Vocalic alternations in Czech prefixes: evidence for prefix movement

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0. Abstract

Looking at vocalic alternations in Czech prefixes, we provide some empirical evidence for the theory proposed in Svenonius (2004). The theory says that verbal prefixes undergo phrasal movement from a low root-attached position to a higher stem-attached position.

1. Introduction[1]

In Czech (as well as in other Slavic languages), verbs are usually decomposed into the so-called stem and a (potentially complex) inflectional marking. An example is shown in (1); the stem is underlined, and it corresponds to the base to which the past tense marker *-l* is added.

The stem usually decomposes into two pieces, namely the root and the theme. The latter can be looked upon as an affixal light verb, assuming a variety of meanings like 'make', 'do', 'become', etc. As such, it has the capacity to turn nouns and adjectives into verbs; see Svenonius (2004b) for an exposition. The brackets in the gloss indicate the assumed structure of the form.

(1)	<u>kop</u>	-a	-l	-a	(2)	vy-	kop	-a	-l	-a
	[[[[dig	-theme]	past]	fem]		out	dig	theme	past	fem
	'she dug'					'she dug out'				

Apart from the suffixes, the verb may also include one or more prefixes. Here we will concentrate only on the prototypical instance of a single prefix of the type that has been referred to as the lexical prefix (see, e.g. Svenonius 2004 for the term). An example is shown in (2).

The goal of the paper is to explore a particular proposal concerning the structural position of the prefix in the string of morphemes that follow it. In most proposals to date, the prefix is analyzed as attached to the root, with the theme marker added to this complex unit, as in (3a). The logical alternatives are (i) to attach the prefix to the stem, as in (3b); or (ii) attach the prefix to the whole word, as in (3c).

(3) a. [[[pref root] theme] infl] b. [[pref [root theme]] infl] c. [pref [[root theme] infl]]

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Based on data from Czech, we argue for a proposal put forth in Svenonius (2004) and more recently Caha and Ziková (2016) that the prefix actually alternates (via phrasal movement) between the two position depicted in (3a,b). This is shown in (4).

(4) pref [[~~pref~~ root] theme]

The paper is structured as follows. In Section 2, we briefly review Caha and Ziková's (2016) reasons for proposing the structure in (4). Sections 3 and 4 are devoted to presenting some independent evidence for the proposal. Specifically, in Section 3, we show that in Czech, prefix vocalization can be best explained if the structure of the verb is as in (3a). In section 4, we show that infinitival lengthening contradicts the structure in (3a), and requires the structure (3b) instead. The point is that these contradictions are resolved by the analysis in (4), which says that the prefix changes its position from (3a) to (3b) in the course of the derivation.

2. Vowel-length alternation in prefixes

Caha and Ziková (2016) look at a length alternation that is found in verbal prefixes. An example is given in (5a,b). In (5a), the prefix is short, in (5b) it is long (vowel length is marked by an acute accent sign placed over the vowel). The distinction between the two forms is dependent on whether the prefix appears on a verb (5a) or a deverbal (simplex event) noun (5b). In order to understand the alternation, Caha and Ziková point out that its triggering conditions are similar to the free/bound alternation found in Norwegian. In this language, prepositional particles alternate between the so-called free and bound status in roughly the same environments where Czech prefixes alternate between short and long, see (5) and (6) juxtaposed.

(5)	a.	**na**-raz-ø on-hit-imp.2.sg 'crash!'	SHORT	b.	**ná**-raz-ø on-hit-nominative 'a crash'	LONG

(6)	a.	kast katta ut! throw the cat out 'throw the cat out'	FREE	b.	ut-kast out-throw 'a discard/a draft'	BOUND

The hypothesis stemming from the analogy is that Czech prefixes alternate (string vacuously) between two structural positions, as in (4), where the base position corresponds to a 'bound' prefix and the derived position to a 'free' prefix. Vowel length simply reflects the two positions.

This hypothesis gains support from the fact that internally to Czech, prepositions – homophonous to the prefixes – alternate in vowel length just like the corresponding prefixes, and this alternation quite transparently corresponds to their free vs. bound status. An example is shown in (7). When *na* 'on' is used as a run-of-the-mill 'free' preposition, it is short, see (7a).

