). This insight is known as Laryngeal Realism (Harris 1994, Iverson & Salmons 1995, Avery & Idsardi 2001, Honeybone 2002, 2005, Ringen & Kulikov 2012): it requires two distinct and privative (i.e. non-binary) primes responsible for voicing, [voice] and [spread glottis] in feature systems, L and H when unary primes are used. L/[voice] provide a phonological instruction for voicing, while H/[spread glottis] impose phonologically controlled voicelessness. In two-way laryngeal systems, then, only one prime is used: voicing languages such as Romance and Slavic only have L/[voice], while in (so-called) aspiration languages such as Germanic only H/[spread glottis] occurs. In both systems, the category that has no phonological specification for laryngeal behaviour is called neutral, transcribed here as C<sup>°</sup>. Hence, voicing languages oppose C<sup>L</sup> : C<sup>°</sup>, while aspiration languages contrast C<sup>H</sup> : C<sup>°</sup>. While the pronunciation of the actively specified categories C<sup>L</sup> and C<sup>H</sup> is commanded by the phonology and hence does not vary, the voicing of the neutral consonants C<sup>°</sup>, escaping phonological control, is a matter of contextual and/or systemic properties. Languages using H/[spread glottis] are called aspiration languages since often C<sup>H</sup> is not only pronounced voiceless, but also aspirated.

2 The neogrammarians already were aware of this fact: Sievers (1901: §181) writes that “on the other hand it needs to be admitted that there are languages that oppose voiceless sounds of different strength. The Swiss for example distinguish the syllables pa and ba, ta and da based on a stronger pressure on p,t, which is weaker on b,d. But both types of sounds are voiceless” (translation mine). For more detail see Scheer & Ségéral (2016).

This, then, allows C° to not take on any contextual voicing, and the result is a language like Danish (or the Swiss variety described by Sievers in note 2) where the surface contrast is between voiceless aspirated (C<sup>h</sup>) and voiceless non-aspirated (C°) obstruents. In other systems C<sup>h</sup> may be spelt out without aspiration, a fact that forces C° to take on some voicing from the phonetic environment in order for the two series to be distinct on the surface. Since this voicing comes from the phonetic environment and is not controlled by the phonology, it is called *passive voicing*. Aspiration and passive voicing in individual H/[spread glottis] languages may also be contextually distributed: in English for example, C<sup>h</sup> is aspirated word-initially and before stressed vowels, but unaspirated elsewhere. This gives leeway for word-initial C° to be more or less passively voiced, while C° needs to be passively voiced in contexts where C<sup>h</sup> is non-aspirated in order to guarantee a surface distinction. This produces a situation where word-initial C°s are voiced to different extents across dialects.

Laryngeal Realism shows two things that are relevant for the analysis of cases where the voicing of sonorants and vowels interacts with other segments.

- (1) consequences of Laryngeal Realism
  - a. there is a language-specific, idiosyncratic and unpredictable relationship between phonological categories and the way they appear on the surface (CH may or may not be pronounced as aspirated).
  - b. the phonetic voicing of obstruents may be phonological (CL in L/[voice] languages) or passive (i.e. phonetic, in H/[spread glottis] languages) in kind. When passively voiced, obstruents do receive voicing from sonorants and vowels, but this transmission occurs in the phonetics and has nothing to do with phonology.

(1)a is called *phonetic interpretation* in Government Phonology (Harris & Lindsey 1995: 46ff, Harris 1996, Gussmann 2007: 25ff). Phonetic interpretation is the idea that sound patterns may not only be due to phonological and phonetic regularities, but also to a list-type relationship that relates phonological and phonetic categories upon conversion of the former into the latter. For example, the classical analysis of the fact that in Polish some *e*'s palatalize (Lsg *-e* as in *lot - loci-e* "flight Nsg - Lsg") while others do not (Isg *-em* as in *lot - lot-em* "flight Nsg - Isg") is phonological. That is, the *-e* of the Isg morpheme is front on the surface, but not underlyingly (Rubach 1984): the morpheme identifies as /-ym/ lexically and therefore does not cause palatalization. It is turned into /-em/ by a (context-free) phonological rule at the appropriate derivational stage, i.e. after palatalization has applied.

