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WHY RUSSIAN VOWEL-ZERO ALTERNATIONS ARE NOT DIFFERENT, AND WHY LOWER IS CORRECT

1. Introduction

This article describes vowel-zero alternations in Russian. It pursues four goals. First, it is shown that the basic pattern in Russian is not any different from the one that is found in other Slavic languages. This is worthwhile since the literature on Russian, including recent references, sometimes challenges the traditional deletion-based analysis in order to (re)introduce insertion-based elements.

Second, it is often held in the literature on Russian that while *e* and *o* are two distinct phonemes, their variants that alternate with zero — the yers — are in complementary distribution: there is only one yer underlyingly, and the quality of vowels that alternate with zero (*e* or *o*) can be predicted. The article makes explicit a necessary ingredient that is shared by all attempts to predict the quality of yers: the existence of a synchronically active process that transforms underlying *e* into *o*. Such an *e* → *o* rule is quite costly conceptually: it supposes multiple opacity, a number of lexical exceptions and the recognition of an absolutely neutralized underlying vowel phoneme that corresponds to former *jat'* (/e/ which may surface as either [e] or [o] must be distinct from /jat'/, which always appears as [e]). This scenario whereby the underlying structure of present day Russian corresponds more or less to Common Slavic is in line with the “abstract” conception that SPE had of the workings of phonology. It may certainly be called into question in the light of the progress that phonological theory has made since then, and namely following the so-called abstractness debate of the 70s. As a result, if one doubts the existence of a synchronically active *e* → *o* rule, there is no way to predict the surface quality of yers.

Third, the article reviews analyses that have been proposed in order to account for Slavic vowel-zero alternations since Lightner's (1965) Lower rule. It is shown in which way the autosegmental environment that was developed in the 80s offers tools that improve the analysis, and points out that the basic insight embodied by Lower describes a regressive lateral relation between two nuclei: whether a nucleus has a phonetic realization or not depends on the presence or absence of a specific kind of nucleus to its right. This is exactly the description of what is known

as government in Government Phonology. The workings of this theory, and in particular of its development called CVCV, are therefore introduced in sections 6.3 and 6.4.

Abandoning the basic insight of Lower (which may have a number of incarnations depending on the theory used) leads to undesirable results. This is shown on the example of the only OT-based account of vowel-zero alternations in Slavic to date, Yearley (1995). Lower is correct and the only means that we have to describe Slavic vowel-zero alternations as a uniform and monocausal process.

Finally, government is a phonological force that has got nothing to do with Slavic: it is active in all languages. By contrast in the literature on Slavic, since yers are held to be specifically Slavic (they do not occur in other languages), so are associated phenomena, which have therefore been confined to the phonology of Slavic languages. That is, it would not cross anybody's mind to talk about yer vowels when it comes to the description of vowel-zero alternations in, say, French or German. This view is unwarranted, though, because it impedes phonological insight: Slavic vowel-zero alternations may have come into being on the grounds of vowels that have only existed in Slavic (yers), but they are controlled by the same grammatical principles (the lateral relation described by Lower) that are responsible for vowel-zero alternations and other processes in other languages. That is, the Lower rule which has acquired some notoriety also beyond Slavic quarters but is typically thought of as an analysis of a specifically Slavic phenomenon, is not any more Slavic than, say, palatalization. Therefore, a goal of this article is also to show that Slavic vowel-zero alternations can contribute valuable insight into phonological theory provided that the Slavic bias is abandoned.

Finally, there are a number of things that the article does not talk about: the behaviour of yer chains in Russian for example, or the behaviour of yers in prefixes and prepositions.¹

2. Vowel-zero alternations in Slavic: the basic pattern

2.1. The alternating capacity of vowels cannot be predicted, it must be recorded in the lexicon

A general property of Slavic vowel-zero alternations is that whether a vowel alternates with zero or not cannot be predicted from stress, its phonetic or contrastive properties. Some illustration is provided under (1) below.²

¹ The latter issue has produced a specialized literature that includes Steriopolo (2007), Gribanova (2008) and Halle & Nevins (2009).

² Relevant (overview) literature on Polish includes Gussmann (2007) and Rowicka (1999). Czech is discussed for example in Scheer (2004: §§ 411 ff.) and Ziková (2008). Lightner (1965, 1972), Worth (1968), Isačenko (1970), Pesetsky (1979), Melvold (1989), Farina (1991) and Yearley (1995) describe the Russian situation, while Rubach (1993) (Slovak), Aronson (1962) and Hristova (1994) (both Bulgarian) discuss other languages. The general Slavic picture is exposed for example in Bethin (1998: 205 ff.) and Scheer (2011).

(1) alternating and non-alternating vowels of the same quality³

	alternating		non-alternating		gloss
	CvC	CøC-V	CvC	CvC-V	
Russian	kusók	kusøk-á	rabót	rabót-a	piece Nsg, Gsg; work Gpl, Nsg
Polish	pies	pøs-a	bies	bies-a	dog Nsg, Gsg; devil Nsg, Gsg
Czech	lev	løv-a	les	les-a	lion Nsg, Gsg; forest Nsg, Gsg
BCS	tajac	tajøc-a	pajac	pajac-a	silence Nsg, Gsg; clown Nsg, Gsg

Some more examples from Russian showing that the alternating capacity of vowels cannot be predicted appear under (2) below (e.g. Lightner 1972: 38 ff., Garde 1980: § 132, Melvold 1989: 31 f., Farina 1991: 255, Yearley 1995: 538). Examples include cases of alternating e and o: these are the (only) vowels that alternate with zero in the language.

Like in other Slavic languages, vowel-zero alternations occur in all lexical (nouns, verbs, adjectives, prefixes, prepositions etc.) and morphological (roots, suffixes, prefixes) categories. This reflects the original free distribution of CS yers, which like all other vowels could occur anywhere. Table (2) below provides illustration from nominal inflection, short and long forms of adjectives and derivation. Note namely the existence of near minimal pairs such as l'on — l'n-a “linen Nsg, Gsg” vs. kl'on — kl'on-á “maple Nsg, Gsg”.

(2) alternating and non-alternating vowels of the same quality in Russian

	alternating		non-alternating		gloss
	CvC#	CøC-V	CvC#	CvC-V	
a. nominal inflection	e d'én'	dn'-á	olén'	olénj-a	day Nsg, Gsg; deer Nsg, Gsg
	p'én'	pn'-á	l'én'	l'én'-i	log Nsg, Gsg; laziness Nsg, Gsg
	l'ev	l'v-á	m'ést	m'ést-o	lion Nsg, Gsg; place Gpl, Nsg
	ot'éc	otc-á	m'atez	m'atez-á	father Nsg, Gsg; rebellion Nsg, Gsg
	m'ést'	mst'-í	mést	mést-o	vengeance Nsg, Gsg; place Gpl, Nsg
	o úgor'	úgr'-a	Ígor'	Ígor'-a	eel Nsg, Gsg; Igor Nsg, Gsg
	l'ón	l'n-á	kl'on	kl'on-a	linen Nsg, Gsg; maple Nsg, Gsg
	rót	rt-á	pót	pót-a	mouth Nsg, Gsg; sweat Nsg, Gsg
	kusók	kusk-á	koról'	korol'-á	piece Nsg, Gsg; king Nsg, Gsg
	són	sn-á	spór	spór-a	dream Nsg, Gsg; dispute Nsg, Gsg
	rót	rt-á	vorot	vorot-a	mouth Nsg, Gsg; collar Nsg, Gsg
	lób	lb-á	vól	vol-á	forehead Nsg, Gsg; ox Nsg, Gsg
	kot'ól	kotl'-á	tól'	tól'-a	kettle Nsg, Gsg; roofing felt Nsg, Gsg

³ Note that in this article the symbol “ø” indicates the absence of a vowel that alternates with zero. Data are presented in spelling (or transliteration for Russian) throughout. In most cases symbols are self-explanatory. Yers are noted as upper case E and O (e.g. Ru /p'Os/ “dog”). Specifics are as follows: Russian stress is indicated by an acute accent in transliteration, and an apostrophe after a consonant indicates its palatality (as in d'én' “day”). Polish cz and Czech č are [tʃ]; in table (7), they are the palatalized version of the underlying suffixal /k/. Polish ł is [w], y is [i] in Polish but [i] in Czech, and the diacritic on Czech ě indicates the palatality of the preceding consonant. In Czech (and Slovak), vowel length is noted by an acute accent or by a little circle on the u (û is a long [uu]). In Polish, ó is pronounced [u] (just as u). Finally, Polish ę, ą are nasal vowels.

b. short-long forms of adj.	e	b'éd'en bólen krás-en	b'édøn-ij bol'n-oj krás-n-yj	b'él	b'él-ij	poor; white sick red
	o	pólon dolog	póløn-ij doløg-a	poxóž lákom	poxóž-tj lákom-yj	full; resembling long; tempting, tasty
c. derivation	e	m'ést' lēd léd-nik	møst'-ít' l'd-ín-a l'd-íst-yj			vengeance; to avenge ice; block of ice refrigerator; covered with ice
	o	vóš	vøš-íviij			louse; lice-ridden

In the same way, it cannot be predicted whether or not a (morpheme-final) cluster will accommodate a vowel-zero alternation. This is shown in table (3) below. Note namely the existence of minimal pairs such as *laska* “caress” (Gpl *lask*) vs. *laska* “weasel” (Gpl *lasok*) (Townsend 1975: 71, Pesetsky 1979: 3, Garde 1980: § 135, Farina 1991:256 ff., Bethin 1998:210 f., more on this pattern in section 4 below).

(3) morpheme-final clusters may or may not host a vowel-zero alternation

		alternating		non-alternating		gloss
		CvC#	CøC-V	CC#	CC-V	
rn	e	zeren	zern-a	sern	sern-a	grain Gpl, Nsg; chamois (zool.) Gpl, Nsg
tr		v'et'er	v'etr-a	metr	metr-a	wind Nsg, Gsg; meter Nsg, Gsg
str	o	kost'or	kostr-á	kóstr	kostr-á	campfire Nsg, Gsg; boon (textile) Nsg, Gsg
sk		lások	lask-a	lask	lask-a	weasel Gpl, Nsg; caress Gpl, Nsg
		mísok	mísk-a	óbysk	óbysk-a	basin Gpl, Nsg; search Nsg, Gsg
		mások	másk-a	rísk	rísk-a	mask Gpl, Nsg; risk Nsg, Gsg
sl		posól	posl-á	mysl	mysl-i	ambassador Nsg, Gsg; thought Nsg, Gsg
br		bob'ór	bobr-á	bóbr	bobr-á	beaver fur Gpl, Nsg; beaver Gpl, Nsg
		óstr-yj	ostór	dóbr-yj	dóbr	acute; good, long — short forms
vr		kovër	kovr-á	lávrr	lávrr-a	rug Nsg, Gsg; laurel Nsg, Gsg
tr		šatór	šatr-á	metr	metr-a	tent Nsg, Gsg; meter Nsg, Gsg
dr		odór	odr-á	výdr-a	vydr	Schindmähre Nsg, Gsg; otter Nsg, Gsg
kr		svókor	svókr-a	íkr-y	íkr	father in law Nsg, Gsg; calves Npl, Gpl
kl		stěkol	stekl-a	svěkl	svěkl-a	beet Gpl, Nsg; glass Gpl, Nsg
mt		lomót'	lomt'-á	poč'támt	poč'támt-a	lump, slice (of bread) Nsg, Gsg; post office Nsg, Gsg
rt		rót	rt-á	sórt	sórt-a	mouth Nsg, Gsg; sort, quality Nsg, Gsg
rk		turok	turk-a	park	park-a	Turc Nsg, Gsg; park Nsg, Gsg
rl		or'ól	orl-á	p'eryl	perl-a	eagle Nsg, Gsg, perl Gpl, Nsg

Finally, note that stress plays no role either: both stressed (*kusók* — *kusøk-á* “piece Nsg, Gsg”) and unstressed (*úzel* — *uzøl-á* “knot Nsg, Gsg”, *mél-ok* — *mel-øk-á* “petty, short adj. masc, fem”) vowels alternate with zero. Since Russian reduces vowels in non-tonic position, in some cases the underlying quality of a vowel never appears on the surface in any form of the word. Gouskova (2012: 85) mentions for example *kúkl-a* — *kúkol* “doll Nsg, Gpl” where the *o* in *kúkol* is in fact a schwa [ə] and speakers

are unable to lexicalize its supposed quality that is shown in spelling (according to etymology). This is also the locus where Russians typically make spelling mistakes. Beyond that, stress never impacts vowel-zero alternations — but vowel-zero alternations impact stress patterns (see Melvold 1989 and Gouskova 2012 on the relationship between stress and vowel-zero alternations).⁴ In this article, transliterations follow the tradition inasmuch as vowel reduction is not noted.