(7) a. **na** břeh-u
on bank-loc
'on the bank'

b. **ná**-břež-í
on-bank-PLACE
'a river side' (lit. the on-bank)

However, prepositions can also be 'bound' in structures resembling English forms such as 'the *under*ground.' A Czech equivalent to such formations is shown in (7b). Here, when the preposition is 'bound,' it is long. So (7) confirms the hypothesis that in morphemes such as *na* 'on', the free/bound distinction correlates with quantity.

The bare bones of the technical implementation for prefixes are then as has been shown in (4). The idea is that first, the prefix and the root are merged together, and form a tight-knit constituent that has a status of a single word. In this configuration, the prefix is long, and surfaces as such in nominalizations, which do not contain any theme marker.

However, if a theme marker is merged later on, as in (4), the prefix moves by phrasal movement and attaches to the stem (composed of the theme and the root). The stem has the status of a phonological word, and the prefix pre-cliticizes to that word, but it no longer counts as 'bound' for the purposes of the short/long distinction.

The details of the analysis are worked out in Caha and Ziková (2016), and we refer the interested reader to that paper. What we want to do here is to go beyond the vowel length distinction and show that there are additional reasons for a derivation along the lines of (4).

The paper is organized as follows. In section 3, we argue that prefix vocalization in Czech requires a cycle of phonological computation over the the root and the prefix (suggesting a structure like in 3a). In section 4, we argue that the process of infinitival lengthening reveals the need for phonological computation that targets the root and the theme, but not the prefix (suggesting a structure like in 3b). These two requirements are apparently contradictory. However, the derivation in (4) in fact predicts the possibility of such paradoxes: the two distinct structures are in fact available at different stages of a single derivation. Section 5 concludes.

3. Prefix vocalization in Czech and Russian

This section investigates a systematic contrast between Czech and Russian concerning prefix vocalization. The difference can be explained by proposing that Czech – compared to Russian

– has an extra cycle of phonological interpretation. This extra cycle of computation is performed over a string that consists of the root and the prefix. Under the assumptions that cycles of phonological interpretation target morphological constituents, this shows that the prefix and the root must form a constituent at some level of representation.

3.1 Prefix vocalization in Russian

Our starting point is the data in (8), which is discussed from the perspective of cyclic or non-cyclic phonological interpretation already in Pesetsky's (1979) paper (cf. Halle and Nevins 2009: 363, Gribanova 2015: ex. 15). The 'ø' signs in the examples indicate silence, the lack of a vowel where one could be expected. The meaning of the arrows will be explained below.

(8)

a. **žëg** -ø
burn -past.masc

b. **žøg** -la
burn -past.fem

c. **podø-** žëg -ø
under burn -past.masc

d. **podø-** žøg -la
under burn past.fem

We start from the contrast between (8a,b). What we see here is that the root for 'burn' alternates between two shapes, one with a vowel (*žëg* in (8a)) and one without it (*žøg* in (8b)). The alternation depends on whether the past tense ending has a vowel or not.

When the ending has a vowel, as in (8b), this vowel allows for a zero in the root. This "allowing" is represented in (8b) by an arrow going from the vowel *a* to the ø in the root. However, when the ending is zero, as in (8a), the zero cannot allow for the lack of a vowel in the root. This is represented in (8a) by a strike-through placed over the arrow going from the ending to the root.

This allowing relation is called government in Government Phonology (see, e.g., Scheer 2006); in that framework, it corresponds to a relationship between two syllabic nuclei. The filled nucleus *a* in (8b) may govern the nucleus in the root, which can therefore remain silent (*žøg*-). The masculine ending corresponds to an empty nucleus (ø), and it fails to govern the nucleus in the root, which therefore has to associate to a lexically specified melody, and surfaces with that melody (*žëg*). The final thing to note is that the empty nucleus in the ending needs to be governed as well; the assumption is that such domain final empty nuclei are governed automatically "by default."[2]

[2] In the literature on Slavic, vowel zero alternations are frequently not treated as the vocalization of empty nuclei, but instead as reflexes of abstract vowels, the so-called yers. The translation between the two ways of

What is going to be of interest is not the pattern per se, but rather the way it interacts with a related vocalization pattern in the prefix. So what we have in (8c,d) are the two different root shapes prefixed by a morpheme that also has a vowel zero alternation site at its right edge. What we see is that if the root has a vowel, this vowel allows for a zero in the prefix, and we get *pod-* in (8c). Again, we interpret this in terms of the government relation between the filled nucleus in the root and the empty nucleus in the prefix. When the root has no vowel, as in (8d), it fails to govern the nucleus at the right edge of the prefix. This ungoverned nucleus has to associate to a melody, and the prefix surfaces as *podo-*.