Instead of having the job done by phonological computation, the phenomenon may also be viewed as purely interpretational: like Rubach, Gussmann (2007: 56ff) holds that there are two distinct items in Polish that appear as [ɛ] on the

surface, palatalizing I-A that occurs in Lsg and non-palatalizing \_I-A that is found in Isg (heads are underscored and “\_” is an empty head). These are distinct in the lexicon and remain unaltered during phonological computation. Phonetic interpretation then converts the output of phonology into phonetic objects. The conversion works like in a multi-lingual dictionary (because phonological and phonetic items belong to two distinct sets of vocabulary, just like words of two distinct languages do): it is unpredictable (there is no reason why, say, English *table* has the Polish equivalent *stół* rather than *dom*) and thus conventional and arbitrary. Equivalences are language-specific and thus part of the systemic settings of each language (in the structuralist sense). They are stored in long-term memory and must therefore be learned in the same way as inventories. The specific Polish convention is that the two phonological objects I-A and \_I-A are spelt out as the same phonetic object [ɛ] – in other words, the phonological contrast is neutralized in pronunciation. On this analysis, the neutralization of the lexical contrast (/e/ vs. /ɛ/ with Rubach, I-A vs. \_I-A with Gussmann) is not operated by phonological activity: phonology does not know (or care) how the items it manipulates end up being pronounced. Rather, the neutralization is interpretational in kind, i.e. occurs post-phonologically when phonological vocabulary is converted into phonetic items.

In a modern modular environment where the same interface mechanisms govern the conversion of morpho-syntactic into phonological vocabulary (upper interface) and the translation of phonological into phonetic items (lower interface), phonetic interpretation is a spell-out operation (just like the conversion of, say, “past tense” into *-ed* in English is due to spell-out). The modular perspective holds that the conversion (at both interfaces) involves the same matching of lists (“past tense” ↔ *-ed*, I-A ↔ [ɛ]), and hence is non-computational. As a consequence, the match of phonological and phonetic items is arbitrary (Boersma 1998, Hamann 2011, 2014). The modularity-based take on the phonology-phonetics interface is discussed in Scheer (2014).

## 4. Western Slavic vowel lengthening before sonorants and voiced obstruents

### 4.1 Old Czech and Old Polish

When word-final yers were lost, languages in the Western area of the Slavic territory lengthened the preceding vowel. Vowel lengthening is recorded for Western Slavic (except for Lower Sorbian) as well as the westernmost languages of South Slavic (Serbo-Croatian and Slovenian). Given that the process seems to relocate

the vocalic unit that disappears on the preceding vowel by making it long, it is traditionally described as compensatory lengthening. The process in its various guises, its geographic extension and possible restrictions to a subset of vowels is described e.g. in Bethin (1998: 96ff), Timberlake (1983a,b), Kavitskaya (2002: 119ff), Shevelov (1964: 447f), Carlton (1991: 215ff), Vondrák (1924: 309-320), Rospond (1979: 65ff), Stieber (1973: §§38-43) and Sanders (2003: 57ff). In all languages where it occurs lengthening is irregular, covering only an unpredictable subset of the words that offer the triggering context. Sometimes also words that should not undergo the process do display lengthening. This is true for all diachronic stages of the languages at hand, including the oldest record available. Given its geographical extension, lengthening is assumed to have occurred in late Common Slavic (CS).

Some illustration is provided under (2) below where the Nsg marker of masculines is used: the loss of CS *-ь* produces length on the preceding vowel (in Old Czech and Old Polish length is marked by an acute accent), while markers such as Gsg were regular vowels in CS that were not lost and hence did not trigger any modification.

(2) Slavic: vowel lengthening after the loss of final yers

CS	Nsg dol-ь	Gsg dol-u	Nsg bog-ь	Gsg bog-a	Nsg most-ь	Gsg most-u
a. Old Polish	dól	dol-u			most	most-u
b. Old Czech	dól	dol-u	bóh	boh-a	most	most-u
c. Serbo-Croatian			bôg	bôg-a	môst	môst-a

It is unclear, though, whether there is really a causal relation between the dropping of final yers and the lengthening observed. Shevelov (1964: 447) says that the lengthening is "customarily called compensatory": the facts could as well be covered by saying that vowels lengthen before word-final consonants. Carlton (1991: 217-219) and Sanders (2003: 60f) discuss reasons to doubt the compensatory causality for Western Slavic. Whatever the initial trigger of the lengthening, Stieber (1973: §41) demonstrates that in 15<sup>th</sup> century Polish there was an active process in the language that lengthened vowels before word-final (voiced, see below) consonants: loans that were present then (but absent when yers were lost, an event that occurred long before the 15<sup>th</sup> century) appear with a lengthened vowel, e.g. *Adaam*, "Adam", *staal* "steel", *captuur* "hood", *ghaan* (modern spelling: *chan*) "khan". Hence at least in Old Polish the position before a word-final consonant (not the loss of a following vowel) is responsible for lengthening.