Whether a vowel alternates with zero or not, and where exactly alternation sites occur, must thus be somehow recorded in the lexicon: it is a lexical property of each morpheme and each vowel. That is, analyses must be able to somehow distinguish “true” (i.e. stable) from “false” (i.e. alternating) vowels of the same quality. And they must be able to identify the presence of an alternation site in the lexical representation of morphemes.

2.2. Diachronic excursus: non-etymological yers and etymological yers that do not alternate

While it is true that the loss of CS yers was the initial spark of vowel-zero alternations in Slavic languages, alternating vowels in modern idioms are entirely independent of this historical fact: it is neither true that they all go back to a CS yer, nor that all CS yers have produced modern alternating vowels. Therefore there can be no doubt that we are facing a phenomenon that is perfectly active in synchronic grammar.

Let us first look at non-etymological yers. An alternating vowel in a modern Slavic language can have three Common Slavic sources: a yer, some other vowel or nothing. This is true for native vocabulary as much as for recent loans. Let us first consider the latter, where alternating vowels may appear in absence of any vocalic input in the donor language. At least in some languages such as Polish and Czech, whether or not a cluster is broken up by an alternating vowel is a matter of lexical idiosyncrasy. This is indeed what is expected given the lexically defined and hence arbitrary distribution of alternating vowels in the native vocabulary: yers are regular items of the vocalic inventory.

In Czech for example, *kart-a* “card Nsg” possesses an alternating vowel in the stem-final cluster (Gpl *karet*), but *kvart-a* “quart” does not (Gpl *kvart*). The same kind of near-minimal pair is found in Polish: compare *sweter* “jumper Nsg” (Gsg *swetr-a*) with *filtr* “filter Nsg” (Gsg *filtr-a*).

In words such as Polish *sweter* “jumper Nsg” or *puder* “powder Nsg” (Gsg *swetr-a*, *pu-dr-u*) it could be argued that what was borrowed are simply phonetic or graphic elements that are present in the input: *puder* for example may have been borrowed from German *Puder* “powder” which, depending on the dialect, may have included a schwa in the final cluster. In cases such as Czech *kart-a*, *palm-a*, *farm-a*, *metr-o*, *bistr-o*, *makr-o* “card, palm (tree), farm, metro, kind of bar, (computer) macro” (Gpl *karet*, *palem*, *farem*, *meter*, *bister*, *maker*) however, no such argument can be made:

⁴ Lightner (1972: 40) argues that yers which receive stress in the course of the derivation are always vocalized. He quotes one single example, p’ós-ik — p’ós-ik-a “dog dim. Nsg, Gsg”: the root vowel of p’ós “dog Nsg” (Gsg: ps-a) should be absent in p’ós-ik since the vowel of the suffix is stable (p’ós-ik-a), i.e. not a yer. As far as I can see, the literature (including Lightner’s own work) does not explore this analysis. An alternative is to consider that the alternating p’ós (ps-á) and the non-alternating p’ós-ik (p’ós-ik-a) are built on two distinct lexical items, one containing (/pOs/), the other lacking (/p’os/) a yer. A similar allomorphy-based solution is suggested by Morris Halle, commenting on a draft version of the article: p’ós-ik is based on the root /pOs-O/ (rather than /pOs/). The final -O then lowers the root-O and thereby derives a stable vowel that appears on the surface. The question for both scenarios is what exactly drives allomorphy selection.

the vowel that appears in the stem-final cluster is absent from all versions of the word in all possible donor languages.

The decision to break up a cluster by an epenthetic vowel or not thus needs to be made upon the lexicalization of new vocabulary items, and this produces a random distribution of alternating vowels. Also, children that acquire their native tongue have no way to know whether the cluster of something that they hear as *swetr-a* “jumper Gsg” in Polish or *metr-o* “metro Nsg” in Czech will or will not break up until they have a chance to hear the word without the final vowel. Relevant mislexicalizations are indeed typical “mistakes” that are reported from children.

At first sight, Russian seems to follow the same pattern. A near-minimal pair appears under (3): *másk-a* “mask Nsg” (Gpl *masok*) comes with an alternating vowel, while *rísk* “risk Nsg” (Gsg *rísk-a*) does not. The comparison of both words, however, is not really conclusive since the former is a feminine in -a, while the latter is a masculine. Farina (1991: 302) asserts that loans are never borrowed into Russian with alternating vowels. According to her, cases such as *mask-a* are due to reinterpretation of the -ka as the regular Russian suffix -ka that encloses an alternating vowel: *mas-ka* (also *kál’k-a* “calque Nsg”, Gsg *kál’ek* because of its reinterpretation as *kál’-ka*). Pointing into this direction is also the fact that the alternating vowel of items such as *Pavel* “first name Nsg” (Gsg *Pavl-a*) is non-alternating when the same word is marked as foreign. That is, *Pavel* does not alternate as soon as it designates a Czech person (Gsg *Pavel-a*).

The arbitrary lexical distribution of alternating vowels in modern languages is also confirmed by the reverse evolution: there are numerous cases of vowels that were CS yers and thus alternated, but today are stable. Examples from Czech include *blech-a* < CS *blъch-a* “flea Nsg”, *bez* — *bez-u* “elder (bot.) Nsg, Gsg” < CS *бѣзъ* (e.g. Trávníček 1935: 48). Examples from Russian are *sót* — *sót-a* “honeycomb Nsg, Npl” < CS *сѣтъ*, *rópót* — *rópót-a* “murmur of discontent Nsg, Gsg” < CS *рѣрътъ*, *topót* — *topót-a* “tram of feet Nsg, Gsg” < CS *тѣрътъ* (Kiparsky 1963: 95 f., 1967: 117, Gouskova 2012: 92).

Let us now turn to alternating vowels without etymological basis that occur in native vocabulary. Table (4) below provides illustration from Czech.

(4) non-etymological yers in native vocabulary

a. epenthesis in Old Czech			b. epenthesis in Modern Czech			
CS	Old Cz	gloss	CS	Old Cz	Mod. Cz	gloss
ogn-ъ	oheň	fire Nsg	vydr-ъ	vydr	vyder	otter Gpl
od-	od(e)-	from	sestr-ъ	sestr	sester	sister Gpl
orz-	roz(e)-	separating, inchoative	stъbl-ъ	stébl	stébel	blade Gpl
bez-	bez(e)-	without	kridl-ъ	křídł	kříděl	wing Gpl

Table (4) shows that diachronic epenthesis was active at different stages of the language: (4)a illustrates epenthetic alternating vowels that appeared between CS and Old Czech,⁵ while (4)b shows epenthesis into Old Czech final clusters that occurred in Modern Czech.

⁵ The three latter items under (4)a are prefixes/prepositions. They show an alternating vowel already in Old Czech despite the fact that there was no yer in CS: e.g. OCz *ote dne* “from the day”, *beze všeho* “without all”, *roze-hnal* “dispel, scatter” (Trávníček 1935: 50).

Analogous cases occur in Russian: CS ogn-ъ > ogón' "fire" (Gsg ogn'-á), CS oġlb > úgol' "coal" (Gsg ugl'-á) (e.g. Kiparsky 1967: 120 f.). Finally, there are also words where an originally regular vowel (i.e. a non-*yer*) has come to alternate with zero today: l'ód — l'd-á "ice Nsg, Gsg" (< CS ledъ) (Kiparsky 1963: 95).

2.3. Deletion, not insertion

A question that has been debated at length in the literature is whether alternating vowels are underlyingly absent and inserted, or present and deleted. Insertion-based analyses have been proposed by, among others, Laskowski (1975, Polish), Czaykowska-Higgins (1988, Polish), Piotrowski (1992, Polish), Townsend (1975: 62 ff., Russian). They are convincingly refuted by Pesetsky (1979, Russian), Gussmann (1980: 26 ff., Polish), Rubach (1984: 28 f., 1993: 134 ff., Polish and Slovak), Szpyra (1992a: 280 ff., 1995: 94 ff., Polish), Farina (1991: 256 f., Russian) and Yearley (1995: 538, Russian).⁶

Among the arguments in favor of deletion, the following two are decisive. It cannot be predicted where alternating vowels should be inserted, and in languages like Russian and Slovak where more than one vowel alternates with zero, it cannot be predicted which vowel will appear in which morpheme. As we will see below, both arguments are challenged in the literature on Russian.

Let us begin with the latter: some illustration from Russian was already provided under (2); it is completed with near minimal pairs under (5)a below, which are accompanied by Slovak examples (from Rubach 1993: 137). Slovak also features near minimal pairs such as *liter* vs. *lotor* and *prí-jem* vs. *ná-jom*, and one more vowel is observed to alternate with zero, á, as shown under (5)b (Rubach 1993: 142 f.).⁷

(5) different alternating vowels in Russian and Slovak

a.	alternating e		alternating o		gloss
	CvC	CøC-V	CvC	CøC-V	
Russian	p'en'	pn'-a	l'ón	l'n-á	stump Nsg, Gsg; linen Nsg, Gsg
	kál'ek	kál'k-a	pálok	pálk-a	calque Gpl, Nsg; stick Gpl, Nsg Gsg
			bob'ór	bobr-á	beaver fur Gpl, Nsg
Slovak	prí-jem	prí-jm-u	ná-jom	ná-jm-u	receipt Nsg, Gsg; hiring Nsg, Gsg
	liter	litr-a	lotor	lotr-a	litre Nsg, Gsg; rascal Nsg, Gsg
	ker	kr-a	cukor	cukr-u	bush Nsg, Gsg; sugar Nsg, Gsg
	šláger	švágr-a	švagor	švagr-a	hit (music) Nsg, Gsg; brother-in-law Nsg, Gsg

⁶ Bethin (1992) advocates a compromise that combines epenthesis (in borrowings) and underlying specification.

⁷ Note that according to Rubach the length of the alternating á is predictable and due to an independent lengthening process: the vowel that alternates with zero is short /a/. Also, most forms with an alternating á have competing forms with alternating ie (which is the long version of e): kart-a — karát / kariat "card Nsg, Gpl".

b.	alternating á, i		non-alternating á, i		gloss
	CøC-V	CáC	CaC-V	CáC	
Slovak	jedl-o	jedál	pedál-ik	pedál	food Nsg, Gpl; pedal dim. Nsg, pedal Nsg
	kart-u	karát	karát-u	karát	card Asg, Gpl; carat Gsg, Nsg
	chrbt-a	chrbát	kabát-u	kabát	back Gsg, Npl; coat Gpl, Nsg

On the face of it, the fact that in Russian *p'én' -pn'-á* “stump Nsg, Gsg” an *e* alternates with zero (rather than *o*), against an alternating *o* (rather than an *e*) in *l'ón -ln-á* “linen Nsg, Gsg”, shows that the quality of the alternating vowel is a lexical property of the root. An insertion-based analysis would not know which vowel to epenthesize into which root. Theories must therefore be able to distinguish as many lexical items as there are alternating vowels in a language. We have seen that there can be up to three contrasting alternating vowels in Slovak (which is probably the record-holding idiom in the Slavic family), and in principle any vowel of a language can have an alternating and a non-alternating version. We will see in section 3 below, though, that the argument based on the unpredictable quality of alternating vowels is challenged in Russian.

The second major reason why insertion is not workable is that there is no context for it. The motor for insertion is held to be the avoidance of (word-final) clusters: the Gpl of Russian *lask-a* “weasel Nsg” and *bobr-á* “beaver fur Nsg” is *lások* and *bob'ór*, respectively; the Gpl forms are supposed to undergo epenthesis in order to avoid final *-sk#* and *-br#*. This cannot be the reason, though, since Russian happily tolerates these clusters in *lask-a -lask* “caress Nsg, Gpl” and *bobr-á -bóbr* “beaver Gsg, Nsg”. More cases where a given consonant cluster sometimes breaks up in word-final position but at other times does not have already been discussed under (3). The same situation is found in other Slavic languages (e.g. Czech *kart-a -karet* “card Nsg, Gpl” vs. *kvarť-a -kvarť* “quarter Nsg, Gpl”).

Surprisingly enough in the face of this evidence that is quoted all through the literature, insertion scenarios, or elements thereof, keep coming back in the literature. Yearley (1995) and Gouskova (2012) are cases in point regarding Russian. Their analysis is discussed in section 4 below.