The important thing is the order in which vocalization is determined. First, we determine whether the root's nucleus is to be filled by inspecting the phonology of the right context. Only after the status of the root's nucleus is determined, we proceed to the prefix. This state of affairs is open to a number of theoretical interpretations, two of which we mention below.

Pesetsky (1977) proposes that phonological operations (including the vocalization of empty nuclei) apply cyclically first to the combination of the root and the past tense suffix, and only after the phonological shape of the root has been established, the prefix is integrated in the second cycle, see (9a). According to Pesetsky, this conclusion leads to a bracketing paradox, because for semantic reasons, one would like to say that the examples (8c,d) are the past tense of a prefixed verb, a paraphrase which leads to the bracketing in (9b). However, if one would run the phonological cycles as shown in (9b), one would expect that on cycle 1, the root would trigger a vowel in the prefix, and the prefix would then keep the vowel on cycle 2.

(9)	a.	[$_{\text{CYCLE 2}}$ pref [$_{\text{CYCLE 1}}$ root past]]	(yields *pod-žëg*)
	b.	[$_{\text{CYCLE 2}}$ [$_{\text{CYCLE 1}}$ pref root] past]	(yields **podo-žëg*)
	c.	[$_{\text{CYCLE 1}}$ [$_{\text{NON-CYCLE}}$ pref root] past]	(yields *pod-žëg*)

Halle and Nevins (2009) avoid the bracketing paradox by saying (roughly) that phonological interpretation in Russian skips the inner-most cycle, and applies to the whole string, as shown in (9c). Then, if vocaliyation proceeds from right to left, as in (8), the paradox disappears.

We do not want to take a stance here concerning which of these options is correct, as our main goal is to show that in Czech, vocalization proceeds along the lines of (9b). Before we do that, we want to show that in Russian, the order of computations expressed in (9a) applies in a larger set of environments. Specifically, we illustrate a similar effect by looking at cases

looking at the alternation is straightforward most of the time, and readers familiar with the yer representations should have no obstacles translating the account into a yer-based framework; see Scheer (2006).

where morphological categories expressed to the right of the root trigger a certain vocalic effect inside it, which then triggers a particular vocalism of the prefix.

The first case that we present is the formation of the so-called secondary secondary imperfectives. The list of verbs in (10) (extracted from Gribanova 2015: table 2 and 3) gives a couple of relevant examples. The verbs in the second column are secondary imperfectives (SI) based on the perfective verbs in the first column:

(10) Russian, pairs of perfective verbs and their secondary imperfective forms

	PERFECTIVE				SECONDARY IMPERFECTIVE			
a.	pod**o-**	b**ø**r	-a	-l	pod**ø-**	bir	-a	-l
	under-	pick	-theme	-past	under-	pick.SI	-theme	-past
b.	roz**o-**	d**ø**r	-a	-l	roz**ø-**	dir	-a	-l
	apart-	tear	-theme	-past	apart-	tear.SI	-theme	-past
c.	ot**o-**	m**ø**k	-nu	-l	ot**ø-**	myk	-a	-l
	away-	lock	-theme	-past	away	lock	-theme	-past

Here, we do not attempt to explain the vowel zero alternation in the root, which, at the first blush, seems to be triggered by a morphological category (SI) that is typically expressed by a suffix in Russian. The only goal is to show that the vowel-zero alternation in the prefix is dependent on what vocalization pattern is forced upon the root by the morphology. Specifically, anytime when the nucleus in the root is filled (as in the second column), then the vowel governs and hence licenses an empty nucleus in the prefix. The crucial thing is that we *first* need to know what the root looks like (based on a relatively 'high' aspectual category that scopes over the prefix), and only later we can determine what the prefix is going to look like.

