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WHEN PROSODY FOLLOWS SYNTAX: VERBAL STEMS IN CZECH

Abstract

This paper examines syntactic and prosodic constituency within a verbal stem in Czech. Working in the frameworks of Nanosyntax and Strict CV, I argue that syntax-to-prosody mapping is direct to the extent that prosodic domains correspond to particular syntactic constituents. On the basis of two vocalic alternations, namely vowel-zero alternations in verbal prefixes and roots and alternations in vowel length in roots and theme suffixes, I show that the perfective verbal stem represented by a linear string prefix-root-theme is parsed into three prosodic constituents, [prefix-root], [root-theme] and [prefix-root-theme]. These prosodic domains correspond to three syntactic constituents: VP and a lower and higher projection of the theme suffix respectively. The crucial point of the syntactic analysis is that the prefix undergoes phrasal movement: it is generated next to the root in VP and when the theme is added, it moves to its specifier. In the [prefix-root] constituent, the vocalization pattern of the prefix is established. The constituents comprising theme suffixes are prosodic domains in which a general rule (called the infinitival template) operates; this rule in effect lengthens underlying long vowels in monosyllabic infinitives.

Keywords

Syntax-Phonology Interface; Verbal Stem; Prosodic Template; Vowel Length Alternations; Vowel-Zero Alternations; Czech.

1. Introduction

In Czech (and Slavic languages generally), morphology of perfective verbs prototypically consists of a root flanked by a verbal prefix and a theme suffix respectively. I will call this three-piece string the perfective verbal stem (for a lack of a better term).

(1) Perfective verbal stem in Czech
prefix-root-theme

The goal of this paper is to show that the three morphological pieces in (1) are grouped into different prosodic constituents, which is revealed through two vocalic alternations. The first type is a vowel-zero alternation occuring in prefixes like *roz-* 'apart'. These prefixes come in two shapes: they either end in the actual consonant (*roz-*), or they have an additional ("epenthetic") vowel after this consonant (*roze-*). I will refer to these shapes as a C-version of a C-(final) prefix, and a V-version of a C-prefix respectively. Examples in (2) illustrate that for the prefix shape, only the root is relevant and the theme plays no role.

(2) V-zero alternations in prefixes

	C-CCVC	V-CC-V	
sort through	*roz-tříd-i-t*	*roze-tř-í-t*	spread
trench	*roz-brázd-i-t*	*roze-br-a-t*	take apart

In table (2), we have infinitives of two verbs 'sort through' and 'spread', both starting with the C-final prefix *roz-*. We can see that the prefix appears in a C-version (*roz-třídit*) and V-version (*roze-třít*) respectively even though it is followed by the identical string of segments *tří*.[1] However, the distribution of the prefix versions is not random: it obviously correlates with morphological structure. When the string *tří* is morphologically parsed as a root, the prefix is C-final: *roz-tříd-i-t*. But when it is parsed as being heteromorphemic, i.e., the vowel *í* is a theme suffix, the prefix appears in its V-final shape: *roze-tř-í-t*. And the same pattern is repeated in the pair *roz-brázd-i-t* and *roze-br-a-t*.

The fact that vowelless roots systematically trigger prefix vocalization indicates that the vocalization pattern is established *before* the theme vowel is spelled out. In that case the verbal stem contains a prosodic sub-constituent circumscribed in (3).

(3) Prefix-root prosodic constituency
[prefix-root]-theme

1 In this paper, I use Czech spelling where long vowels are marked by an acute accent.

Let us now move from prefixes to theme suffixes. They also come in different shapes which are based on alternations in vocalic length. The theme-alternation pattern is shown in (4).

(4) Length alternations in theme suffixes: infinitive vs. past participle

infinitive: VV	past participle: V	gloss
tř-í-t	*tř-e-l*	rub
lst-í-t	*lst-i-l*	outwit
br-á-t	*br-a-l*	take

The table shows that theme vowels combining with CC-roots alternate between short and long depending on the morphosyntactic environment: the long themes are followed by the infinitive suffix *-t*, their short cousins occur before the past participle suffix *-l*. In the table, the first two rows show the pattern when the infinitive theme is *-í* and its participial cousin is a short vowel, which is either *-e* or *-i*. In the last row, a similar pattern occurs with *-á* and *-a*.

Now let us look at what happens when these forms are prefixed. In that case, two patterns arise, as shown in (5).

(5) Length alternations in theme suffixes: *i/e*-pattern vs *a*-pattern

i/e-pattern			*a*-pattern		
CC-í-t	pref-CC-í-t	pref-CC-i/e-l	CC-á-t	pref-CC-a-t	pref-CC-a-l
tř-í-t	*roze-tř-í-t*	*roze-tř-e-l*	*br-á-t*	*roze-br-a-t*	*roze-br-a-l*
lst-í-t	*obe-lst-í-t*	*obe-lst-i-l*			

In the *i/e*-pattern, the addition of the prefix has no phonological effect: the theme vowel is long in both the simple and the prefixed infinitive (*tř-í-t*, *roze-tř-í-t*) and short in both types of past participles (*tř-e-l, roze-tř-e-l*). This, however, is not a case with the *a*-pattern. In the *a*-pattern, only both types of past participles, i.e. simple and prefixed, agree in the theme quantity (*br-a-l, roze-br-a-l*). The infinitive forms, on the other hand, show variation: the simple infinitive has a long vowel (*br-á-t*), while its prefixed cousin has a short vowel (*roze-br-a-t*). What do these facts tell us about prosodic constituency?