2.4. The distribution of vocalized and unvocalized alternation sites

Before turning to the Russian-specific discussion of the two issues mentioned, let us look at the contexts in which alternating vowels are present, as opposed to those where they are absent. The basic pattern that, with some variation, occurs in all Slavic languages, appears under (6) below.⁸

⁸ There is also an interesting paradigm in Polish and Russian (and maybe elsewhere) that follows the pattern under (6), except that the stem-final consonant cluster does not break up in word-final position: e.g. Ru *igr-a -igr* — *igór-n-ij* “game Nsg, Gpl, adj.”, *vojn-á -vójn* — *vojen-n-ij* “war Nsg, Gpl, adj.”. Originally I wanted to write the article about this pattern, which for lack of space now can only be mentioned in passing. The gist of it is that the vowel which appears in the stem-final cluster in the adjectival forms (i.e. with suffixes that are C-initial on the surface) cannot be underlyingly present because it is absent in Gpl. Unlike regular

(6) basic pattern of Slavic vowel-zero alternations

	C__C-V	C__C-ø	C__C-CV	gloss
Russian	zemlj-á	zemél'	zemél'-nij	land, Earth NOMsg, GENpl, adj.
Czech	lokøt-e	loket	loket-ní	elbow GENsg, NOMsg, adj.
Polish	wojøn-a	wojen	wojen-ny	war NOMsg, GENpl, adj.

The alternation shown follows the division between open and closed syllables: a vowel appears in closed syllables (Russian *zemél'*, *zemél'-nij*), while zero occurs in open syllables (*zemø-ljá*). That is, a syllable nucleus is phonetically expressed if its rhyme needs to accommodate a coda. This syllable-based view, however, needs to be complemented with the additional data under (7) below that witness vocalization in open syllables (the grey-shaded column).⁹

(7)

	open syllable		closed syllable	
	zero C__C-V	vowel C__C- <i>yer</i> Cø	vowel C__C-ø	vowel C__C-CV
Russian	døn'á kotøl-á igól-øk-a	d'en'ók kot'el-ók igól-oč'ek	d'én kot'ól igól-ok	d'en'øk-á kot'el-øk-á igól-oč'-øk-a
Czech	dom-øk-u	dom-eč-ek	dom-ek	dom-eč-øk-u
Slovak	kríd-øl-o	kríd-el-iec	kríd-el	kríd-el-øc-e
Polish	buł-øk-a	buł-ecz-ek	buł-ek	buł-ecz-øk-a
BCS	lakøt-a	lakat-an	lakat	lakat-øn-og

The paradigms shown are fully regular in the languages in question, and the relevant distributional regularity is thus as under (8) below.¹⁰

(8) Alternation sites are vocalized in open syllables iff the following vowel alternates with zero.

Indeed, in all cases where an alternation site is vocalized in an open syllable (Russian *d'e-n'ók*), the vowel of the following syllable alternates with zero itself (*d'e-n'ø-ká*). In other words, the existence of a vowel in *d'en'*- is a consequence of the fact that the vowel in *-ok* alternates with zero. Alternation sites are never vocalized in open syllables when the following vowel is stable (but see note 4).

vowels that alternate with zero (the yers), it must thus be epenthetic. This is precisely the analysis of Worth (1968) for the Russian version of the pattern (see Scheer 2012 for the Polish version).

⁹ Glosses: Russian “day” Gsg, dim. Nsg, Nsg, dim. Gsg; “kettle” Gsg, dim. Nsg, Nsg, dim. Gsg; “needle” dim. Nsg, double dim. Gpl, dim. Gpl, double dim. Nsg; Czech “house” dim. Gsg, double dim. Nsg, dim. Nsg, double dim. Gsg; Slovak “wing” dim. Nsg, double dim. Gpl, dim. Gpl, double dim. Nsg; Polish “bread roll” dim. Nsg, double dim. Gpl, dim. Gpl, double dim. Nsg; BCS “elbow” Gsg, adj. Nsg, Nsg, adj. Gsg.

¹⁰ The yer literature typically talks about vocalized and unvocalized yers: yers are lexically present and thus may or may not appear on the surface. In the former case they are said to be vocalized, while in the latter they are unvocalized. The same goes for the more neutral (and less Slavo-centric) term alternation site. These vocabulary items are commonly used in the article.

In sum, then, the distributional generalization that covers all facts discussed identifies as the disjunction under (9) below (which is rendered in SPE-type notation).

- (9) the yer context
alternation sites show
- | | | | |
|-----------------|---|--------------------------|-----------|
| $V/ _$ | $\left\{ \begin{array}{l} C.CV \\ C\# \\ C \text{ Ъ, Ъ} \end{array} \right\}$ | in closed syllables | d'en'-k-á |
| | | before yers | d'én |
| $\emptyset/ _$ | CV | iff $V \neq \text{Ь, Ъ}$ | d'en'-ók |
| | | | døn'-á |

The challenge raised by this distribution is its disjunctivity: vocalization occurs in closed syllables and in open syllables iff the following vowel is a yer. Hence the question is in which way closed syllables and yers constitute a natural class, i.e. what they have in common. We will see below that the syllable-based generalization can be maintained if certain assumptions are made regarding underlying representations and the cyclic (or today phase-based) nature of the derivation.

3. Predictability of the quality of alternating vowels and the $e \rightarrow o$ rule

3.1. Traditional analyses: two-way contrast for surface *e* and *o*

Let us now look at the specific situation in Russian regarding the two major arguments against insertion: neither the context nor the quality of alternating vowels can be predicted. The present section discusses the latter issue. It was already mentioned that near minimal pairs such as *p'én'* — *pn'-á* “stump Nsg, Gsg”, against *l'ón* — *ln-á* “linen Nsg, Gsg” seem to disqualify insertion because epenthesis would not know which vowel to insert into which root.

On the face of it, it is also not the case that the quality of alternating vowels may be predicted from the palatal vs. non-palatal character of the preceding consonant. Table (10) below shows that stressed yers occur in all possible contexts: alternating *ó* and *é* are found before and after soft and hard consonants (Plapp 1999: 43 f.).

- (10) yer quality is not predictable from the consonantal environment

	ó		é		
C__	són	sn-á	vengérk-a	véng-r	sleep Nsg, Gsg; Hungarian woman, Hungarian
C'__	l'ón	l'n-á	p'en'	pn'-a	linen Nsg, Gsg; stump Nsg, Gsg
__C	l'ód	l'd-á	chrebét	chrebt-á	ice Nsg, Gsg; spine Nsg, Gsg
__C'	ogón'	ogn'-á	seméj	semj-á	fire Nsg, Gsg; family Gpl, Nsg

Therefore (at least) two different yers, front /E/ and back /O/, are distinguished by Lightner's original work and more recently by Melvold (1990), Yearley (1995) and Plapp (1999: 42 ff.). The latter author provides specific discussion of single-yer vs. two-yer approaches. Townsend (1975: 69, note 1), Hamilton (1980: 103 ff.)

and Farina (1991) argue for a single yer perspective whereby yers uniformly vocalize into o

As a representative of the two yer camp, Yearley (1995: 538) says that “the epenthetic approach [...] is completely impracticable for Russian [...]: it is altogether unpredictable whether it is e or o that will turn up in the output”. This is counting without the e → o rule in Russian, though: the obstacle can be circumvented if the last vowel of bob’or and the root vowel of l’on are underlyingly /e/: hence /bober/, /len/ → bob’ór, l’ón by virtue of a process that turns e into o.

The existence of such a process is indeed well supported in the phonology of Russian and in the literature (e.g. Lightner 1965: 21 ff., 139 ff., 1969, 1972: 20 ff., 42 f., Townsend 1975: 9, 69 f.). It builds on alternations like the ones that are shown under (11) below, which typically concern derivational relationships (but also occur in inflection).

(11) e — o alternations in Russian

	o	e	related form	gloss
a.	ber’óz-a s’óstr-y upr’ók	beréz-nik s’éstr-in bez-upréc-n-ost		birch tree, birch forest sister Npl, sister’s reproach, irreproachable
b.	l’ód	l’ed-óv-y l’éd-nik		ice, ice adj. refrigerator
c.	m’órz-l-ij pad’óz	m’éruzost’ pad’éž		frozen, vile thing animal plague, case
d.	jólka	jél’i jél’i	jést’	they were eating, to eat spruce, spruce trees Npl

The idea is to kill two birds with one stone: the e → o rule¹¹ affords to maintain the unity of a common underlying form for e- and o- versions of the same morpheme, and it can account for the “unnatural” palatalization of consonants preceding o. Hence l’ód “ice” is based on /led/ whereby the e first palatalizes the lateral and then undergoes e → o. Interestingly, in all cases where the analyst is tempted to derive an [o] from an /e/, the vowel is stressed: e → o is in fact é → ó. Russian spelling has a specific character, <ě>, for stressed ó that is held to be underlying /e/ (and has an opaque palatalizing action on the preceding consonant): l’ód “ice” for example is spelt лёд. The symbol ě is also often used in the phonological literature where examples are given in transliteration. These works thus de facto use three symbols: ě (whose phonetic value is [o]: лёд, l’ěd [l’ód] “ice”) is opposed both to e (which is really pronounced [e]: день, d’én’ “day”) and o (whose phonetic value is also [o], but which does not stem from an /e/ and does not palatalize preceding consonants: сон, son “sleep”).

This phonemically-looking way to transcribe Russian data (three distinct underlying items, two of which may be neutralized on the surface) is indicative of the fundamental question raised by the e-o alternations: either we bite the bullet and admit that there

¹¹ Or constraint set that achieves the same effect (e.g. Padgett 2010). The present article consistently talks about the e → o “rule” without this implying any theoretical commitment.

are three distinct underlying items of which one, *ě*, either neutralizes with *e* or with *o* on the surface. Or we maintain that there are only two underlying items, */e/* and */o/*. Some authors try to maintain the underlying unity of *e* and *ě*: in their view, the latter is just a handy notation for those */o/*'s that end up being *[e]*'s (e.g. Townsend 1975:69). But exactly which subset of the */o/*'s, then, is concerned? How do we tell *o*'s from *ě*'s, other than by the result? Townsend (1975: 69) calls the instructions for learners of Russian that should help them to convert */o/* into *e* “rule of thumb”, and is not really explicit on how they work in detail, where the counter-examples lie and so on. Another version of the two-way contrast scenario is Hamilton (1980), who also argues that alternating *e/o* is underlyingly */o/*, which is taken to *e* after palatalized consonants (for unstressed *o*) or when palatal consonants both precede and follow (for stressed *o*). Needless to say, there are numerous counter-examples, which Hamilton (1980: 131) goes about like this: “[i]n fact, the number is so great that common sense would suggest we should give up on it [the *o* → *e* rule]”, before discounting them with reference to analogy.

Finally, Zubritskaya (1995:109 f., 115 note 6) also goes with a two-way contrast, but argues for a non-uniform treatment of alternating *e/o*: depending on whether the preceding consonant is palatalized, */o/* or */e/* is underlying. In case of underlying */o/*, reduction in unstressed position produces *i*, which is spelled <*e*>.

3.2. “Abstract” analyses: three-way contrast for surface *e* and *o*

The *e* → *o* rule has a diachronic reality (e.g. Shevelov 1964: 423, Carlton 1991: 289, Kiparsky 1963: 107 ff., Lightner 1969: 44 ff.): CS *e* became *o* before non-palatal consonants and in absolute word-final position (Kiparsky's 1963: 107 formulation¹²). Unsurprisingly enough for SPE-type phonology, Lightner (1969: 50) takes over this rule into the synchronic grammar of Modern Russian without any change. It can account for the alternations under (11)a where the *e* is followed by a palatal consonant (or a consonant palatalized by a following front vowel), while the *o* is not. It also covers *l'od* — *led-nik* under (11)b, but fails to derive *l'ed-ov-yj* where the root *e* is only followed by non-palatal segments.

There are numerous cases, however, where Lightner's rule underapplies: */ě/* does not appear as *[ó]* although it should for example in *l'éto* “summer”, *v'éra* “faith”, *sn'ég* “snow”, *d'élo* “business” or *m'ésto* “place”. Also, examples under (11)c show that both *é* and *ó* can exist in identical contexts, and (11)d even provides a minimal pair for alternating and non-alternating *é* where two homophonous *é*-bearing items have either related forms with *é* all through (the root meaning “to eat”), or alternating forms with *ó* (the root for “spruce”). There is an obvious diachronic reason for all this: stable modern *é* that never alternates with *ó* continues a CS *ě* (OCS symbol *ѣ* called *jat'*, whose original phonetic value is unclear, maybe diphthongal: Shevelov 1964: 164 f., 422 f., Carlton 1991: 98 f.), and the *e* → *o* rule only affects CS *e* (as well as *yers*). In later development, “*ě* [...] merges completely with *e* in all respects except that *ě* does not undergo the ‘*e* > ‘*o* process” (Carlton 1991: 287).