Another place where we see such an interaction is in the present tense. Two examples are given in (11). Once again, the same logic connects the presence/absence of a vowel in the prefix to the one in the root. As in (10), the presence of the vowel in the root is controlled by a relatively high morphological category (tense).

(11)

	PAST				PRESENT		
a.	roz**o-**	d**ø**r	-a	-l	roz**ø-**	der	-u
	apart-	tear	-theme	-past	apart-	tear	-pres.1sg
b.	pod**o-**	b**ø**r	-a	-l	pod**ø-**	ber	-u
	under	pick	-theme	-past	under-	pick	-pres.1sg

The lesson is thus the following: in Russian, when we want to predict whether the prefix has a vowel or zero, we must first determine whether the root has a vowel or not. Interestingly, we must do so even in cases when this information is scopally higher than the prefix.

3.2 Prefix vocalization in Czech

With the basics in place, let us now turn to analogous data sets from Czech. In (12a,b) we see a pair that is similar to *žëg* vs. *žøg-la* (recall (8a,b)). The root is different, it means 'go,' but just like the Russian root for 'burn' it has two allomorphs in the past tense, one with a vowel (*še*-) and one without (*šø*-). Still like in Russian, the form chosen depends on the government of the root's nucleus by an affix, as the arrows in (12a,b) indicate.

(12)

a.	**še**	-lø		c.	**ode-**	še	-lø
	go	past.masc			away	go	past.masc
b.	**šø**	-la		d.	**ode-**	šø	-la
	go	past.fem			away	go	past.fem

In (12c,d), the two distinct root shapes are prefixed by *od(e)*- 'away,' which has a vowel zero alternation site on its right edge just like Russian *pod(o)*- 'under'. The feminine form in (12d), looks the same as the corresponding Russian form in (8d). Here, it could still be proposed that the final nucleus – being non-empty – governs the nucleus in the root, which remains empty, and may not govern the prefix-final nucleus as a consequence. However, this logic fails in (12c). The example contrasts empirically with the Russian *pod-žëg* in (8c): there is a vowel in the Czech prefix, which is missing in Russian.[3]

Following the same logic, the expectation would be this: starting at the right edge of (12c), the final empty nucleus is governed by default, and remains empty. It fails to govern the empty nucleus in the root, so we get the root *še*-. But now we expect that the root nucleus will govern the empty nucleus in the prefix, which should yield the form *odø*-, contrary to fact.

The solution to this problem is to involve a cyclic derivation of the forms. First, on cycle 1, we run a phonological computation over the string composed of the root and the prefix; see (13a). The final empty nucleus – the one in the root – is governed by default and remains empty.

[3] We are aware that in Russian, one also finds a limited number of examples that work as the Czech (12); in fact, the past tense of 'go' is one of these. However, the purpose of the exercise is not to focus on a single example, but rather to show that what is exceptional in Russian, is systematic in Czech across the three distinct environments. But it is of course interesting that some Russian verbs seem to follow the Czech pattern.

Being empty, it fails to govern the nucleus in the prefix, which has to associate to a melody. The result of the computation on cycle 1 is therefore "*ode-šø*." This string is further used as the input to computation at cycle 2, where it is affixed with the past tense *–lø*.[4] This affix has an empty nucleus, which is final at cycle 2 and is therefore governed. Being governed, it remains empty and fails to govern the empty nucleus in the root, which gets vocalized.

(13) *The derivation of ode-še-l*

a. CYCLE 1: odø-šø
b. RESULT: odešø
c. CYCLE 2: [CYCLE 1 odešø]-lø
d. RESULT: odešelø

(14) *The derivation of ode-š-la*

a. CYCLE 1: odø-šø
b. RESULT: odešø
c. CYCLE 2: [CYCLE 1 odešø]-la
d. RESULT: odešla

Involving cyclic computation will not lead to any problems in the feminine form, as the derivation (14) shows. The only difference is that on cycle 2, the ending *–la* leads to the non-pronunciation of the empty nucleus in the root. So the difference between Czech and Russian can be described by saying that Czech – but not Russian – has a cycle of phonological computation that encompasses the prefix and the root as a unit.