Following Caha – Scheer (2008), I assume that theme vowels are lexically short and undergo lengthening due to the prosodic constraint triggered by the infinitive context. From this perspective, the fact that in the *i/e*-pattern lengthening occurs in both simple and prefixed infinitives can be captured if we assume that the prefix does not contribute to the infinitival template. In that case, the prefix and the theme vowel must each be a part of a separate prosodic domain. In the *a*-pattern, on the other hand, where the addition of the prefix prevents the theme

-*a* from lengthening, the prefix and the root will be computed within a single domain. In sum, the two theme-alternating patterns reveal two more types of prosodic consituency of the verbal stem.

(6) Root-theme and prefix-root-theme prosodic constituency
i/e-pattern: prefix-[root-theme] *a*-pattern: [prefix-root-theme]

Putting all the pieces together, the perfective verbal stem represented by the linear string *prefix-root-theme* is parsed into several prosodic constituents. The prefix-root constituent is relevant to all stems, because all CC-roots trigger prefix vocalization regardless which type of theme vowel they combine with. By contrast, the constituent in which the quantity of the theme vowel is defined varies in size depending whether it includes a prefix or not.

(7) Two patterns of prosodic constituency

	a-stems	*i/e*-stems
prefix vocalization	[prefix-root]	[prefix-root]
theme quantity	[prefix-root-theme]	[root-theme]

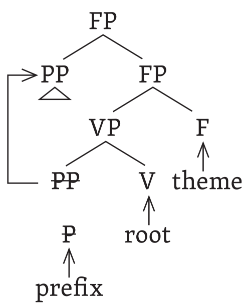
Looking at table (7), *a*-stems and *i/e*-stems show different prosodic grouping. In *a*-stems, there is a subset-superset relation between the two constituents. This can be easily captured by a cyclic derivation where the phonological material derived in the first cycle is included as a whole in the next cycle. However, when applied to *i/e*-stems, this simple explanation fails. In this case, both constituents are equal in size and overlap only partially: one includes the root plus the prefix, the other the root plus the theme. In what follows I propose a solution to this prosodic constituency puzzle based on a general idea that syntax-to-prosody mapping is direct to the extent that "phonology need not to build its own domains, but can merely operate over the strings it receives from the syntax directly" (Samuels 2011, 582).

2. Syntactic structure of the verbal stem and its spell out

Existing analyses of syntactic structure of verbal stems in Slavic have two common ingredients. First, they assume that at some point in derivation, the prefix forms a single syntactic constituent with the root. The second ingredient is the assumption that prefixes undergo movement. The differences are at which point in the derivation the prefix-root constituent is established and which type of movement prefixes undergo; see e.g. Babko-Malaya (2003), Svenonius (2004), Gribanova (2009), among many others.

For reasons of space, I do not discuss the various proposals in detail. Instead, I adopt a syntactic structure proposed by Caha – Ziková (2015), inspired by a work on Germanic particles by Taraldsen (2000) and a work on Slavic prefixes by Svenonius (2004). The structure of the verbal stem is shown in (8). Here, the prefix and the root are generated inside VP. When this constituent is merged with a functional projection headed by the theme vowel (FP), the prefix moves to Spec,FP and as a consequence it scopes over the whole stem.[2]

(8) Syntactic structure



Recall that on the basis of the behaviour of the two vocalic alternations, we have identified three prosodic constituents within the verbal stem. Their correspondence to syntactic constituents is summarized in the following table. The prefix-root constituent, in which the vocalization pattern of C-prefixes is established, corresponds to the VP. The root-theme constituent, identified in *i/e*-stems, corresponds to the lower projection of the FP. Finally, the constituent comprising the whole stem, matches the topmost projection of the FP.

(9) Syntactic and prosodic constituency

syntax		prosody
VP	↔	[prefix-root]
lower FP	↔	[root-theme]
higher FP	↔	[prefix-root-theme]

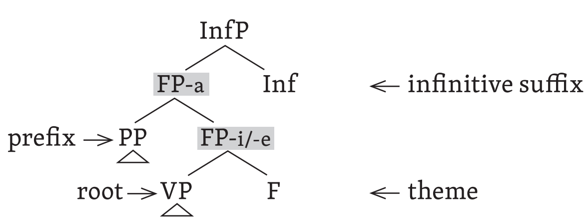
2 I do not discuss here what the exact nature of the FP hosting a theme vowel is. However, since Slavic theme vowels are usually claimed to be connected to argument structure and event structure, which are traditionally associated with *v* and Asp heads, then the F is in fact a shorthand for a more fine-grained sequence of functional projections; see e.g. Svenonius (2014), *inter alia*.

The crucial point of our analysis is that the prefix moves from the VP to the Spec,FP. This type of movement creating the structure in (8) is proposed in Caha – Ziková (2015). In that paper, we draw a parallel between Germanic verbal particles which alternate between bound morphemes, i.e. prefixes, and free morphemes, and Czech verbal prefixes which show alternation in vowel length;[3] compare e.g. an English noun-verb pair *out-come*, where the particle is prefixed to the root, and *come out*, in which the particle is free and follows the verb with its Czech analogue *vý-stup* and *vy-stoupit*, where the prefix is long and short respectively. We claim that the separability of the particle on the one hand and the shortness of the prefix on the other are both responses to the same thing, namely to the fact that the prefix moves out of the VP.[4]

The second argument for the prefix movement scenario such as outlined in (8) comes from the behaviour of *i*-stems. Recall that when themes -*e* or -*i* are merged with a vowelless root, they undergo lengthening in the infinitival context (marked by the suffix -*t*). And this lengthening happens in both simple and prefixed infinitives; compare infinitives *mž-í-t* 'drizzle' and *za-mž-í-t* 'cloud' (the theme is long) with past participle forms *mž-i-l* and *za-mž-i-l* (the theme is short). In what follows, I argue that this pattern can be understood if the prefix moves higher than the theme, i.e., higher than FP.