Synchronically, then, with former *ě* and *e* being indistinguishable, there is no way to state the context of a rule that would take */ě/* to *[ó]*. Except if undergoers and

¹² The detail may be more intricate, cf. Shevelov (1964:423) or Townsend's (1975:69) efforts to find a synchronic rule of thumb.

non-undergoers are distinct underlyingly according to their diachronic identity. Unsurprisingly, Lightner goes for this “abstract” option whereby the synchronically underlying forms of a modern language mimic the state of affairs of some thousand years ago: this is the take of SPE (where modern English underlying forms roughly correspond to Common Germanic). Lightner (1972: 42 f.) proposes to distinguish former *e* and former *ě* by virtue of length: the former is underlyingly short /*e*/, while the latter is long /*ē*/. The *e* → *o* rule then applies only to short /*e*/, i.e. /*led*/ → *l’ód* “ice” vs. /*snēg*/ → *sn’eg* (whereby /*ē*/ is thus absolutely neutralized: there is no overt vowel length in Russian; /*ē*/ is taken to *e* after *e* → *o* has applied).

Also, the *e* → *o* rule is ordered after (i.e. fed by) the Lower rule (on which more below) that transforms yers into *e*: /*pEs*/ → /*pes*/ → *p’ós* “dog”. Unfortunately, though, not all vowels that alternate with zero and are followed by a non-palatal consonant undergo *e* → *o*: there are also alternating *é*’s as in *l’év* “lion” (Gsg *l’v-á*), *chrebét* “spine” (Gsg *chrebt-á*) or *korčm-á* “inn tavern” (Gpl *korčém*). Lightner (1972: 75 ff.) discounts them by the lexical diacritic feature [*±Russian*]: those that resist *e* → *o* (like /*lEv*/) are marked [-Russian], and only [+Russian] items such as /*pEs*/ “dog” are concerned by *e* → *o*.

Work that follows the *jat’*-based three-way contrast proposed by Lightner includes Plapp (1999: 22 ff.) and Matushansky (2002). Plapp has three distinct phonemes, but tries to avoid an absolutely neutralized *jat’*-looking item. Her strategy is to differentiate stable *e* and *e* that alternates with *o* by virtue of contrasting underspecification: alternating /*e*/ is underlyingly specified only for [-back] and may then be turned into *o* by a rule that changes [-back] into [+back] before hard consonants: *é* → *ó* / *___* Chard. That is, the hard consonant spreads its [+back] feature onto the /*e*/.¹³ The missing features are then filled in by default rules, which namely supply [+round]. Non-alternating /*e*/ on the other hand is underlyingly specified for both [-back] and [-round], and the latter feature is somehow set in stone, i.e. unmodifiable. This kind of /*e*/ may also be affected by the *é* → *ó* rule, but the result of acquiring a [+back] feature is a mid back unrounded vowel, i.e. an item that does not exist in the phonemic inventory of Russian and therefore cannot be interpreted. Default rules cannot supply [+round] either because the lexical [-round] specification is set in stone, and the result is that the alien vocalic item falls back to [e] by default.

Instead of a three-way contrast where *jat’* or *ē* is the third term, Plapp’s version of the *jat’* is an /*e*/ that is [-round] (as opposed to regular /*e*/ that is unspecified for roundness). The difference is notational in kind, and in addition Plapp (1999:31 ff., 38 f.) also needs the reverse rule for unstressed mid vowels that turns *o* into *e* after palatalized consonants: *o* → *e* / *C’___*.

3.3. Stress is not a good predictor either

Another attempt at identifying the triggering conditions of *e* → *o* is made by Farina (1991): instead of the non-palatalty of the following consonant (which is not even mentioned), stress is held responsible. It was already mentioned that all

¹³ The fact that the source of the [+back] feature is supposed to be local, i.e. the following hard consonant, has the effect of embarrassing Plapp (1999: 38) when it comes to the analysis of (tonic) word-final alternating *e*/*o*’s: there is no following consonant that could supply the [+back] feature. The solution proposed is that word-final tonic vowels that alternate with *e* are underlyingly /*o*/ (the Nsg marker of neuter nouns is a case in point).

instances of *e* are stressed. Hence $e \rightarrow o$ becomes $\acute{e} \rightarrow \acute{o}$, a context-free rule. There are indeed alternations that seem to obey this kind of stress conditioning. Consider the data under (12) below.

(12) *e* — *o* alternations in Russian: stress conditioned?

	<i>o</i>	<i>e</i>	related form	gloss
a.	p'ěč'ón-k-a v'ós'en	p'ěč'en v'esn-á		liver (of an animal, as food), liver spring Gpl, Nsg
b.	d'en'-ók st'iš-ók	túfel'-ek or'ěš-ek	stích, or'éch	day dim., show dim. verse dim., nut dim.; verse, nut
c.		rub'ěž mat'ěž grab'óz kut'óz	rub'ež-á mat'ež-á	border Nsg, Npl mutiny Nsg, Npl robbery Nsg, Npl binge Nsg, Npl

Under (12)a the alternating *e/o* in p'ěč'ón-k-a — p'ěč'en occurs before a non-palatal consonant in both forms, but while the *e* is unstressed, stress falls on the alternating vowel in the derived form p'ěč'ón-k-a, which produces *ó*. The other example under (12)a is a nightmare case for the classical rule that turns *e* into *o* before non-palatal consonants: the distribution of *e* and *o* in v'ós'en — v'esn-á is the reverse of what it should be — *ó* occurs before a palatal, *e* before a non-palatal consonant. But again the *o* is stressed, while the *e* is not.

Farina (1991: 260 ff.) studies diminutives in -ek / -ok (whose vowel alternates with zero); she tries to show that the quality of the suffixal vowel can be predicted, and by doing so crucially relies on stress-conditioned $\acute{e} \rightarrow \acute{o}$. That is, -ók occurs when the suffix is stressed, but -ek is found when stress falls elsewhere. Examples appear under (12)b. Note that while Farina provides ample illustration for both the -ók and the -ek paradigm with velar-final roots where palatalization occurs (nov'ič'-ók vs. or'ěš-ek), the -ók — -ek alternation relies on one single word for non-velar-final roots: there are countless examples following d'en'-ók, but Farina could come by only one single diminutive in -ek: túfel'-ek. Also note that it is quite mysterious how Farina is able to detect that the unstressed vowel after so-called hushing consonants (š, č, ž, šč, e.g. Townsend 1975: 4) as in or'ěš-ek is *e*, rather than *o*: unstressed vowels reduce and completely neutralize in this context: they are phonetically indistinguishable (ikanie and akanie, e.g. Zubritskaya 1995: 98 ff.).

Unfortunately for Farina (1991: 259 ff.), though, we have already seen that it is not the case that all stressed *e*'s turn into *ó*: those that were former *jat*'s like the one in sn'eg "snow" do not. There are also stress-based minimal pairs of alternating and non-alternating $\acute{e}/\acute{o}$ as under (12)c: the suffix -ež/-ož sometimes appears as -óz under stress (and then has an alternating form in -ež when unstressed), but at other times is -ěž in tonic position (in which case the vowel quality is stable in unstressed position). In sum, stress is not a reliable factor either for predicting when mid vowels are *e* or *o*.

While Lightner discusses counter-examples and sets up a mechanism that can account for them, Farina (1991) does not even bother talking about counter-examples or the triggering environment for $\acute{e} \rightarrow \acute{o}$. This is as explicit as it gets: "(/E/ or /e/ →)

e → [ó] (in some stressed positions)” (Farina 1991: 259). The reader is thus told that é → ó sometimes does, but at other times does not apply, and concludes that it goes into effect exactly in those cases where Farina needs it to, but is blocked when its application would produce results that do not suit her.

On this backdrop, consistent with Farina’s “é → ó applies whenever I need it to” is that her analysis “needs [...] only one underlying jer whose backness is (for the most part) determined by the backness of the preceding consonant” (Farina 1991: 298), and that there is a “a large degree of predictability for the feature [-bk] on jers” (Farina 1991: 303). The quality of yers can thus be predicted “for the most part”, but Farina does neither talk about nor identify nor quantify the set of items that resist the prediction.

3.4. The abstractness debate and alternatives to abstract analyses

The bottom line, then, is this: the prediction of the quality of alternating vowels in Russian crucially relies on a rule, e → o. In order to make this rule work, an absolutely neutralized additional phoneme that represents CS jat’ is needed, and one must be prepared to allow for a number of lexical exceptions to its application. As was mentioned, this is the typical SPE-type “abstract” solution. While the abstractness debate of the 70s has moved the field away from this perspective, we have seen that there are also modern incarnations of Lightner’s synchronic jat’ (Plapp 1999, Matushansky 2002).

A prototypical example that may illustrate the abstractness debate (Kiparsky 1968–73 and following, see Scheer 2011 for an overview) is so-called velar softening in English, a process whereby, according to SPE, the underlying velar stop in /*elektrik*/ is turned into a dental fricative before *i* when *electri[s]-ity* is derived (overviews are proposed e.g. by Halle 2005 and Green 2007: 172 ff.). The question is whether there is any phonological computation involved at all when *electricity* is produced: the linguist identifies two morphemes — but does grammar make the same analysis? The rule is only triggered by *i*’s that belong to a restricted number of affixes (such as -ity), and it transforms *k* into *s* directly, i.e. without the typologically expected and historically real intermediate stage *ts*.

The alternative to the computational solution is to consider that *electricity* as a whole is a single lexical entry, just like *dog* and *table*. In this case (suppletion), there is no phonological activity at all when *electricity* is uttered: no underlying /*k*/ is palatalised by the following front vowel; the [s] is already /*s*/ at the underlying level. There is no concatenative, i.e. morphological activity either: *electricity* is made of one single piece, rather than of two pieces. A third possibility is allomorphy: the stem has two distinct lexical recordings, /*elektrik*/ and /*electris*/, which are selected by the suffix. Hence there is concatenation, but no phonological computation.

The question is thus whether the pieces that a linguist is able to identify are really the pieces that are used in grammatical computation. Another way to look at the problem is along the trade-off between the size of the lexicon and the amount of phonological (and morphological computation): the anti-lexicalist stance of SPE is that the smaller the lexicon, the better the theory. That is, the more words are cut into pieces, the smaller the number of lexical entries; also, the bigger the number of phonological processes that are needed in order to derive the correct surface form,

the larger the distance between underlying and surface forms. Applying this principle has produced strange flowers: Lightner (1978: 18 f., 1981, 1985) derives *sweet* and *hedonistic*, *queen* and *gynaecology*, *thirst* and *torrid*, *eye* and *ocular* and so forth from the same underlying form, which supposes modern English speakers who perform Grimm's Law, Verner's Law and the pre-Greek $s > h$ shift. This is absurd, and certainly nobody today will endorse such a scenario. A synchronic $e \rightarrow o$ rule follows precisely this pattern: it describes the events of diachronic evolution that have occurred hundreds or thousands of years ago, and assumes underlying representations that look much like CS.

The broad result of the abstractness debate was that all phonological theories which individuated in the early and mid 80s have to some extent learned the following lesson: many alternations that early generativists believed were produced by online phonological computation do not represent any synchronically active process at all. Two etymologically, paradigmatically or semantically related forms do not necessarily stand in a derivational relationship: they may as well be recorded as two independent lexical items (suppletion), or represent allomorphic activity. Hence *sweet* and *hedonism*, but also, perhaps, *electric* and *electricity* or *sane* and *sanity*, may represent two distinct lexical entries that have not been modified by any rule before they reach the surface.

It goes without saying that the question where exactly the red line runs between the computational and the lexical or allomorphic option is open: some cases are lexical for sure, and the online computation of others is beyond doubt. But the swampy midfield is large enough for much debate (see e.g. Embick 2010): relevant discussion today runs under the heading of (anti-)lexicalism. After a decidedly lexicalist period in the 80s (both in syntax and phonology), anti-lexicalist analyses in the spirit of the 60s have gained ground again in certain minimalist quarters (e.g. Williams 2007).