Crucial for our purpose is that in Polish and Czech (but also Lower Sorbian and probably members of Lechitic other than Polish, i.e. Polabian and Kashubian), lengthening

only occurred if the final consonant was either a voiced obstruent or a sonorant. The pattern may thus be described as under (3). Note that here and below the data are restricted to the vowel *o*, which of all vowels is most inclined to undergo lengthening.<sup>3</sup>

(3)  $o > oo / \_ C_{+voice} \#$  where  $C_{+voice}$  = sonorants and voiced obstruents

(4) Old Czech  
lengthening before word-final sonorants (R) and voiced obstruents (D)

	alternating roots				non-alternating roots	
	Nsg masc.		Gpl fem./neutr.		Nsg masc.	
	Nsg	Gsg	Nsg	Gsg	Nsg	Gsg
___D	bóh	boh-a	noh-a	nóh	roh	roh-u
	nóz	nož-ě	vod-a	vód	stoh	stoh-u
	vóz	voz-u	slov-o	slóv	bob	bob-u
	poss.	-ov-a			lov	lov-u
	-óv					
	Dpl -óm				kov	kov-u
					rod	rod-u
___R	stól	stol-u	hor-a	hór	bor	bor-u
	dvór	dvor-a	škol-a	škól	hrom	hrom-u
	mój	moj-ě			strom	strom-u
	dóm	dóm-u			lom	lom-u
	sól	sol-i			zvon	zvon-u
	vól	vol-u			hon	hon-u
	pól	pol-u			boj	boj-ě
	hnój	hnoj-ě				
___T	rok	rok-u				
	brok	brok-u				
	krok	krok-u				
	tok	tok-u				

Illustration for Old Czech is provided under (4) where lengthening occurs in *bóh* (before a voiced obstruent) and *dól* (before a sonorant), but not in *rok* (before a voiceless obstruent).<sup>4</sup> Note that R is shorthand for sonorants, D for voiced and T for voiceless obstruents.

3 The situation of this vowel is also easier to assess since (like *e*) it was always short in CS. Hence, long *o* in historically recorded languages can only be the result of lengthening: there is no original long *oo*, which would have occurred in any context (i.e. followed by any consonant).

4 The Western Slavic situation is described by Pedersen (1905: 305) and Vondrák (1924: 309-320), Old Czech and its further development is discussed in Gebauer (1963 [1894]: §502c), Hujer (1946: 93f), Komárek (1969: 73f, 1982: 30f) and Trávníček (1935: §§259-261), while the Old Polish pattern is exposed in Stieber (1958: 17f, 1973:



As was mentioned, the alternation is far from covering the entire lexicon in Old Czech. There are disobeying items both ways: those where the triggering environment is met but which do not show lengthening (roh - roh-u, bob - bob-u, stoh - stoh-u, bor - bor-u), and those where lengthening should not occur because the following sonorant or voiced obstruent is not word-final: hróz-a, stvór-a, mór-a, smól-a. These cases are usually explained by analogy. Note that it is still true that the root-final consonant of the latter items is voiced: their Gpl forms hróz, stvór, mór, smól instantiate the context for lengthening, and the lengthened form may then have been lexicalized.<sup>5</sup>

The situation is about the same in Old Polish: the root vowel is lengthened before final voiced obstruents (but not before vowel-initial inflectional markers) for example in *bóg, bób, róg, nóž, wóz, miód, wróg, chłód, gród, zlob* and final sonorants as in *dól, stól, sól, dvór, mój, król, tchórz*. When comparing Old Czech and Old Polish, the incomplete and unpredictable coverage of the lexicon is illustrated: the aforementioned Old Czech roh - roh-u, bob - bob-u should have lengthened but did not, while in Old Polish they did: róg - rog-u, bób - bob-u. On the other hand, Old Polish dom - dom-u should have lengthened but did not, but Old Czech displays regular dóm - dom-u.

Finally, note that Old Polish had (only) one nasal vowel, nasal o (written <ą>), which also underwent lengthening before word-final sonorants and voiced obstruents, as for instance in *ząb - ząb-u* "tooth Nsg, Gsg" (Stieber 1973: §35, Carlton 1991: 128f).