The scopus of the templatic domain which controls quantity of themes -*i* and -*e* is shown in (10). Here we have the structure of the infinitive form after prefix movement. We can see that the lower FP constituent contains just two pieces: a verbal root (which is part of the remnant VP constituent) and a theme. This lower FP thus corresponds to a templatic domain seen in *i/e*- stems.

(10) Infinitive templatic domains



3 According to their phonological behaviour, verbal prefixes in Czech fall into three groups: 1. C-final prefixes which show vowel-zero alternantions at their end, 2. V-final prefixes whose final vowel alternates between short and long (e.g. *pro~prů* [u:], *pro-střelit – prů-střel* 'shoot through sth., bullet hole'), and 3. V-final prefixes with non-alternating short vowels (e.g. *do-*, *do-střelit – do-střel* 'shoot to sth., range of fire'). This article deals only with the first group, the second two groups are analyzed in the cited paper.

4 We furthermore argue that the difference in ordering – in Germanic the particle either precedes the verb or follows it, but in Czech it is always pre-verbal – results from the fact that verb movement works differently in Germanic and Czech.

In *a*-stems, the infinitive templatic domain is bigger because only simple infinitives show the long theme *-á*: compare *hn-á-t, hn-a-l* 'propel, inf., past part.' vs. *za-hn-a-t, za-hn-a-l*. In (10), this bigger domain corresponds to a higher FP.[5]

To sum up, two templatic domains correspond to two projections of the FP. The smaller one comprises the F head and its phrasal complement, i.e., the VP, the bigger one contains also a phrasal adjunct, i.e., the PP. These domains can thus be defined in terms of structural adjacency: the lower FP is a sister of PP, the higher is a sister of InfP.

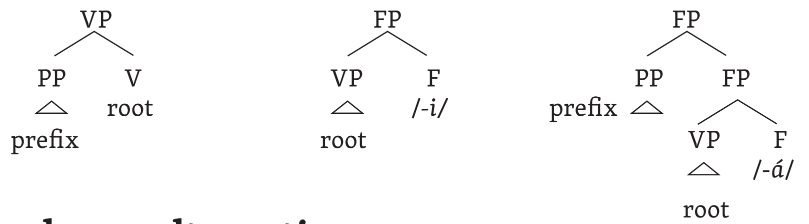
Now let us move on to the last prosodic constituent, i.e., VP. As we have already seen, VP is the prosodic domain in which the vocalization pattern of the prefix is established. This can be done only if the syntactic structure of the verbal stem in (8) undergoes multiple spell out.

I adopt a Nanosyntactic approach to spell out (Caha 2009), where lexical insertion targets both terminal and non-terminal syntactic nodes (the so called phrasal spell out). A consequence of this is that spell out is not category-specific (as is assumed by phase-based models like Distributed Morphology), but it is tried at every merge. This means that the lexicon is searched serially to find an appropriate lexical entry, i.e., the entry matching a given syntactic structure. Under this view, it follows directly that the VP being a merger of the prefix and the root is a prosodic domain. Moreover, if the prefix undergoes movement after having been spelled out, leaving the root *in situ*, then information about syntactic constituency must be preserved during the spell out. This is what is proposed by Newell (2008) or Šurkalović (2011), among others.

To conclude this section, table (11) summarizes syntactic structure of the three prosodic constituents of the perfective verbal stem. The next two sections provide a detailed look at how their phonological structure is computed.

5 According to the analysis proposed here, the difference in phonological behaviour of both types of stems follows from the difference in the size of the templatic domains. In other words, the infinitive stem has the same structure in both cases and what differs is which of its parts is under the scope of the templatic restriction. However, one could consider an alternative analysis, according to which things are the other way round. In that case, what would differ is not the size of the template itself, but the syntactic structure of the infinitive. In other words, an interpretation of the fact that in *i/e*-stems, the prefix is out of the templatic domain could simply be that its landing site is not Spec,FP, as in *a*-stems, but Spec,InfP. But this alternative makes an unattested prediction, such as different scopal relations between the prefix and the infinitive. In fact, we have no evidence that *a*-infinitives and *i/e*-infinitives would systematically differ with respect to their aspectual features. For an argument that the infinitive suffix never contributes to the template and hence must be out of the templatic domain see Section 4.1.

(11) a. [prefix-root] vocalization pattern b. [root-theme] inf. template: *i/e*-stems c. [prefix-root-theme] inf. template: *a*-stems



3. Vowel-zero alternations

In this section, I examine vowel-zero alternations which appear in C-final prefixes (and roots as well). First I show that their distribution is derivable from the phonological structure of the root. Then I turn to arguments showing that the vocalization pattern can be understood if it happens *before* the prefix movement.

As has already been mentioned, Czech has a set of verbal prefixes which can appear either in a consonant- or vowel-final version; I call them C-prefixes with C- and V-versions. With respect to their phonological structure, C-prefixes form two groups: prefixes with vowelless C-versions (*s(e)-, z(e)-, v(e)-*, and *vz(e)-*) and prefixes whose C-versions contain both consonants and vowels (*ob(e)-, od(e)-, pod(e)-, nad(e)-, před(e)-*, and *roz(e)-*).