We have seen what it takes to have a computational solution for the $e - o$ alternations in Russian: an absolutely neutralized underlying *jat'* plus lexical exceptions. This is a high price that most phonologists today will not be prepared to pay, also for a reason associated to abstractness that was not mentioned thus far but plays an important role from today's perspective: the $e \rightarrow o$ rule involves opaque rule interaction. The rule must apply before *jat'* becomes *e*, and front vowels must palatalize preceding consonants before $e \rightarrow o$ goes into effect. While this was not worth mentioning when Lightner wrote, opacity has been a central issue in the past 15 years or so because OT has made the promise of a purely parallel computation where opacity has no place. It is mainly for this reason that Padgett (2010) rejects a synchronically active $e \rightarrow o$ rule. The price to pay on this side, i.e. when the $e-o$ alternations are handled by allomorphy or suppletion, is the existence of two separate lexical recordings e.g. for the root *l'ód* (and all others under (11)): either *l'ód* and *l'ed-óv-yj* are two separate lexical entries (i.e. *l'edóvy* is stored as a whole, just like *electricity* is in the above example), or the root has two lexical recordings /led/ and /lod/ which are chosen by allomorphy according to the morphological context.

Everybody needs to make up his or her mind, and from my experience the Russian $e - o$ alternations are a particularly difficult case: on the one hand the Lightner-type machinery is utterly awkward and undesirable, but on the other hand giving up on any computation that takes *e* to *o* introduces a large amount of allomorphy not only into derivation, but also into inflection (e.g. *v'esn-á - v'ós'en*).

However, two things are for sure. Using $e \rightarrow o$ as a joker without bothering what exactly its triggering conditions are and without even discussing its Lightner-type consequences is not an option (this is what Farina 1991 does). Second, if there is any hope to predict the quality of vowels that alternate with zero in Russian, a synchronically active $e \rightarrow o$ rule is needed.

We are thus back to our initial concern: whoever wants to question that there are two lexically distinct vowels that alternate with zero in Russian, *e* and *o*, needs to endorse the Lightner-type scenario (and this still includes lexical exceptions as we have seen). One may be inclined to reject a synchronically active $e \rightarrow o$ rule as Padgett (2010) does, even though this may be for reasons that have got nothing to do with opacity. Russian without $e \rightarrow o$, then, validates the argument against insertion of alternating vowels: the insertion mechanism would not know whether *e* or *o* should be inserted into a given slot.

4. Insertion (or elements thereof) in OT due to the abandon of Lower

4.1. The locus of alternating vowels cannot be predicted

Despite the unquestionable fact that the locus of vowels that alternate with zero cannot be predicted in Russian (or in other Slavic languages, see section 2.1), insertion-based analyses, or bits and pieces thereof, come back every now and then.

Calling on Yearley (1995), Gouskova (2012: 83) for example says that “in some cases [...] the presence of [a] vowel is obligatory: without it the cluster would be unpronounceable”. Gouskova does not make explicit what it means for a cluster to be “unpronounceable”: there is no physiological, phonetic, muscular, psychological or other obstacle that would prevent Russians (or speakers of any other language for that matter) to pronounce *-pk#*, *-tk#*, which are the examples invoked. According to Gouskova, thus, the forms *chlópok* (instead of *chlópok* — *chlopok-e* “cotton Nsg, Lsg”) and *korótk* (instead of *korótok* — *korotk-á* “short, masc., fem”) would be “unpronounceable”.

The fact that Russian does not happen to have word-final *-pk#*, *-tk#* (or other clusters for that matter) is entirely irrelevant, since the vowel-zero alternation behaves exactly in the same way when the alternative word-final clusters do exist, see the aforementioned cases (*lások* “weasel Gpl” vs. *lask* “caress Gpl” etc.). The only thing that matters is whether or not the stem-final cluster accommodates a yer (yes in *lask-a* “weasel”, *chlopč-e*, *korotk-á*, no in *lask-a* “caress”). The rest, i.e. the surfacing of the vowel, is predictable from the context (see section 2.4): yers are vocalized in closed syllables, i.e. including before word-final consonants.

This simple statement covers *all* situations. Not invoking it is missing an obvious generalization, and creates the illusion of multi-causality where a single mechanism is at work. On Gouskova’s (2012) count, some yers vocalize because they stand in closed syllables (*/lasOk/* → *lások* “weasel Gpl”), others in order to avoid an “unpronounceable” coda cluster (*/chlopOk/* → *chlópok* “cotton Nsg”), and others for yet a different reason which was not mentioned so far: Gouskova (2012: 83) holds that yers in monosyllabic CVC items such as *son* — *sn-a* “sleep Nsg, Gsg” vocalize because “every syllable must be headed by a vowel” in Russian and hence *sn* is not

a legal word. One wonders what the motivation for Gouskova might be to throw overboard a simple generalization that covers *all* situations (yers vocalize before word-final consonants), just in order to replace it by a heterogeneous set of unrelated mechanisms that loses the insight of Lower.

4.2. Crypto-action of a ban against complex codas?

Yearley (1995) and Gouskova (2012) do acknowledge the existence of all relevant patterns, including the fact that a given cluster may or may not break up in word-final position, and that this is a lexically idiosyncratic property of each morpheme. Gouskova (2012: 82) quotes *v'ët'er* "wind" vs. *m'ëtr* "meter", and Yearley (1995: 538) writes that "it is simply not possible in Russian to predict the sites of 'epenthesis' based purely on grounds of syllable structure." They therefore follow the traditional deletion analysis whereby yers are present in underlying representations. Nevertheless, Gouskova (2012: 83) writes that "final clusters are allowed in Russian in general, even if they are avoided in words such as" *v'ët'er*. How could a cluster be "avoided" that is perfectly legal? How should it be decided in which case the language "avoids" legal clusters, and in which case they are pronounced without being broken up?

The reason why Gouskova (2012: 83) makes the cryptic statement that "syllable structure constraints matter for the distribution of yers, even if not all of the constraints are surface-true in Russian" is Yearley's analysis: "[t]he various epenthetic analyses of jers [...] have been driven by the observation that where jers appear in output forms seems to have a very high sensitivity to syllable structure. This is an important point and one to which we shall return later" (Yearley 1995: 538). Yearley's OT-based mechanism that selects vocalized or unvocalized versions of yer-containing morphemes relies on two constraints: *Mseg[μ]* and *Parse-V*. Yearley follows Rubach (1986) in that yers are underlyingly floating, i.e. moraless segments, which are promoted to a surface existence when the candidate where they associate to an extra mora (that originates in GEN) is selected. *Mseg[μ]*, then, requires that every mora in the output correspond to a mora in the input. Hence all yers that are realized violate *Mseg[μ]*. *Parse-V* on the other hand demands that feature bundles present in the input be also realized in the output. That is, unpronounced yers always violate this constraint.

In Yearley's system, *Mseg[μ]* is ranked above *Parse-V*, which means that no yer can ever be pronounced, except if some higher ranked constraint enforces its presence in the output. This is where syllable structure enters the scene: the higher ranked constraint in question that Yearley chooses is **Complex[coda]*. That is, the yer in /lasOk/ → lások "weasel Gpl" surfaces because the complex coda -sk# would be unacceptable. What about those cases, then, where identical clusters do not break up (lâsk "caress Gpl")? What makes the ban on complex codas inoperative in these cases? Yearley (1995:543) simply says that the vocalization of the yer in /lasOk/ "weasel Gpl" is a case of the emergence of the unmarked, i.e. a sub-regularity in a language where one can see the action of a certain constraint in a specific environment that is outranked elsewhere. Yearley does not betray, however, how exactly this is implemented technically: the reader is left with the idea that **Complex[coda]* marshals only those items where the non-realization of a yer would produce a coda cluster. If the cluster exists underlyingly, the constraint does not bite. In other words, **Complex[coda]* is able to detect yers: it selectively applies to forms that contain these vowels.

Whatever the general merits of Yearley's analysis, the fact to be highlighted is that the alleged impact of syllable structure on yer vocalization follows from Yearley's analytic choices, and from nothing else. It is only the attempt to build an OT-based analysis of the pattern that is traditionally accounted for by the Lower rule (on which more below) that reintroduces syllable structure and hence insertion-based elements into the picture. The thing is that Lower cannot be easily mimicked in a constraint-based environment, and its basic insight is therefore abandoned: yers vocalize because there is another yer in the following syllable. On Yearley's analysis, they do not vocalize for this reason, but for a heterogeneous set of reasons in which the ban on word-final clusters is one ingredient out of many, even though it is not surface true.

4.3. Diachronic and synchronic questions

Now the following argument could be brought to bear by analysts who promote insertion-based scenarios (or elements thereof). If it is true that the distribution of yers in morphemes is lexical accident and hence unpredictable (see section 2.1), why do non-occurring (i.e. illegal) consonant clusters such as *-pk#*, *-tk#* always accommodate a yer and never occur as such without being separated by an underlying vowel? That is, why is there a distributional gap in Russian whereby */-pOk#/* and */-tOk#/* do, but */-pk#/* and */-tk#/* do not exist? This is a valid question, which however has no answer in the *synchronic* phonology of the language: if it is agreed that yers are underlyingly present, which is something that Yearley and Gouskova subscribe to, the question why */-pk#/*, */-tk#/* never occur without a yer is irrelevant since it addresses the distribution of lexical items, and the synchronic phonological computational system has no means to influence or marshal underlying forms. It simply works with whatever the lexicon provides.

The question why */-pk#/*, */-tk#/* never occur without a yer can only have a diachronic answer. There are two solutions: either because CS had no lexical item of that kind (i.e. there was a constraint against the clusters at hand), or because there was a constraint against these clusters in some previous stage of the language or in Modern Russian. In the latter case, a yer was inserted into illegal clusters: recall from section 2.2 that there are many "non-etymological" yers in Slavic languages. Hence even if the reason for the absence of yer-lacking */-pk#/*, */-tk#/* is a constraint against these clusters that is still synchronically active in Modern Russian (something that could be tested by looking at recent loans, acronyms or nonce-words), the yer is already present in the underlying form, and its insertion has occurred when the constraint first became active. In other words, we are facing a kind of lexicon optimization: an underlying form is shaped according to its foreseeable fortune during computation. Since */-pk#/* and */-tk#/* have no chance to survive the application of phonology anyway, they develop a yer.

It is obvious that constraints on syllable structure may change over time in a given language, and we know positively that Slavic languages treat the clusters that were produced by the loss of the yers in different ways according to their individual parameter setting. When comparing the exhaustive record of word-initial sonorant-obstruent clusters in 13 Slavic languages for example (Scheer 2007), one finds that there are languages like Polish and Czech which more or less faithfully restore the CS state of affairs, except that the yers are missing: any CS sequence *#C₁-yer-C₂V* appears as *#C₁C₂V*, no matter what the sonority profile. Other languages did impose regular sonority restrictions: in Belarusian and Bulgarian for example, there are no

initial sonorant-obstruent clusters at all. Slovak is of that kind as well:¹⁴ it has used various strategies in its history in order to avoid initial sonorant-obstruent clusters. An epenthetic vowel for example appears in *ortut'* “quicksilver” (< CS *řṭṭṭ*, Cz and Ru *rtut'*, Po *rtęć*), yers are irregularly vocalized in open syllables as in *ruvat'* sa “to fight” (< CS *řvati*, Cz *rvát*, Po *rwać*, Ru *rvat'*), alternating vowels are turned into non-alternating vowels as in *raž* — *raž-i* “rye Nsg, Gsg” (< CS *řžь*, Cz *rež* — *rž-i*, Ru *rož* — *rž-i*) or *lev* — *leva* “lion Nsg, Gsg” (< CS *lvъ*, Cz *lev* — *lv-a*, Ru *l'ev* — *l'v-a* etc.), and metathesis of the two initial consonants is observed in *žmúrit'* “to blink, to flicker” (< CS *ṃg-ur*, Cz *mžourat*).

Coming back to the specific Russian case, then, the answer seems to be clear: there is no reason to invoke any repair strategy against illegal word-final clusters in stages of the language after CS since such clusters did not occur in CS in the first place. That is, Russian has not inherited any root that ends in *-pk#*, *-tk#* which does not host a yer. As was mentioned, whether the ban on *-pk#*, *-tk#* is still active in the grammar of Modern Russian could be tested by looking at borrowings, acronyms or nonce-words. Should it turn out that Modern Russian tolerates these clusters, the absence of *-pk#*, *-tk#* would simply be an accidental gap due to the structure of the inherited lexical stock.

4.4. A non-question

Finally, a related issue is one of the two major points made by Gouskova (2012): the question why only the vowel of the last syllable of a morpheme can alternate with zero (in Russian).¹⁵ That is, why is *V* in *CVC*-items and *V*₂, but not *V*₁ in *CV₁CV₂C*-items able to alternate with zero? Yearley (1995) and Gouskova (2012) develop a complicated mechanism in order to derive this “asymmetry”, which they argue must be accounted for by the synchronic computational system of the language.