## 4.2 Evolution in the modern languages

The developments shown under (5) below have occurred since Old Czech and Old Polish. They have further obscured the already irregular pattern, to the effect that the alternations in Modern Czech and Modern Polish are entirely unpredictable and lexicalized. Since Old Czech and Old Polish analogy has worked in both ways: it levelled out alternations where they are rightful (for example in Gpl forms in Czech: OCz *vod-a - vód* "water Nsg, Gpl" > MCz *vod-a - vod*) and created them where they have no grounds (e.g. before voiceless consonants

in Polish as in *sobot-a - sobót* "Saturday Nsg, Gpl", *powrót - powrot-u* "return Nsg, Gsg" etc.).

The modern situation with all its ins and outs is described by Bethin (1979: 253f, 259), Gussmann/Gussmann, 1980 #773; Bethin, 1979 #3951£ (1980: 53f, 113ff, 2007 : 261ff), Szpyra (1989: 160ff, 1992: 288ff) and Grzegorzczkova (1999: 114ff) for Polish and by Trávníček (1951: §12) for Czech.<sup>6</sup>

(5) developments since Old Czech / Old Polish

	Czech	Polish
1. final devoicing	nóż [nɔɔʒ] > nóž [nɔɔʃ]	nóz [nɔɔʒ] > noż [nɔɔʃ]
2. raising oo > uu	nóż [nɔɔʃ] > nūž [nuuʃ]	nóz [nɔɔʃ] > nóž [nuuʃ]
3. short ą > ę	–	ząb-u > zęb-u

In addition, Polish has lost distinctive vowel length. In Czech where vowel length is still distinctive today, [ɔ] thus alternates with [uu] (spelt <ú>): *nūž* [nuuʃ] - *nož-e* [nɔʒɛ].<sup>7</sup> In Polish, since length was lost it is only because of the raising oo > uu that the alternation is still visible: long [ɔɔ] is [u] today (spelt <ó>), while short [ɔ] is unchanged, to the effect that *nóz* [nuʃ] alternates with *nož-a* [nɔʒa]. The same goes for the nasal vowels: the short-long contrast is only preserved because the short nasal vowel became front. As a result, the alternation type exemplified by *ząb* [zɔmp] - *zęb-u* [zembu] "tooth Nsg, Gsg" occurs.

Note that in both languages final devoicing has obliterated the surface trigger: final voiced obstruents are no longer voiced on the surface. Hence, a phonetic account based on surface voicing is out of the question. It is also ruled out since in the modern languages the alternation involves a category change: o and u/uu are different phonemes (unlike the original short-long distinction).

Category changes in the modern languages can thus only be due to phonological patterning. But even in Old Czech and Old Polish, the unpredictable lexical idiosyncrasy strongly suggests that the alternation was always lexicalized, from day one: a process like (3) was never carried out by phonological computation. Rather, phonetic length was phonologized through a modification of the lexical entry (restructuring). Synchronic alternations in inflectional paradigms (in the old

§38f), Klemensiewicz (1964: 52f), Rospond (1979: 65ff) and Długosz-Kurczabowa & Dubisz (1993: 79ff).

5 It seems that there is only one word in Old Czech where lengthening occurs before a (word-final) voiceless obstruent: *póst - post-u* "fasting Nsg, Gsg" (> mod. Cz. *půst - púst-u*).

6 The situation of Polish nasal vowels is specifically discussed in Gussmann (1980a: 54, 84ff, 2007: 269ff), Rubach (1984: 130ff, 229f), Szpyra (1989: 163ff, 1995: 104) and Bethin (1992: 62ff).

7 There are only 20 roots left that display the alternation, with long vowels only in Nsg: *hnūj - hnoje; lūj - loje; mūj - moje; tvūj - tvoje; svūj - svoje; stūj ! - stojím; stūl - stole; sūl - soli; dūl - dolu; hūl - hole; kūl - kolu - kūlu; pūl - polovina; vūl - vola; dūm - domu; kūň - koně; dvūr - dvoru; -ūv - -ova; vūz - vozu; nūž - nože; būh - bohu.*

and modern languages) are then the result of the introduction of vowel length just in the form where it occurred (Nsg and Gpl) without this affecting other forms. In other words, there was no common underlier anymore in these cases, but rather two allomorphs. Table (6) below contrasts an instance of this restructuring with a word where phonetic length was not lexicalized.<sup>8</sup>