Gribanova – Blumenfeld (2013) analyze vowel-zero alternations in Russian C-final prepositions and show that they are driven either phonotactically or lexically: a preposition either vocalizes due to general phonotactic constraints like *#ssC (e.g. /so sv/*etom* 'with light', /so sk/*orost^{j}u* 'with speed'), or phonotactics plays no role (e.g. /v mn/*oẑestve* 'in a mathematical set'). And this is precisely what we see by looking at Czech prefixes.

Examples of vocalization patterns that are triggered by a phonotactic constraint which rules out word-initial geminates (*#C_iC_i) are shown in table (12). The left part of the table shows that if the merger of a given C-prefix would produce an initial geminate, its V-version is always choosen: roots *syp* 'pour' and *val* 'roll' combine with vocalized prefixes *se-* and *ve-* respectively. The emergence of initial heterogeneous clusters (*v-sypat* 'pour into', *s-valit* 'tumble') or internal geminates (*roz-sypat* 'strew'), on the other hand, does not trigger the appearance of the V-final version of the prefix.

(12) Phonotactic vocalization

V-version		C-version		
C_ie-C_i		C_i-C_x		VC_i-C_i
se-syp-a-t	*ve-val-i-t*	*v-syp-a-t*	*s-val-i-t*	*roz-syp-a-t*
down-pour	in-roll	in-pour	dow-nroll	apart-pour

Now I turn to the cases where prefix vocalization can hardly be explained in terms of phonotactics. These are illustrated in table (13). Here we have pairs of verbs whose roots start with identical consonant clusters, which yield both versions of the prefix. Hence the crucial factor in determining whether the prefix is vocalized cannot be the consonant cluster phonotactics.[6] Rather, it is the presence of a vowel in the root that is crucial for prefix's shape: V-versions of prefixes appear with vowelless roots, C-versions with roots in which the cluster is followed by a vowel.

(13) V-version appears with CC-roots, C-version with CCV-roots

$CV\text{-}C_iC_x\text{-}V$	$C\text{-}C_iC_xV$	gloss
roze-br-a-t	*roz-brázd-i-t*	take apart, churn up
ze-tl-í-t	*z-tlum-i-t*	moulder, dim
ode-čp-í-t	*od-čpavk-ovat*	stop to emanate, deammonize
roze-mn-ou-t	*roz-množ-it*	rub out, reproduce
se-lh-a-t	*z-lhostejn-ě-t*	fail, become indolent
roze-mž-í-t	*roz-mžik-a-t*	start to mizzle, start to wink

According to Gribanova – Blumenfeld (2013), lexical vocalization of C-final prepositions in Russian is possible only if the preposition and what follows it form a single syntactic constituent (or, to be more exact, a single PP which contains a non-branching NP). The claim is that only in this case the preposition and the following material are integrated into a prosodic domain whose boundaries restrict lexical vocalization. By contrast, phonotactic vocalization is not sensitive to syntactic constituency, it is applied across the board.

The crucial idea of this analysis, namely that lexical vocalization derives from syntactic constituency, is consistent with our claim that the vocalization pattern in C-prefixes is petrified within the VP constituent, i.e. before the prefix moves higher to Spec,FP. Since the prefix and the root are spelled out together within one domain, then both phonotactic and lexical vocalization as well are expected to appear. And this is exactly what our data show. By contrast, if the prefix would get the form in a moved position, in which it is not structurally adjacent to the root, then only general phonotactic constraints, but not the lexical properties of the root should be decesive for its form.

6 These data thus provide a strong argument against a cluster avoidance approach to vowel-zero alternations which is uncritically repeated in all reference grammars of Czech.

3.1 *Lower*

Slavic vowel-zero alternations have been intensively analyzed in various linear and autosegmental frameworks (see the overview in Scheer – Ziková 2010). All of these analyses follow the essence of the Lower rule:

(14) Lower
Vowels alternating with zero are lexically present, defective vowels, so-called yers.
A yer is audible iff there is another yer in the following syllable, otherwise it is silenced: /cE-cEc/ → /cE-cc/.

At first sight, Lower seems to be a sufficient tool to derive the vocalization pattern illustrated in table (13). Since C-prefixes show vowel-zero alternations in final position they must be yer-final lexically, i.e. /podE-/, /sE-/ and so on. And if yers surface only when the following syllable has a yer, then the contrasting effect of aparently identical clusters on the prefix must be caused by the presence/absence of a yer, i.e. /bEr/ vs /brázd/, /tEl/ vs /tlum/ and so on.

3.2 *When Lower-based analysis fails: imperatives*

The Lower-based analysis of the vocalization pattern thus predicts that all CC-roots have the same lexical representation: since CC-roots always trigger prefix vocalization, all of them must contain a bogus cluster separated by a yer. Having a uniform lexical representation, CC-roots are therefore predicted to show uniform behaviour. This prediction, however, fails to account for how CC-roots behave in imperative forms.

On the surface, the 2sg imperative morpheme appears in three forms: -Ø, -*i* and -*j*. Table (15) illustrates that their distribution is phonologically-driven. In the first line, we have three verbs whose roots fall into three phonological classes: *pař-i-t* ‘steam’ and *kypř-i-t* ‘hoe’ have roots ending in a single consonant or a consonant cluster respectively, *přá-t* ‘wish’ has a vowel-final root. And all these roots show distinct imperative forms: the C-final root takes the null suffix (*pař-Ø!*), the CC-final one has the -*i* (*kypř-i!*) and the V-final root shows the -*j* (*pře-j!*). The reminder of the table then repeats the same distributional pattern.