The question is what drives Yearley and Gouskova to ask this question in the first place: how could *V*₁ in monomorphemic *CV₁CV₂C* possibly alternate with zero? And how could the analyst detect that there is such an alternation at all? In order to get a vowel-zero alternation, the right context of the alternation site must be able to be manipulated: the vocalization of yers depends on what occurs to their right (see the following section). Yers appear on the surface in closed syllables (*__C{C,#}*), but remain unpronounced in open syllables (*__CV*, except if the following vowel alternates with zero itself, i.e. is a yer: *__CE/O*, see section 2.4).

An alternation site can only reveal the alternating character of its vowel if it can occur in both of these contexts, and this means that it must be morpheme-final: we can see that the vowel of /son/ “sleep” alternates with zero because we are able to place it in a closed syllable (in word-final position) as in *són* “sleep Nsg” and also in an open syllable as in *sn-á* “sleep Gsg”. Were there no *V*-initial suffixes that could be attached, the root would always be vocalized; and were there no way to place /son/ in a closed syllable, e.g. because it is a bound root and occurs only with *V*-initial suffixes, the yer would always be unpronounced. In both cases, there would be no grounds for assuming the presence of an underlying yer at all.

¹⁴ With a residue of a few roots/words such as *lest'* — *lst-i* “cunning, ruse Nsg, Gsg”, *lož* — *lž-i* “lie Nsg, Gsg”, *lživý* “id., adj”, *peot*. *lkat'* “to mourn”, arch. *lpiet'* “to cling, to stick”.

¹⁵ The other point being why only mid vowels alternate with zero in Russian.

V₁ in CV₁CV₂C is precisely an instance of the former situation. Were it a yer, we would *never* be able to see it on the surface: /COCV₂C/ would always come out as CCVC because we are unable to remove V₂. A closed yer syllable as in COC.CV₂C would instantiate the latter pattern: we would *never* be able to have the yer unpronounced since it would never occur in an open syllable, and the result would be invariably CV₁CCV₂C.

Finally, a bisyllabic root where both vowels are yers CO₁CO₂C will not make any difference either: since yers vocalize in closed syllables and in open syllables iff the following vowel alternates with zero itself (this is the basic insight of the Lower rule, as exposed in the following section), O₁ will systematically appear on the surface no matter what the suffixal situation. That is, /CO₁CO₂C-V/ produces CVCøC-V, and /CO₁CO₂C/ appears as CVCVC. But this pattern, specifically discussed by Gouskova (2012: 88, her case (21c)), is hypothetical anyway since for the reasons exposed we will never be able to identify the leftmost vowel as a yer: it never alternates. The only evidence that can be brought to bear is diachronic in kind, and Gouskova (2012: 92) indeed quotes two cases, which were mentioned in section 2.2: rópot — rópot-a “murmur of discontent Nsg, Gsg” < CS рѣрѣтъ, topot — topot-a “tram of feet Nsg, Gsg” < CS тѣрѣтъ. As expected, the leftmost root vowel, etymologically a yer, always appears on the surface, and there are no grounds to consider it a yer synchronically (in addition the second etymological yer does not alternate either, which is something that may occur in diachronic development, cf. section 2.2).

In sum, then, the question that Yearley and Gouskova ask is a non-question. Its answer automatically follows from the general workings of the yers (no matter in which theory) and for sure does not require any specific machinery. Or rather, there *must not* be any specific machinery in order to account for the non-occurrence of patterns that could not occur anyway.

5. Lower

5.1. Original linear implementation

Let us now see how yers have been handled in phonological theory since Lightner (1965). If there is any chance to capture the distribution of vocalized and unvocalized alternation sites (the yer context (9)) in terms of a non-disjunctive statement at all, the formulation must not include any reference to closed and open syllables: the closed-syllable analysis is contrary to fact. An alternative is to generalize the other branch of the disjunction: a vowel that alternates with zero, i.e. a yer, appears on the surface if and only if it is followed by another yer. This is the essence of Lightner’s (1965) proposal, which is known as *Lower*. The rule appears under (13) below.

- (13) Lower
 $E, O \rightarrow e, o / __ C_0 \{E, O\}$

In Lightner’s view and in all subsequent analyses that use a version of Lower, yers are vowels that are present in underlying representations and appear in various colors throughout Slavic languages. Obviously (but tacitly) for the sake of their phonetic identity in CS, they are located in the central upper part of the vocalic triangle: /E/ identifies as high front centralized lax, while /O/ is said to be high back centralized lax.

In the course of the derivation, then, yers are either lowered to some mid or low vowel according to the language at hand (this is where the name of the rule comes from), or deleted. The latter event is ordered after the former, to the effect that yers never appear on the surface in their underlying form. In other words, they are absolutely neutralized.

5.2. Implications of Lower: the distribution of abstract vowels

Lower supposes underlying forms where yers (which are also called abstract vowels in the generative tradition) are distributed in a specific way. A word such as Ru *d'en'* — *døn'-a* “day Nsg, Gsg” for example must be underlyingly /dEnE/. Indeed, if it is true that yers are vocalized when followed by another yer, the word-final consonant must be followed by a yer: only /dEnE/ can be turned into *d'en'* via Lower. Therefore, consonant-final words are assumed to end in yers underlyingly. These word-final yers are attributed the morphological value of a case marker (i.e., Nsg in /dEnE/, Gpl in Ru *zemel'* /zemEl'-O/ “land, Earth Gpl”).

According to this analysis, thus, yers are distributed as follows: they exist 1) in locations where a vowel alternates with zero and 2) after word-final consonants in nouns, where they are case markers. While the former may appear on the surface under certain conditions, the latter never enjoy a phonetic existence.

The derivations under (14) show Lower and yer deletion at work, also in case several alternating vowels occur in a row. The example used is the Polish word for bread roll *bulka* (see (7), the rule that palatalizes k into cz is not represented).

(14) sample derivations showing the action of Lower

	underlying →	Lower →	yer-deletion →	surface	relevant yer occurs in
a.	buł-Ecz-Ek-a	buł-ecz-Ek-a	buł-ecz-k-a	bułecz-k-a	__ C yer C V
b.	buł-Ek-O	buł-ek-O	buł-ek	bułek	__ C yer #
c.	buł-Ecz-Ek-O	buł-ecz-ek-O	buł-ecz-ek	bułecz-ek	__ C yer C yer #
d.	buł-Ek-a	buł-Ek-a	buł-k-a	bułk-a	__ C V

Note that under (14)c Lower must apply two times and from left to right, i.e. cyclically following the morphological structure [[[buł] Ek] Ek] O], in order to transform /buł-Ek-Ek-O/ into buł-ecz-ek-O. Were [bułEk Ek O] interpreted in one go, it would not be clear to which yer Lower should apply first. The traditional assumption is therefore that Lower is applied cyclically (e.g. Lightner 1965: 111 f., Pesetsky 1979, Rubach 1984: 184 ff.).

6. Representations have a word to say: the autosegmental turn

6.1. Autosegmentalised Lower

In the 80s when the autosegmental idea was applied to all areas of phonological theory, Lower also evolved. The autosegmentalisation of Lower was operated by Hyman (1985: 58 f.) and Rubach (1986) (see also Kenstowicz & Rubach 1987, Bethin

1998: 205 and Plapp 1999: 40 ff. provide overviews), and specifically for Russian by Melvold (1989) and Farina (1991). Rather than the rule itself, it concerns the lexical identity of yers: recall that their distribution is unpredictable, and that they must be distinguished from non-alternating vowels of the same quality at the underlying level. In a non-autosegmental environment, the only way to express that two vowels are different is to make them contrast in quality. Hence, a six-vowel system such as the one encountered in Polish ([i, u, i̯, ɜ, ɔ, a]) will have to be augmented by two yers, whose melodic identity must not coincide with any of the existing vowels. The traditional solution since Lightner (1965) is to make yers high vowels, but which are attributed a [-tense] feature that isolates them from the other three high vowels. The result is a system where Polish possesses no less than five high vowels: /i, u, i̯, E, O, ɜ, ɔ, a/.¹⁶

In autosegmental representations, a vowel that enjoys phonetic expression is defined as the association of a melodic unit with an x-slot, which in turn is dominated by a syllabic constituent. If there is an x-slot but no melody, nothing is heard (empty onset or nucleus); if there is a melody available but no x-slot, no phonetic trace will appear (e.g. floating consonants like in French liaison); finally, if both melody and x-slot are present but remain unassociated, nothing is pronounced either.

Autosegmental representations thus offer an alternative way of making yers different from other vowels: their peculiar properties may be encoded structurally, rather than melodically. The alternative proposed by Rubach (1986) and Kenstowicz & Rubach (1987) therefore grants a melodic, but no skeletal identity to yers (see also Hyman 1985: 58 f. along the same lines in a mora-based environment): yers are floating pieces of melody that do not possess any skeletal anchor in the lexicon, while stable vowels (that may be melodically identical) are lexically associated to an x-slot. The corresponding underlying representations are shown under (15) below for the three relevant distributional situations, which are illustrated by Russian *zeml'a* ‘land, Earth’ (see (6)).¹⁷

(15) yers are floating pieces of melody: Rubach (1986)

a. zemølj-e Dsg						b. zemel' Gpl					c. zemel'-nij adjective						
x	x	x		x	x	x	x	x		x	x	x	x		x	x	
z	e	m		e	l'	z	e	m	e	l'	z	e	m	e	l'	e	n ij

This option offers several advantages. First, there is no need anymore to make yers high vowels, a location whose only motivation was their historical CS identity. Also, no extra feature needs to be invoked anymore: the choice of [-tense] was entirely arbitrary. Diacritic underlying identities for both yers such as /@/ and /%/ and any

¹⁶ The situation is actually more complicated than that, see Gussmann (1980: 63 ff.), Rubach (1984: 27 ff., 139 ff.).

¹⁷ Note that the autosegmentalization of Lower introduces representations as under (15) where syllabification is contrastive: two lexical items may be distinct only by the fact that a vowel either floats or is lexically attached. While contrastive syllable structure may be suspicious in OT quarters because it violates (at least some versions of) Richness of the Base, it is the classical take on vowel-zero alternations in Slavic. Analyses in OT such as Yearley (1995) make no exception.

position in the vocalic triangle defined by whatever feature would have done the job in the linear environment provided that the two items are different from all other underlying vowels.

The alternative under (15) thus does away with an absolute neutralization (i.e. a vowel that never appears on the surface in its underlying form) and the associated arbitrariness. Rather, alternating (yers) and non-alternating vowels are now identical as far as their melodic representation is concerned: the contrast is expressed in terms of association (compare the two e's under (15)a). While in the linear system each alternating vowel was a (Slavic-) specific underlying melodic object distinct from all other vowels, the underlying representation of alternating vowels in autosegmental terms is simply their floating melodic identity without a skeletal slot. Any alternating vowel will thereby be different from its melodically identical but stable peer.

Another advantage is that the rule of yer deletion can be dispensed with: the phonetic absence of unassociated melodic material is automatic in the autosegmental environment.

The autosegmentalised version of Lower is shown under (16) below.

(16) autosegmentalised Lower (Rubach 1986, Kenstowicz & Rubach 1987)

$$\textcircled{V} \rightarrow \begin{array}{c} x \\ | \\ V \end{array} / _ C_0 \textcircled{V}$$

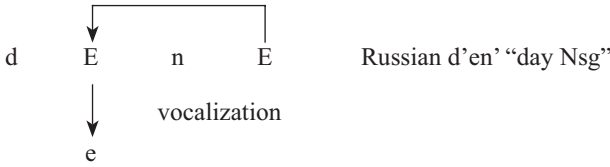
Yers, i.e. floating melodies, are circled. Lower associates a skeletal slot to a yer iff this yer is followed by a (number of) consonant(s) and another yer. The (cyclic) application of the autosegmentalised version of Lower transforms the underlying floating melodies of (15) into the attested surface forms. That is, it promotes all members of a chain of yers save the last to phonetic existence.

6.2. Lower describes a lateral relation

Recall from section 2.4 that the basic pattern, uninformed of the behavior of sequences of alternating vowels, invites for an analysis in terms of open and closed syllables: alternating vowels seem to be present in the latter, but absent in the former situation. The fact that alternation sites also vocalize in open syllables, provided that the following vowel alternates with zero itself, has refuted this analysis. This is how Lower entered the scene: instead of relying on a causal relationship between syllable structure and the vocalization of alternation sites, it describes a **lateral relation** between vowels. That is, the only information which is needed in order to compute the phonetic value of alternation sites concerns the following vowel, which is either a yer (i.e. a floating piece of melody) or a non-yer (an associated piece of melody). In the former situation, the alternation site is vocalized (i.e. the floating melody receives an x-slot), in the latter it is not.