(6) genesis of lexical idiosyncrasy in Old Czech

	phonetic length lexicalized		phonetic length not lexicalized	
	Nsg	Gsg	Nsg	Gsg
phonetic lengthening	/bog/ → boog	/bog-a/ → boga	/rog/ → roog	/rog-u/ → rogu
Old Czech	/boofi/ → boofi	/bofi-a/ → boha	/rofi/ → roofi	/rofi-u/ → rofiu
final devoicing	/boofi/ → boox	/bofi-a/ → boha	/rofi/ → roox	/rofi-u/ → rofiu
raising oo → uu	/buufi/ → buux	/bofi-a/ → boha	/rofi/ → rox	/rofi-u/ → rofiu
Mod. Czech	bůh [buux]	boha [bofia]	roh [rɔx]	rohu [rofiu]

Given this situation, the modern alternations are lexicalized, i.e. managed by allomorphy (or suppletion): two lexical items are associated to the meaning “God” in Modern Czech: /buufi/ and /bofi/. The former is selected in Nsg and Asg contexts, while the latter appears elsewhere. On the other hand, there is just one lexical item associated to “angle”: /rofi/.

### 4.3 A once regular phonological process?

While it would be hard to make a case for the modern situation to be managed by a phonological or phonetic regularity, a phonological process such as under (3) can be argued to have existed when the alternation was originally innovated. Following the life cycle of phonological processes (Baudouin de Courtenay 1895, Vennemann 1972, Bermúdez-Otero 2014), the innovation of such a process is achieved by phonologizing an existing phonetic pattern. Given its phonetic origin, the phonological process is completely regular at first and may then acquire morphological and lexical conditions. In this perspective, the Old Czech and Old Polish situation represents an already advanced stage in the life of the original vowel lengthening where alternations are lexicalized. As was mentioned, the

<sup>8</sup> Note that there is no phonetic length due to following word-final voiced consonants left in the modern language since it was either phonologized and now is a long /uu/, or undone by final devoicing: the stem-final consonant of *roh* is still underlyingly voiced, but voiceless on the surface in *roh* [rɔx]. If the workings of the modern phonetics resemble the original state of affairs, surface length should still be present before stem-final sonorants (which do not undergo final devoicing) in words such as *výbor* - *výbor-u* where phonetic length was not lexicalized.

process is thought to have been innovated in late Common Slavic, where according to the life cycle perspective it would have been regular and phonological in kind.

This scenario takes for granted that the rule under (3) is a possible phonological process. Its critical ingredient is the reference to the voicing of sonorants. If sonorant and vowel voicing are never phonologically active and hence cannot be manipulated by phonological computation, (3) is not a possible phonological process and the Old Czech / Old Polish pattern that was already fully lexicalized needs to be accounted for by a different prospect. The following section looks at a well-known parallel phonetic pattern that occurs in English. It leads to a scenario where the phonological stage in the life cycle is skipped and a phonetic pattern is directly integrated into a random set of lexical items.

## 5. English: pure surface lengthening without lexicalization

In English, vowels are lengthened before sonorants and voiced obstruents without this lengthening being phonologized. English has short and long (or tense and lax) vowels, which are both significantly longer phonetically when occurring before sonorants and voiced obstruents. That is, short vowels are longer and long vowels are extra-long in this context. This is shown under (7) below (data are adapted from Pöchtrager 2006: 18) where phonemic length is indicated by repeating the vowel, while phonetic extra length is marked by “:”.

(7) English: phonetic lengthening of short and long vowels

	short (lax) vowels				long (tense) vowels			
	T		D, R		T		D, R	
__p,b	rip	rɪp	rib	rɪ:b	loop	luup	lube	luu:b
__f,v	stiff	stɪf	live	lɪ:v	leaf	liif	leave	lii:v
__t,d	bit	bɪt	bid	bɪ:d	beat	biit	bead	bii:d
__k,g	sick	sɪk	big	bɪ:g	beak	biik	league	lii:g
__s,z	hiss	hɪs	his	hɪ:z	(a) use	juus	(to) use	juu:z
__n			bin	bɪ:n			bean	bii:n
__m			dim	dɪ:m			deem	dii:m
__l			bill	bɪ:l			peel	pi:l

The phonetic literature provides extensive study and description of the phenomenon: see for instance Rositzke (1939), Peterson & Lehiste (1960), House (1961), Raphael (1972). The effect of sonorants and voiced obstruents on preceding vowel length is documented throughout, although this of course is not the only

factor: morpho-syntactic divisions, place and manner of articulation also play a role (Peterson & Lehiste 1960, Klatt 1973, Crystal & House 1988).