(15) Distribution of 2sg imperative markers[7]

infinitive	imperative	infinitive	imperative	infinitive	imperative
	-Ø / VC__		-i / VCC__		-j / CV__
pař-i-t	*pař-Ø!*	*kypř-i-t*	*kypř-i!*	*přá-t*	*pře-j!*
han-ě-t	*haň-Ø!*	*rochn-i-t*	*rochn-i!*	*hní-t*	*hni-j!*

7 Line by line glosses: steam, hoe, wish; vituperate, idulge, decay.

Whatever the lexical representation of the imperative morpheme is, the point is that with C-final roots it surfaces as -Ø or *-i* depending whether the final consonant of the root is preceded by a vowel or not. Bearing this observation in mind, let us focus on what happens when the imperative morpheme is merged with CC-roots.

Recall that the Lower-based analysis predicts that all CC-roots have a yer in between the cluster. And since the surface form of the imperative morpheme is predictable from the phonology of the root, as shown in table (15), then it should be the same with CC-roots. This prediction, however, fails when data in table (16) are considered. In this table, we have three pairs of CC-roots with similar phonotactics but with different imperative forms: the roots in the first shaded column have the zero suffix and their cluster is broken up with an epenthetic vowel, the roots in the second column show a cluster followed by the suffix *-i*.

(16) Double behaviour of CC-roots: imperative

gloss	infinitive	imperative	imperative	infinitive	gloss
	CC-V-t	CeC	CC-i	CC-V-t	
scratch	*dr-á-t*	*der-Ø!*	*dř-i!*	*dř-í-t*	chafe
beat	*pr-á-t*	*per-Ø!*	*př-i!*	*př-í-t*	argue
mill	*ml-í-t*	*mel-Ø!*	*cl-i!*	*cl-í-t*	declare

Summing up, CC-roots behave uniformly with respect to the prefix vocalization, but distinctively with respect how the imperative morpheme is phonologically realized. This puzzle can be solved when we abandon the main assumption of the Lower-based analyses that vocalization of yers is always triggered by the presence of a yer in the next syllable. And this is what a Strict CV approach to vowel-zero alternations does (e.g., Scheer 2004, Ziková 2008).

3.3 Two phonological types of CC-roots

Within the Strict CV framework, consonant clusters are separated by phonetically unrealized syllabic nuclei. What is crucial is that these nuclei can differ underlingly: they are either empty or contain a floating piece of melody which surfaces only under certain conditions. This therefore enables us to identify two types of CC-roots: 1. roots of the *dr(-á-t)* type with a floating vowel in between the CC cluster, see (17a); and 2. roots of the *dř(-í-t)* type in which the cluster is separated by an empty nucleus (17b).[8] Finally, (17c) shows the structure of the root of the *drol (-i-t)*

8 A fact that diachronically *dr(-á-t)* and *dř(-í-t)* represent a single root, is not surprising. In the diachronic perspective, many instances are attested where roots have been undergoing different changes including the lost of the alternanting vowel on the one hand and its development on the other; see Ziková (2008).

type where the initial cluster *dr* is followed by a vowel. In this case, the cluster represents what is traditionally called a branching onset where consonants contract a lateral head-final relation (marked by “<”) which is supported (“licensed”) by the following vowel; for melodic and configurational conditions on branching onsets, see Cyran (2010).

(17)	a.	C	V	C	b.	C	V	C	c.	C	V	C	V	C
		|		|		|		|		|		|	|	|
		d	e	r		d		ř		d	<	r	o	l

Without going into the details of how the imperative forms are exactly derived, we can conclude that the presence/absence of a floating vowel inside the cluster is the reason why CC-roots show different behaviour in the imperative context. If the floating vowel is present inside the cluster, it surfaces in the imperative form. Otherwise vowelless roots behave the same way as roots of the VCC-type shown in the fourth column in table (15): the cluster is followed by the vocalic suffix.

3.4 Two types of CC-roots, but one vocalization pattern

Now, let us turn our attention back to C-prefixes. Why is it the case that all CC-roots trigger their vocalization, given that they differ lexically? The answer is that the prefix-final nucleus is never governed in the context of CC-roots.

The idea is that the distribution of phonetically unrealized nuclei must be regulated, otherwise infinite consonant clusters could emerge. In general, there exist three configurations in which a nucleus can be silenced. These are summarized in table (18). In (18a), the silenced nucleus occurs within the branching onset. (18b) shows the situation when a nucleus is silenced because it is governed by the following pronounced nucleus, which is indicated by a leftward arrow linking the two nuclei. Finally, in (18c), the nucleus is silenced because it is the last one in a row.[9] We can see that there is a difference between branching onsets on the one hand, whose silenced nuclei are always melody-free, and the remaining two configurations on the other hand, in which silenced nuclei can be either melody-free, or contain a floating vowel.[10]

9 In government-based frameworks, such nuclei are known under the acronym FEN (which stands for “final empty nucelus”). Originally, FENs have been claimed to follow each consonant that occurs at the very end of a “phonological domain” (see Kaye 1990). Without going into a theory-internal discussion, I depart from this traditional view by claiming that being FEN means being last nucleus in a row. From this it follows that FEN can occur either *after* a final consonant or *inside* a final consonant cluster. Only in this case we will explain why CC-roots with floating vowels (17a) do not vocalize when the VP domain is spelled out.

10 Another contrast is between (18a,b) on the one hand, and (18c) on the other hand. While nuclei in branching onsets and nuclei in governed position, i.e., those followed by a pronounced nucleus, are silenced by default, the behaviour of domain-final nuclei is regulated parametrically; see Kaye (1990).