The fundamental insight of the Lower rule is thus that vowel-zero alternations are the result of a regressive (right-to-left) intervocalic relationship: the patient is the leftmost vowel, whose phonetic value is determined by its neighbor to the right. This is depicted under (17) below.

(17) Lower describes a lateral and regressive relationship between vowels



6.3. The distribution of yers and the regressive lateral relation match tools of Government Phonology

The ingredients of Lower are a striking match of tools that have been developed in (Standard) Government Phonology (Kaye et al. 1990, Kaye 1990) on entirely independent grounds.¹⁸ That is, empty nuclei have exactly the same distribution as yers — they occur in places where vowels alternate with zero and after word-final consonants —, and their appearance on the surface is controlled by a regressive lateral relation with the following vowel — government.

Empty nuclei are not an invention of Government Phonology: they are a logical consequence of the autosegmental program whose key property is the independence of different tiers of representation. This predicts that the presence of an object on one tier may face nothing on another tier. Melody must thus be able to occur without an x-slot (which produces a floating piece of melody as under (15) on the vocalic, French liaison consonants on the consonantal side), and x-slots without melody. The latter configuration translates as empty constituents: empty onsets are indeed common practice since early autosegmental analyses (e.g. Clements & Keyser 1983: 143, Wiese 1996: 49 ff., Carr 1993: 195 ff.), but their vocalic counterpart, empty nuclei, have met enduring resistance until quite recently (see note 19; the non-parallel career of empty onsets and empty nuclei is further discussed in Scheer 2004: § 387).

While empty nuclei were sporadically used in the literature for example by Anderson (1982) and Spencer (1986, on Polish vowel-zero alternations), they were given a theoretical status with stable cross-linguistic properties only in Government Phonology.¹⁹ While they were a mere analytic option in the work quoted, Standard Government Phonology defines their distribution by a phonological version of the ECP (Empty Category Principle): in all languages, empty nuclei occur 1) after the last consonant of consonant-final words (Kaye 1990) and 2) in places where vowels alternate with zero (Kaye et al. 1990: 219 ff.).²⁰

For example, French *la semaine* “the week” may be pronounced [la səmɛn] or [la smɛn] (the vowel-zero alternation is optional). The latter form illustrates both types of empty nuclei.

¹⁸ This argument is developed at greater length in Scheer (2005).

¹⁹ Today empty nuclei are more broadly assumed, e.g. by Dell (1995), Burzio (1994), Kiparsky (1991), van Oostendorp (2005). It may be true, though, that there is still a bias for acknowledging the existence of (word-)final, rather than (word-)internal empty nuclei.

²⁰ A third location are so-called bogus clusters, i.e. consonant clusters that according to the rules of Standard Government Phonology can neither be syllabified as branching onsets nor as coda-onset sequences (i.e. in *atolas*). Later developments of Standard Government Phonology (Kaye 1992, Gussmann & Kaye 1993) have further enlarged the distribution of empty nuclei, but this does not bear on the argument.

(18)

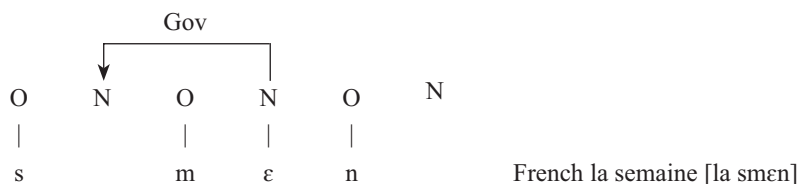


Table (18) also shows the reason why the alternating vowel, which is schwa in French, may be absent from the surface: it is under the influence of government, a lateral force which originates in the following vowel and is always regressive (right-to-left).²¹

Government Phonology set up this system without any reference to the Slavic evidence (Scheer 2004: § 69 ff.), just as the classical generative analysis of Slavic vowel-zero alternations owes nothing to Government Phonology, which did not exist when Lightner wrote. The independence of both analyses thus lends support to their basic tenets (Scheer 2005).

Today the autosegmental analysis of Slavic vowel-zero alternations that was introduced by Rubach (1986) is largely undisputed: alternating and non-alternating vowels are lexically distinguished in terms of association (Bethin 1998: 207 f. provides a good overview of the different incarnations of this idea that have been proposed).²²

In Government Phonology, Gussmann & Kaye (1993) have applied the general distribution of empty nuclei that has no specific bond with Slavic to Polish vowel-zero alternations. In this perspective, alternating vowels (i.e. yers) have the opposite identity with respect to Rubach (1986): rather than melodies that lack lexical association (to an x-slot), they are represented as empty nuclei, i.e. a constituent that lacks melody. This option is shown under (19) below.

(19) yers are empty nuclei: Gussmann & Kaye (1993)

Russian "land, Earth"

a. zemlj-e Dsg	b. zemel' Gpl	c. zemel'-nij adjective
Gov O z N e O m N l' O e N	Gov O z N e O m N ↑ e O l' N	Gov Gov O z N e O m N ↑ e O l' N n O ij N

On this take, an *e* is epenthesized into empty nuclei that fail to be governed. Government is defined as a lateral relation whose head (origin) must be phonetically expressed: it relates the final nucleus and its preceding peer under (19)a because the former is filled with the dative case marker, but breaks down under (19)b when the

²¹ Rowicka (1999) is an isolated attempt to conceive of government as a head-initial relation.

²² While Morris Halle has adopted the autosegmental frame more generally, his work on Slavic continues to apply Lightner's original linear SPE-style analysis where yers are distinct underlying melodic items and autosegmental structure plays no role (e.g. Halle 1994, Halle & Nevins 2009).

final nucleus is empty (in classical terms: when the internal yer is followed by a final yer). When applying, government has thus the effect of silencing its target: the empty nucleus enclosed by *m* and *l'* under (19)a remains unpronounced, but must appear on the surface when it fails to be governed as under (19)b. Since government is a regressive lateral relation, strings that are subject to phonological computation are parsed from right to left. Thus the final filled nucleus first governs its lefthand neighbor under (19) c, which therefore remains empty. Being phonetically unexpressed, this nucleus is then unable to act as a governor, a fact that causes the preceding empty nucleus to escape government and hence to vocalize.

Like the traditional analysis, the government-based version of Lower needs to recur to cyclic derivation in order to account for sequences of alternating vowels. In Po *bul-ecz-ek* “bread roll double dim. Nsg” (see (14)c), the application of government to the entire string /buł₃kø₂kø₁/ in one go would produce *bułøczek: ø₁ would be unable to govern ø₂ which would therefore vocalize and govern ø₃.²³

In order to derive the vocalization of all alternating vowels in a row, Gussmann & Kaye (1993) therefore apply government cyclically: *bul-ecz-ek* is divided into three cycles that are computed each in its own right: given [[[buł₃]kø₂]kø₁],²⁴ nothing happens on the first cycle [buł₃] since there is only one domain-final empty nucleus. The second cycle identifies as [buł₃kø₂] and bears two empty nuclei in a row, a situation that provokes the vocalization of ø₃ through the regular (non-)application of government (ø₂ is unable to govern ø₃, which therefore vocalizes). The input to the third cycle is thus [bułøk₂kø₁], and the presence of two empty nuclei in a row again causes the leftmost to vocalize, producing the surface result *buleczek*.

Gussmann & Kaye’s (1993) analysis is an interesting blend of deletion- and insertion-based strategies: on the one hand the locus of alternating vowels is lexically specified by the presence of empty nuclei; these are pronounced by default but may be silenced when they are struck by government. In this sense we are talking about deletion. On the other hand, however, empty nuclei are (melodically) empty and therefore need to be filled in with melody that is lexically absent. In this sense the analysis is insertion-based.

It was shown in section 2.3 that insertion-based analyses were refuted mainly on the grounds of two arguments: 1) the locus of insertion cannot be predicted and 2) the quality of the vowel that alternates with zero may be an idiosyncratic property of morphemes (like in Eastern Slavic). While Gussmann & Kaye’s (1993) system escapes the first criticism (empty nuclei determine the locus of alternation sites lexically), the second argument hits the target: in languages like Russian where more than one vowel alternates with zero, it cannot be predicted which vowel will be inserted into which morpheme.

The quality of alternating vowels must thus be recorded in the lexicon. Following Melvold (1989: 115 ff.), Scheer (2004: §§ 81 f.) has therefore proposed to unify Rubach’s original take where yers are floating melodies that are recorded in the lexical makeup of morphemes with the government-based strand. That is, alternating vowels

²³ This actually derives the Havlik pattern (as opposed to the Lower pattern), which is also found in Slavic (and beyond): in a sequence of alternating vowels, Havlik’s Law vocalizes every other, starting from the right edge (see Scheer 2004: §§ 416, 468, Scheer & Zikova 2010).

²⁴ This underlying form is simplified for the sake of exposition: the suffix *-ek* identifies as /-økø/ in Gussmann & Kaye (1993), but due to an operation called reduction loses its leftmost empty nucleus during the derivation.

(yers) are nuclei that possess a melody, which however is not associated lexically.²⁵ By contrast, the melody of non-alternating vowels is lexically associated. The three options discussed are contrasted under (20) below, using the Russian word *d'en* “day Nsg” (*døn'-a* “day Gsg”).

(20) underlying representation of vowels that alternate with zero (yers)

a. Rubach (1986)				b. Gussmann & Kaye (1993)				c. Scheer (2004, 2005)			
x		x		O	N	O	N	O	N	O	N
d'	e	n'	e	d'		n'		d'	e	n'	

On the assumption of (20)c, then, government acts as an association-inhibitor: floating melodies associate by default except when their nucleus is governed. Or, in other words, melodies can only associate to ungoverned nuclei.²⁶ Another interesting property of (20)c is that it makes a difference between two kinds of “empty” nuclei: one that is really empty, and one that possesses an unassociated floating melody. All previous accounts, linear and autosegmental alike, have granted yer-status to items that alternate with zero (the leftmost e under (20)a) as much as to items that never appear on the surface (the rightmost e under (20)a). By contrast, Farina (1991: 280 f.) and following her Scheer (2004: § 419) argue that there are two distinct representations for what is traditionally represented as yers: items that sometimes appear on the surface (nuclei provided with a floating melody under (20)c) are different from items that occur in word-final position but never appear on the surface (the final empty nucleus under (20)c).

6.4. CVCV and the contrast between *Ru láska* (Gpl l^ásk) and *l^áska* (Gpl l^ások)

The contrast between “real” empty nuclei and nuclei that possess a piece of floating melody is necessary in an environment where the existence of empty nuclei which are not involved in vowel-zero alternations is recognized. This is the case of so-called CVCV (or strict CV), the development of Standard Government Phonology in which (20)c is couched (Lowenstamm 1996; Szigetvári 1999; Scheer 2004; Szigetvári & Scheer 2005; Cyran 2010).

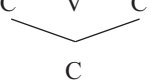
The central idea of Government Phonology is the lateralisation of structure and causality: instead of the familiar syllabic arborescence, lateral relations among constituents (government and licensing) are responsible for the effects observed. While

²⁵ See also Gussmann (2007). As far as I can see, the structure under (20)c was first proposed by Melvold (1989: 115 ff.), who argues that there are three lexically distinct yers in Russian: one type has a melody but no nucleus, the second type has a nucleus but no melody, finally the third type (i.e. (20)c) has both nucleus and melody, which however are lexically unassociated.

²⁶ This analysis is along the lines of the behaviour that is classically assumed for floating pieces of melody: for example, French liaison consonants (e.g. the final *-t* of */petit/*, cf. *pet[it] enfant* “small child” vs. *pet[i] café* “small coffee”) are traditionally taken to be lexically floating; they associate whenever an accessible, i.e. empty onset is available (e.g. Encrevé 1988). Hence association works in absence of any explicit lexical relationship between the floater and the receiving constituent. The same is true for (20)c: the floater associates whenever it can, and to the only nucleus that is available. The accessibility of this nucleus is defined by government (governed = inaccessible, ungoverned = accessible).