An outgrowth of Government Phonology, GP2.0 (Pöchtrager 2006, Pöchtrager & Kaye 2013), has made the English pattern the central motivation for introducing a new representational theory where voiced obstruents are phonologically short (one x-slot), while voiceless obstruents are long (two x-slots). On this analysis, a  $\check{V}C$  stretch is allocated three x-slots, to the effect that there is only one left for the V before voiceless obstruents, while the vowel may occupy two x-slots before voiced obstruents. This perspective where the V and the C thus compete for a piece of duration also has a phonetic version: «a longer intervening consonant must 'borrow' duration from the preceding vowel» (Maddieson 1996: 165). On Pöchtrager & Kaye's analysis, the phonetic pattern is transferred into the phonology.<sup>9</sup>

It needs to be noted, though, that the Western Slavic pattern is not merely a lexicalized version of the English situation: being followed by a sonorant or voiced obstruent is a necessary condition, but lengthening occurs only if this consonant is also word-final. Phonetic duration (provided by voiced consonants in all contexts) is selectively lexicalized according to what looks like a typically phonological (or rather: morphological) condition, i.e. the right word edge. This seems to be something that phonetics cannot do and hence appears to provide clear indication for a stage where a phonologized version of the phonetic pattern along (3) was active in phonological computation.

An observation by Klatt (1973: 1102) shows that this is not that case: the end of the word is already a factor that is present in the phonetic pattern of English vowels. Klatt has compared the duration of vowels in  $CVC\#$  (*beat, stoop, glide, room*) and  $CVCV(C)$  (*beaten, stupid, gliding, rumour*) items. He found that for each given following consonant  $C_x$ , the vowel in  $CVC_x\#$  was significantly longer than in  $CVC_xV(C)$ . He further reports that the difference in duration between vowels followed by word-final and internal consonants is significantly higher when the consonant is a sonorant or a voiced obstruent, as compared to voiceless obstruents. Hence, the duration of the vowel in *beaten* is 97% of the duration of the vowel in *beat*, and this ratio goes down to 80% for the pair *trashy - trash*. But voiced consonants produce lower ratios: the vowels in *gliding* and *rumour* make only 72% and 61% of the vowels in *glide* and *room*, respectively.

9 A consequence of this move is that x-slots on this count are quite different from what phonologists usually refer to as timing units: voiceless obstruents are "geminate" and phonetically lengthened vowels that are phonemically short occupy two units, while their phonemically long congeners encompass 3 slots.

Hence, English implements both conditions of the Western Slavic pattern in the phonetics: vowel duration is significantly higher before voiced consonants that are word-final, as compared to word-final voiceless consonants. Or, put differently, of all contexts vowels have the highest duration before word-final voiced consonants. If the English pattern is indicative of the Western Slavic situation, what was phonologized in the latter is thus a simple phonetic pattern: only vowels with the highest duration were considered as long vowels (in phonological computation and/or in the lexicon).

## 6. Conclusion

The purpose of the preceding pages was to show that there is a purely phonetic perspective on the Western Slavic pattern discussed which is infamous for its irregularity. Both conditioning factors, i.e. the presence of a voiced obstruent or a sonorant to the right of the lengthened vowel and the word-finality of these consonants, may be active in a purely phonetic conditioning: this is shown by Klatt's (1973) study of English.

This makes an analysis viable where the process was never present in phonological computation of any diachronic stage: it was phonologized in such a way that phonetic length was recorded in the lexical entry of individual words. This lexicalization concerned individual words, i.e. covered the lexicon in an arbitrary way and triggered an allomorphic management of ensuing alternations.

This alternative that vaults the phonological computation stage of the canonical life cycle roots in the idea that spontaneous and non-spontaneous voicing are truly waterproof. In the phonetics any articulation that is pronounced with vibrating vocal folds is voiced. Therefore, phonetics is unable to make a difference between the voicing of sonorants/vowels and the voicing of obstruents. In the phonology, though, only obstruents are specified for voicing. The voicing of sonorants and vowels is irrelevant and invisible, and phonological computation takes it into account under no circumstances.

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