(18) Configurations with silenced nuclei

a. branching onset b. governed nucleus c. domain-final nucleus

```
C   V   C   V       C   V    C   V       C   V    C   /   C   V
|       |   |       |        |   |       |        |       |
C   <   C   V       C  (V)   C   V       C  (V)   C       C  (V)
```

Having introduced what nuclei can be silenced, let us examine how the derivation of the VP constituent proceeds. As we could see in (13), when this constituent is part of the infinitive form, the vocalization pattern is always Ce-CC. The prefix-final nucleus surfaces, i.e., a floating vowel associates to it, because it is neither in a governed position (18b), nor in a domain-final position (18c). By contrast, the root nucleus being domain-final does not surface. The relevant configurations are shown in (19).[11]

(19) a. /rozE-dEr/ → /rozedr/ b. /rozE-dř/ → /rozedř/

```
C   V   C   V  -  C   V   C        C   V   C   V  -  C   V   C
|   |   |   ↑     |       |        |   |   |   ↑     |       |
r   o   z   e     d   e   r        r   o   z   e     d       ř
```

The second vocalization pattern found in the infinitive forms, i.e., C-CCV, is derived as in (20). Here, we have two silenced vowels in a row neither of which is domain-final. The root nucleus is silenced because it is part of a branching onset. The prefix-final nucleus, on the other hand, does not surface because it is in governed position: it is governed by the root vowel (which also licenses the branching onset).

(20) /rozEdrol/ → /rozdrol/

```
C   V   C   V  -  C   V   C   V   C
|   |   |         |       |   |   |
r   o   z   e     d   <   r   o   l
```

Before moving on to the next section, I have to mention one consequence of the proposed model concernig the syllabic structure of consonant clusters. The present analysis assumes that if a floating vowel is not pronounced before a consonant cluster, the syllabic identity of such a cluster must be the branching onset

11 For a lack of space, I do not discuss phonotactic vocalizations that consist in the interaction between two neighbouring consonantal positions, rather than between two nuclei.

and nothing else (i.e., neither a coda-onset nor a bogus cluster). Only in this case, the pre-cluster nucleus is in a governed position.

Bearing this in mind, let us now consider the data below (repeated from table (13)). What they show is that the prefix-final nucleus is silenced regardless what the phonotactic of the root-initial cluster looks like. From this, it follows that root-initial clusters of any sonority profile (rising, flat, and even falling) can be syllabified as branching onsets.

(21) C-CCV: sonority plays no role

rising sonority	flat sonority	falling sonority
*roz-**br**ázd-i-t*	*od-**čp**avk-ova-t*	*z-**lh**ostejn-ě-t*
*z-**tl**um-i-t*	*roz-**mn**ož-i-t*	*roz-**mž**ik-a-t*

The behaviour of Czech root-initial clusters thus questions the mainstream view on syllabic structure such that it is fully derivable from the sonority profile of segmental strings. According to this view, only clusters of rising sonority can be syllabified as branching onsets. The examples discussed here rather support an alternative approach proposed within the government-based framework, which says that information about syllable structure is a part of the lexical representation; see, e.g., Ségéral – Scheer (2005).[12]

To sum up, the Strict CV approach to the vocalization pattern proposed here, agrees with the classical Lower-based analyses in that the trigger of vowel-zero vocalizations is the relationship between two syllabic nuclei. The crucial difference is that in the Lower-based approaches, nuclei triggering vowel-zero alternations have the same lexical identity (i.e. yers), while in the approach advocated here they do not: they are either empty nuclei or nuclei with floating vowels. Only in that case we can explain why CC-roots behave both uniformely (with respect to the prefixes) and distinctively (with respect to the imperative markers).

3.5 Once vocalized, always vocalized: imperative forms

In this section, I introduce a new vocalization pattern, i.e. Ce-CeC, found in imperative forms, which is an instance of phonological opacity: the prefix-final nucleus surfaces, even though it occurs in a governed position. The existence of this pattern is a strong argument for our analysis that the prefix gets its shape within the VP constituent, i.e., *before* it moves to Spec,FP.

We already know that CC-roots with floating vowels appear as vowelless in the infinitive, but vocalize in the imperative; e.g., *br-á-t – ber* 'take, inf. – 2sg imper.',

12 Another argument for this claim comes from doublets such as *od-zpív-a-t/ode-zpív-a-t* 'sing'. Their existence can be explained if syllable structure (or at least some of its parts) is encoded in the lexicon: the variation of the prefix form before CCV-roots appears because their clusters can be lexicalized either as branching onsets or as bogus clusters.

ml-í-t – *mel* 'grind, inf. – 2sg imper.' or *ps-á-t* – *piš* 'write, inf. – 2sg imper.'. How can we explain the vocalization of the root? In the previous section, I claimed that domain-final nuclei are silenced: when the VP constituent is spelled out, the root nucleus is domain-final and thus does not surface; see the derivations in (19). From this perspective, the root nucleus in the imperative forms cannot be domain-final. An explanation would be that the lexical identity of the imperative zero is an empty nucleus: in the imperative form, seen in (22), a floating vowel of the root associates to its nucleus because it is neither in a governed nor in a domain-final position.[13]

(22) imperative: /bEr-E/ → /ber/

C V C - V

b e r

What happens when a C-prefix is added? Our analysis predicts that the imperative forms should follow the pattern Ce-CeC in which both floating vowels, i.e. the prefix-final and the root-medial, surface. Why should this be so? Because syntactic structure of the imperative, shown in (23), contains a prosodic sub-domain corresponding to the VP: when the imperative head, whose phonological identity is an empty nucleus, turns the floating vowel in the root into a stable vowel, the prefix has already been vocalized within the VP.