Standard Government Phonology is a hybrid arboreal-lateral system (Scheer 2004: § 165), CVCV takes lateralisation to its logical end: syllabic constituency boils down to a strict sequence of non-branching onsets and non-branching nuclei in all languages. There are no codas and no rhymes, and the minimal syllabic unit that may be manipulated is an onset followed by a nucleus: the existence of the former implies the latter and *vice versa*. For the sake of illustration, the constituent structure of some basic phonological objects appears under (21) below.²⁷

(21)

closed syllable				geminate		long vowel		[...C#]		
C	V	C	V	C	V	C	V	...	C	V
										
C	V	C	ø			C	V	C	ø	

In traditional approaches, syllabic arborescence assures the function of binding together different constituents, thereby identifying their grouping into higher units. In CVCV, this function is shifted onto lateral relations that hold between constituents, i.e. government and licensing. Effects that are usually attributed to the fact that a given segment belongs to this or that syllabic constituent stem from the configuration regarding government and licensing that it is involved in.

This may be illustrated by the following example. Coda phenomena are effects that are triggered by codas and either appear on the coda consonant itself (lenition, devoicing etc.) or on the preceding vowel, in which case they are called closed syllable effects (vowel shortening, nasalisation etc.). The situation of (internal and final) coda consonants in CVCV, as opposed to onsets, is shown under (22) below.

(22) coda consonants in CVCV are consonants that occur before a governed empty nucleus

a. internal coda consonant	b. final coda consonant	c. onset
Gov/Lic  ... V C V C V V R T V	Gov/Lic  ... V C V # V C	Gov/Lic  ... V C V C V C V

In classical approaches, the coda disjunction $_\{ \#, C \}$ is reduced to a non-disjunctive statement by saying that consonants in word-final and pre-consonantal position belong to a specific constituent, the coda. In CVCV, coda consonants (22 a, b occur before a governed empty Nucleus (unlike onset consonants (22)c). The difference between both descriptively equivalent statements is the causal relation between the relevant environment and the observed phenomena. We know that coda consonants, i.e. those that occur in $_\{ \#, C \}$, are weak: they are prone to all kinds

²⁷ For the representation of obstruent-liquid clusters (i.e. branching onsets) see Scheer (2004: § 14), Segeral & Scheer (2005) and Brun-Trigaud & Scheer (2010). On the following pages, T is shorthand for obstruents, R for sonorants; onsets are transcribed as “C”, nuclei as “V”.

of lenition. On the coda account, this observation has no explanation: there is no reason why codas, rather than onsets, should be weak. By contrast, the fact that objects are weak before empty, rather than before contentful nuclei, has an obvious explanation: empty nuclei cannot support their onset because they are empty and governed.

A consequence of CVCV is that not all empty nuclei host a vowel-zero alternation: there are also empty nuclei that never ever appear on the surface. The sk cluster of both Russian *laska* (Gpl *lask*) “caress” and *laska* (Gpl *lask*) “weasel” for example encloses a nucleus. While this nucleus remains silent in the Gpl of the former word, it appears as o in the Gpl of the latter. Both must therefore have a distinct lexical identity: as indicated under (20)c, in CVCV alternating vowels are nuclei that possess a floating piece of melody, while empty nuclei that never appear on the surface lack such a melody. This contrast is depicted under (23) below.

(23) contrast between nuclei that possess and that lack a floating melody

a. Ru <i>lask</i> -a “caress”						b. Ru <i>lask</i> -a “weasel”					
C	V	C	V	C	V	C	V	C	V	C	V
l	a	s		k	a	l	a	s	o	k	a
Gpl: <i>lask</i>						Gpl: <i>lask</i>					

Before concluding, the last question to be (briefly) addressed is the workings of yers beyond vowel-zero alternations, and also beyond Slavic.

7. Bearing of yers on phenomena other than vowel-zero alternations

7.1. Within Slavic

Yers usually draw attention because of their own behavior: we have seen how their alternation with zero is analyzed. The central empirical fact that led to the Lower rule and the view that yers entertain a lateral relation with the following vowel is the yer context (9): a yer appears on the surface in closed syllables and in open syllables iff the following vowel alternates with zero. Yers thus react on other yers or, looked at from the other end, stable vowels provoke the phonetic absence of a preceding yer, while a yer provokes its presence. As a conditioner, yers thus behave as if they were not there, although they are phonetically present.

Interestingly, this effect is not only observable on yers, but also on other vowels: the yer context also controls alternations beyond vowel-zero alternations, a fact that typically goes unnoticed in the literature. Scheer (2004: § 428) has collected the following examples in Western Slavic (see also Halle & Nevins 2009).²⁸

²⁸ Note that vowel length is contrastive in Czech, but not in Modern Polish. Glosses: a) “frog” Nsg, dim. Gpl, Gpl, dim. Nsg; “name” Nsg, Gpl, adj.; b) “knife” Gsg, “scissors” (i.e. dim. of “knife”) Gpl, “knife” Nsg, “scissors” Npl; c) “cow” Nsg, dim. Gpl, Gpl, dim. Nsg; d) “tooth” Gsg, dim. Nsg, Nsg, dim. Gsg.

(24) alternations conditioned by the yer context “in closed syllables and in open syllables if the following vowel is a yer”

		open syllable		closed syllable	
		C__C-V	C__C-yer	C__C#	C__C-CV
a.	Czech VV–V	žáb-a jměn-o	žab-ek	žab jmen	žab-øk-a jmen-ný
b.	Czech o-û	nož-e	nûž-ek	nûž	nûž-øk-y
c.	Polish o-ó	króv-a	krów-ek	krów	krów-øk-a
d.	Polish ę-ą	zęb-a	ząb-ek	ząb	ząb-øk-a

Space restrictions do not allow for much discussion. Let us therefore only consider the distribution of long and short vowels in Czech. These are restricted to a well-defined paradigm, feminine a-stems and neuter o-stems (a typical situation for Czech vowel length). At first sight the alternation looks like an instance of regular closed syllable shortening: short vowels occur in closed syllables (*žab*, *žab-ka* “frog Gpl, dim. Nsg”), while long vowels appear in open syllables (*žáb-a* “frog Nsg”). Just like with vowel-zero alternations, however, this syllabic generalization is refuted by cases such as *žab-ek* “frog dim. Gpl” where a short, rather than the expected long vowel appears in an open syllable. This only happens if the following vowel alternates with zero, i.e. is a yer (its alternating character is established by *žab-k-a* “frog dim. Nsg”). In other words, the disjunctive yer context can be reduced to a simple non-disjunctive statement as before: short vowels (just as zeros) occur before yers, while long vowels are found before non-yers.

Before drawing conclusions from the fact that a number of other alternations are controlled by the same yer-based contextual conditions as vowel-zero alternations, a word is in order regarding the alternations under (24), whose non-productivity is notorious. There are many relevant lexical items that do not participate. Diachronically, all four alternations shown amount to the same original Western Slavic process that manipulated vowel length.²⁹ The fact that the alternations are either not synchronically active (in Polish) or restricted to specific paradigms (in Czech) does not mean that they are less indicative, or do not witness a phonological process that once was synchronically active.

Therefore, if the yer context (9) is responsible for vowel-zero alternations as much as for other alternations, the Lower rule turns out to be but a sub-regularity of a much broader process whereby yers play the central role. That is, regarding (24) as much as vowel-zero alternations, the striking property of yers is that they behave as if they were not there even when they are phonetically expressed.

7.2. Beyond Slavic

We have already seen that the autosegmental analysis of yers creates the conditions for a scenario where nothing in their representation is specifically Slavic. While linear approaches represent them as two idiosyncratic melodic items in the underlying vocalic

²⁹ Vowel length was lost in Modern Polish: alternations in this language are only witnessed by cases where original long and short versions of a vowel at some point also diverged in vowel quality. The diachronic and philological detail of the processes under (24) is discussed in Scheer (2004: § 426).

inventory, they become regular and Slavic-unspecific phonological objects in auto-segmental times: only Slavic languages have [–tense] yers, but all languages can have floating pieces of melody. Government-based analyses have gone one step further: the lateral relation embodied by Lower identifies as government, and word-final consonants are followed by an empty nucleus, rather than by a yer with morphological value. Finally, it was shown in section 2.2 that vowels which alternate with zero in modern Slavic languages may be perfectly independent from the Common Slavic vowels that are known as yers.

The insight that the phenomena at hand are not specifically Slavic, but phonological in nature, is also supported by the fact that the yer context (9), which is rather specific, is found to control alternations beyond Slavic. Scheer (2004: § 426, 2006) reports a number of cases in point, among which two well-known alternations in French that concern schwa and [ɛ] on the one hand, and the ATRness of mid vowels on the other (e.g. Tranel 1987 for an overview). In French, the only vowel that alternates with zero is schwa [ə]. It was already mentioned that unlike in Slavic, the alternation is optional.

The schwa-[ɛ] alternation may be illustrated by the word *appeler* “to call”: [ɛ] appears in closed syllables (*j’appelle* [apɛl] “I call”, *il appellera* [apɛlʁa] “he will call”) and before a vowel that alternates with zero (*il appellera* [apɛləʁa] “he will call”), while schwa is found in open syllables (*appeler* [apøle] “to call inf.”). Regarding the other alternation, French possesses six mid vowels that subdivide into two sets: +ATR [e, o, ø] and -ATR [ɛ, ɔ, œ]. In a number of Southern varieties, ATRness is distributed according to the yer context: +ATR versions occur in open syllables if the following vowel does not alternate with zero (*fêter* [fete] “to party”), while mid vowels are -ATR in closed syllables (*je fête* [fet] “I party”, *perdu* [pɛʁdy] “lost”), and in open syllables if the following vowel alternates with zero (*céleri* [sɛləʁi]/[sɛlʁi] “celery”).

The yer context also conditions consonants. The well-known alternation of the German velar nasal is a case in point (Scheer 2004: § 480, relevant literature includes Dressler 1981 and Hall 1992: 199 ff.). Like the English velar nasal, the underlying /ŋg/ reduces to [ŋ] in closed syllables (*Ding* [dɪŋ] “thing”, *Angst* [ʔaŋst] “fear”), but appears as [ŋg] before full vowels (*Ingo* [ʔɪŋgoo] “first name”, *evangelisch* [ʔɛfangeelɪʃ] “protestant”). Parting company with English (cf. Engl. *finger* [fɪŋgə]), though, German also produces the reduced form before schwa (*Inge* [ʔɪŋə] “female version of Ingo”, *Bengel* [bɛŋəl] “rascal”). The same pattern, i.e. where consonants behave alike in coda position and before schwa, also occurs in Dutch (Kager & Zonneveld 1986).

Of course there is no point in trying to attribute these alternations to yer vowels or other Slavic-specific items. What we are facing is a truly phonological pattern that occurs in Slavic as much as in other languages, and whose key feature is the behavior of vowels that alternate with zero. Rather than like other vowels, they behave as if they were not there even when they are phonetically expressed. Note that the quality of these vowels is entirely irrelevant: they may be peripheral like in Slavic, or central (“true” schwas) like in French and German.

Analyses of so-called Slavic yers will therefore have to make sure that their instruments are not bound to Slavic, but can express more general phonological processes. Yers need to be extracted from their narrow Slavic context where they have lived in a waterproof environment in much of the structuralist and the generative tradition. They can offer rich insight into phonological theory if they are placed in a broader context: “yers” condition processes that are different from vowel-zero alternations, and they are active beyond Slavic.

8. Conclusion

On the empirical side, the above discussion has shown two things: Russian is not any different from other Slavic languages regarding the non-predictability of alternation sites, which must be specified lexically. Also, the vowel quality of alternating vowels needs to be recorded in the lexicon unless one wants to buy into a synchronically active $e \rightarrow o$ rule, which it is hard to believe in for a number of reasons.

On the analytic side, the article has argued that the basic insight of Lower is correct: vowel-zero alternations are due to a lateral relationship between two nuclei whereby the rightmost (trigger) determines the (non-)vocalization of the leftmost (patient). Scenarios such as Yearley's (1995) which abandon this idea are driven into a situation where a number of unrelated mechanisms are held responsible for a phenomenon that is uniform in nature and may be described by a single conditioning (the lateral relation of Lower). Also, the multicausal analysis reintroduces through the back door a conditioning factor that we know is inoperative (the prohibition of coda clusters which in fact are not prohibited at all).

It therefore remains to be seen how the insight of Lower could be expressed in OT: Yearley (1995) seems to be the only OT-based analysis of Slavic vowel-zero alternations that is available to date. By contrast, the government-based analysis of yers in the environment of CVCV is a faithful expression of Lower in a Slavic-unspecific vocabulary. This is warranted since the article has also argued that there is no Slavic-specific solution to Slavic yers. The pattern discussed is but an instantiation of a broader set of phenomena that all have in common the fact that vowels which alternate with zero behave as if they were not there, even when they are phonetically expressed. Therefore a uniform analysis of the cross-linguistically resident pattern under (9) (the yer context) is required, and it is argued that the government-based version of Lower cast in the specific syllabic environment of CVCV qualifies.

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