The very same difference is relevant in the remaining data sets. In the formation of secondary imperfectives, the fact that the perfective verb has an empty nucleus in the root triggers a vocalized version of the prefix in the first column. The very same version of the prefix is maintained in the second column, where the formation of secondary imperfectives yields a vowel in the root. This is distinct from what we saw in Russian in (10); there, the vowel in the root triggered a consonant-final version of the prefix.

(15) Czech, pairs of perfective verbs and their secondary imperfective forms

	PERFECTIVE				SECONDARY IMPERFECTIVE			
a.	pod**e-**	b**ø**r	-a	-l	pod**e-**	bír	-a	-l
	under-	pick	-theme	-past	under-	pick.SI	-theme	-past
b.	roz**e-**	d**ø**r	-a	-l	roz**e-**	dír	-a	-l
	apart-	tear	-theme	-past	apart-	tear.SI	-theme	-past
c.	od**e-**	m**ø**k	-nu	-l	od**e-**	myk	-a	-l
	away-	lock	-theme	-past	away	lock	-theme	-past

[4] We are making here a simplification; *-l* and *–ø* are in fact two pieces, so we could have three cycles of computation. This would change nothing on the result, see Halle and Nevins (2009) for a fully cyclic exposition.

This can again be explained under the assumption that in Czech, there is a cycle of computation that includes the root and the prefix, see (16a). In (16a), the vocalization of the prefix is perfectly regular: the root has an empty nucleus, so the prefix-final empty nucleus is not governed and must vocalize. This vocalization cannot be cancelled on cycle 2 where a vowel appears in the root to express a morphological category (the SI, see Gribanova 2015 for an account).

(16) *Secondary imeprfectives in Czech*

a.	CYCLE 1:	podø-bør
b.	RESULT:	pode-bør
c.	CYCLE 2:	[$_{\text{CYCLE 1}}$ podebør]-SI
d.	RESULT:	podebír

Finally, the same contrast shows in the present tense, compare (17) with (11). The present tense forms can again be explained under the assumption that they involve a step analogous to (16a).

(17)

	PAST				PRESENT		
a.	roz**e-**	d**ø**r	-a	-l	roz**e-**	der	-u
	apart-	tear	-theme	-past	apart-	tear	-pres.1sg
b.	pod**e-**	b**ø**r	-a	-l	pod**e-**	ber	-u
	under	pick	-theme	-past	under-	pick	-pres.1sg

3.3 Conclusions

This section has observed that Czech and Russian differ in the way prefixes with vowel zero alternation sites react to vowel-zero alternations in roots. In Russian, we must first determine what happens in the root, and only then we can predict the shape of the prefix. In Czech, things work the other way round: we must first compute the shape of the prefix in combination with a particular root, and only later we can add the affixes. The important thing to us is the conclusion that in Czech, the prefix and the verb root form a cyclic domain (and hence, a morphological constituent) to the exclusion of the suffixes. Russian has served here mainly as an indication that things would indeed look different if there was no such cycle.

4. Infinitival lengthening

This section explores a process that we dub the infinitival lengthening (see Scheer 2001, Caha and Scheer 2008). Our goal is to show that the process operates over a string containing the root and the theme marker, but not the prefix. Again, under the assumption that phonological

operations targets morphological constituents, this has implications for the structural position of the prefix. We now proceed to the facts.

The process of infinitival lengthening targets the vocalic stem markers *-a, -i* and *-ě*, yielding *-á, -í* and *-í* respectively. The process is illustrated in the first two lines of the table in (18): the past tense *d-**a**-l* 'give-theme-past' shows the underlying form of the theme marker, and this form is lengthened in the infinitive (*d-**á**-t* 'give-theme-inf').

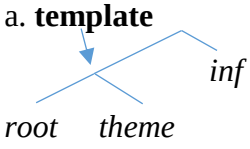
(18) *Infinitival lengthening of the theme with light roots*

	a-stem	*i*-stem	*ě*-stem
light root, past	*d-**a**-l* 'give'	*sn-**i**-l* 'dream'	*tř-**e**-l* 'rub'
light root, infinitive	*d-**á**-t*	*sn-**í**-t*	*tř-**í**-t*
heavy root, past	*děl-**a**-l* 'make'	*vol-**i**-l* 'vote'	*hoř-**e**-l* 'burn'
heavy root, infinitive	*děl-**a**-t*	*vol-**i**-t*	*hoř-**e**-t*