(23) Syntactic structure of imperative

$[_{\text{ImpP}}\,[_{\text{FP}}\,[_{\text{PP}}\,\text{prefix}][_{\text{FP}}\,[_{\text{VP}}\,[_{\text{PP}}\,\cancel{\text{prefix}}]\text{root}]\text{theme}]]\text{imperative}]$

By contrast, if the structure in (23) would be spelled out as a whole, the pattern C-CeC with the prefix-final nucleus being governed by the root vowel should emerge. As examples in table (24) show, the prediction of our model is borne out: the imperative forms really follow the pattern Ce-CeC, not *C-CeC.

13 A fact that obstruents undergo palatalization (e.g. *krad-e-š* – *krad'* 'steal, 2sg present – 2sg imperative' or *žen-e-š* – *žeň* 'propel, 2sg present – 2sg imperative') indicates that the nucleus which represents an imperative morpheme has a palatal flavour.

(24) One paradigm, two vocalization patterns : Ce-CC vs Ce-CeC

infinitive	*ode-br-a-t*	*se-ml-í-t*	*pode-ps-a-t*
past participle	*ode-br-a-l*	*se-ml-e-l*	*pode-ps-a-l*
imperative (2sg)	*ode-ber*	*se-mel*	*pode-piš*
present tense (2sg)	*ode-ber-e-š*	*se-mel-e-š*	*pode-píš-e-š*
secondary imperfective	*ode-bír-a-t*	*se-míl-a-t*	*pode-pis-ova-t*

Moreover, the last two rows in the table show that the prefix is vocalized also in the present tense and the secondary imperfective forms, where the root is vocalized as well. And again, this can be explained by assuming that the prefix gets its form before the functional heads encoding present tense features and secondary imperfective features induce vocalization of the root.[14]

Summing up, this section presented arguments that VP, where the prefix is base-generated next to the root, corresponds to a separate prosodic domain. The main argument came from the behaviour of the CC-roots that follow two vowel-zero alternation patterns within a single paradigm.

4. Vowel length alternations

In this section, I provide an analysis of the second of the vocalic alternations identified in the verbal stem, i.e., alternations in vowel length. Building on findings made by Caha – Scheer (2008), I argue that these alternations are triggered by the templatic restriction associated with particular syntactic nodes.

Let us start by repeating the table (5), where two alternation patterns are summarized. These patterns show that theme vowels alternate between short and long depending on their morphosyntactic context. In the *i/e*-pattern, a short theme found in the past participle corresponds to a long one in both a simple and a prefixed infinitive. In the *a*-pattern, on the other hand, only the simple infinitive takes a long theme.

(5) Length alternations in theme suffixes: *i/e*-pattern vs *a*-pattern

i/e-pattern			*a*-pattern		
CC-í-t	pref-CC-í-t	pref-CC-i/e-l	CC-á-t	pref-CC-a-t	pref-CC-a-l
*tř-**í**-t*	*roze-tř-**í**-t*	*roze-tř-**e**-l*	*br-**á**-t*	*roze-br-**a**-t*	*roze-br-**a**-l*
*lst-**í**-t*	*obe-lst-**í**-t*	*obe-lst-**i**-l*			

14 The exact mechanism of how vocalization of the root in the present tense and the secondary imperfective forms works is not discussed here. However, we can assume that it will be similar as in the imperative, where a given morphosyntactic category is expressed by a non-segmental affix, or, to be more precise, by a piece of syllabic structure. See also Gribanova (2015) who proposes something similar for verbal forms in Russian.

An important point is that the theme alternations occur only with vowelless roots. If the themes *-i/-e* and *-a* are merged with a CVC-root, no alternation takes place. For example, in the infinitive – past participle pairs like *teř-e-t* – *teř-e-l* 'moulder', *lešt-i-t* – *lešt-i-l* 'polish' or *kor-a-t* – *kor-a-l* 'crust', the theme vowel is always short.

The term *i/e*-pattern covers the behaviour of not only *i*-stems, but also stems without an overt infinitive theme (so-called zero stems). This is illustrated in the table (25). Here we have two types of monosyllabic roots, i.e., C-final (CVC) and V-final (CV), whose vowel alternates between short and long the same way as themes *-i* and *-e* do.[15]

(25) Zero stems pattern with *i/e*-stems

CV(C)-l	CVV(C)-t	pref-CVV(C)-t	gloss
pek-l	*péc-t*	*roz-péc-t*	bake, make crisp
krad-l	*krás-t*	*roz-krás-t*	steal
pi-l	*pí-t*	*vy-pí-t*	drink, drink out
kle-l	*klí-t*	*pro-klí-t*	swear, maledict

To sum up the empirical findings, monosyllabic infinitives always have long vowels (or diphthongs) which are parsed as belonging either to the theme or to the root.[16] When these infinitives become polysyllabic by prefixation, a change in vowel quantity appears only in *a*-stems.

4.1 *Templatic lengthening*

As I already mentioned, the length alternations are analyzed in Caha – Scheer (2008). Their analysis is based on the idea that alternating vowels are lexically short and that the reason why they appear as long is the existence of a prosodic constraint, called the *infinitival template*, which is defined in terms of a minimal prosodic weight. Since cross-linguistically, long vowels (and diphthongs) are heavier than short vowels, the lengthening of vowels can be viewed as increasing the prosodic weight.