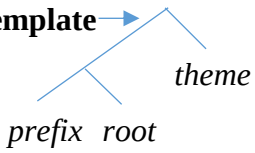
The process only lengthens stem markers after roots that have no vowel (like *d-* 'give'). When the root has a vowel, as in the two lines at the bottom, stems do not lengthen. In the literature quoted, this has been taken as an indication that infinitival lengthening is a kind of a templatic requirement, demanding that in the infinitive, the root and the theme marker taken together have to weigh (minimally) two moras. If the root has a vowel, then its simple concatenation with the theme marker yields a unit that already has two moras; so no lengthening takes place. When the root has no vowel, the theme has to lengthen in order to fill the required weight.

Before moving on, let us adopt the assumption, defended recently in Hyman, Inkelas and Sibanda (2008), that templatic domains target constituents in the morphosyntactic structure. In concrete terms, since the root and the theme *together* must weigh minimally two moras, it means that they form a constituent over which this requirement is stated, see (19a).

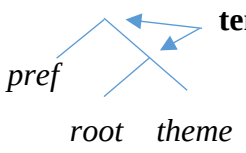
(19) a. **template**



b. **template**



c. **template**



It then becomes relevant to ask what happens when a prefix is added into the structure. In Section 3, we concluded that the prefix and the root form a tight-knit constituent. The thematic vowel attaches only later on (see 16a), which forces the structure in (19b). In this structure, the only constituent that contains both the root and the theme is the top-most node; but this constituent also includes the prefix. The prediction is, then, that a moraic prefix should

contribute to the weight of the form, and make a heavy root out of a light one.

When we look at the *a*-stem paradigm in the table (20), this seems to be the case. With a moraic prefix *vy-* 'out' added to the root, infinitival lengthening no longer applies; the relevant cell is shaded. The reason for this is that the templatic domain comprises all the three morphemes, and these by simple concatenation provide the needed phonological weight.

(20) *Infinitival lengthening: the contribution of the prefix*

	a-stem	*i*-stem	*ě*-stem
light root, past	d-**a**-l 'give'	sn-**i**-l 'dream'	tř-**e**-l 'rub'
light root, inf.	d-**á**-t	sn-**í**-t	tř-**í**-t
moraic prefix, past	vy-d-**a**-l 'give out'	vy-sn-**i**-l 'dream out'	vy-tř-**e**-l 'rub out'
moraic prefix, inf.	vy-d-**a**-t	vy-sn-**í**-t	vy-tř-**í**-t

However, problems appear in *i*-stems and *ě*-stems. In these classes, the prefix does not contribute to the overall weight of the form. This can be seen in the shaded cells in the relevant columns of the table (20): the theme marker lengthens even when a moraic prefix is present, yielding *vy-[sn-**í**]-t* 'dream out', and *vy-[tř-**í**]-t* 'rub out'. This means that in these two classes, the bi-moraic template scopes only over the root and the theme, as indicated by the brackets.

However, such a constituent is not present in (19b), hence, this structure does not contain the units needed to capture the way infinitival lengthening works. The relevant units are only available if the structure would be as shown in (19c). The behavior of *i/ě* stems can be described by proposing that the templatic requirement applies to the lower node pointed at by the arrow. The behavior of *a* stems can be captured by proposing that the templatic requirement targets the top-most node of (19c), which includes all the relevant pieces that contribute to the weight of the *a*-stem. So the conclusion is that the structure (19c) can incorporate both the fact that in the *a*-stems, there is a constituent that includes all three pieces, as well as the fact that in *ě* and *i* stems, the prefix is counted out.

5. Conclusions

The conclusion that emerges from the last two sections is that various phonological processes show the need for groupings of morphemes that apparently cannot be captured by a single morphological structure. However, these contradictory requirements can be nicely explained within the theory of Caha and Ziková (2016). In their proposal, prefixes are first merged together with the root, and here their vocalization is determined. However, once the theme

marker is merged, they move away from the root, and land above the theme marker. This means that when the infinitival ending is added – triggering the bimoraic templatic requirement – the constituent structure looks as in (19c). All in all, the data discussed here provide an independent argument for prefix movement, as first proposed in Svenonius (2004), and later used to account for the length alternation in (5) by Caha and Ziková (2016).

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