Generally, there exist two approaches to prosodic weight: one approach assumes special weight-bearing units, called *moras*, which mediate between the melodic level and the syllabic level. The other approach claims that weight can be read off directly from the syllabic structure; see the discussion in Ulfsbjorninn (2014). In this paper, I follow the latter approach and propose that the prosodic

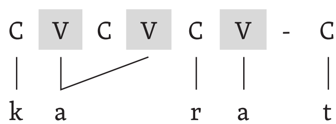
15 Zero stems can be viewed as spelling out the whole FP, rather than having the F head spelled by the zero theme marker. Some of them also have long vowels in both the infinitive and past participle form; see e.g. *pás-t*, *pás-l* 'graze'. In this case, the root vowel is simply lexically long.

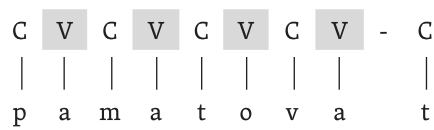
16 Only a very small subset of all monosyllabic infinitives has short vowels (which are always mid): *moct* 'can', *jet* 'drive', *zet* 'be open', *pět* 'sing', *spět* 'proceed'. Some of them show variation: *hřmět/hřmít* 'thunder', *lpět/lpít* 'cling', *chvět/chvít* 'tremble', *skvět/skvít* 'be characterized by'.

weight of the infinitive form simply corresponds to the number of its pronounced nuclei.

Consider, for example, the infinitive *kár-a-t* 'chasten' with a long vowel in the root and a short theme. Its structure is shown in (26a). Since long vowels are represented as bi-nuclear, the weight (W) of this form equals to 3V (the weight-bearing nuclei are shaded). Finally, in (26b), we have the infinitive *pamat-ova-t* 'remember', whose root and theme both have two vowels, it thus weighs 4V. As for monosyllabic infinitives, their vowels are always long which means that they always weigh 2V.

(26) a. *kár-a-t* (W=3V) b. *pamat-ova-t* (W=4V)

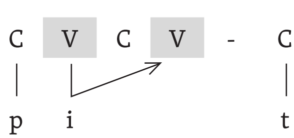


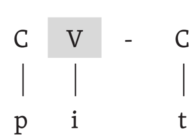


To sum up, weight of infinitives ranges from 2V (27a) to 4V (26b). While the upper weight limit is in principle unrestricted (for example infinitives *soukromnič-i-t* 'to do private bussines' or *číšník-ova-t* 'to work as waiter' weigh 5V and 6V respectively), the bottom limit must be at least 2V. So the conclusion will be that the template defines the *minimal* weight of the infinitive form. This is the reason why lexically short vowels lengthen in monosyllabic infinitives: infinitives such as **pi-t* (27b) weighing 1V are ruled out.

Up to now, we have been assuming that the infinitive is always marked by the consonantal suffix *-t*. However, there are two other allomorphs, *-i* and *-ti*. The fact that monosyllabic stems lengthen regardless of whether the infinitive marker contains a vowel or not (consider, for instance, doublets like *pí-t/pí-ti* or *péc-t/péc-i* 'bake') indicates that the infinitive suffix never contributes to the templatic weight; otherwise short forms like **pi-ti* or **pec-i* would be expected to appear. This observation is in accordance with our claim that the templatic domain corresponds to a syntactic constituent headed by the theme, not by the infinitive morpheme itself.

(27) a. *pí-t* (W=2V) b. **pi-t* (W=1V)

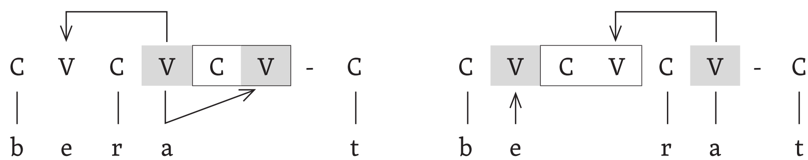




By comparing the long, i.e., derived, form of the root in (27a) with the short one listed in the lexicon, shown in (27b), the lengthening mechanism is revealed: it consists of the insertion of an empty CV unit, which creates a space for vowel spreading. In what follows, I argue that the locus for insertion is always fixed to the end of the spell out domain.

The argument for this claim comes from the behaviour of stems that contain CC-roots with floating vowels. They have potentially two options of how to meet the templatic requirement: they can utilize either the floating vowel of the root or the theme vowel. The first option is shown in (28b): the empty CV unit (it is framed) is inserted into the root which makes its floating vowel ungoverned; as a consequence, the root vowel is spelled out and the infinitive gets a prosodically appropriate form *ber-a-t*. According to another scenario, the empty CV unit is inserted after the theme vowel. Its melody in turn spreads onto the inserted nucleus and the infinitive form *br-á-t* with the silenced root vowel and the lengthened theme vowel is derived (28a).

(28) a. *br-á-t* (W=2V) b. **ber-a-t* (W=2V)



Since stems with floating vowels always follow the lengthening pattern depicted in (28a), we can conclude that the insertion of the empty CV unit triggered by the infinitive template is anchored to the right edge of the templatic domain. Moreover, the behaviour of these stems gives us evidence that floating vowels are not weight-contributors: if they would, then short infinitives such as **br-a-t* should be grammatical.

To sum up this section, there is a general rule (called the *infinitival template*) that in effect lengthens underlying long vowels in monosyllabic infinitives. This rule is directly associated to the syntactic structure: it operates over FP, c-commanded by the Inf head.

(29) The infinitival template

When FP is c-commanded by the Inf head, its prosodic weight must be at least 2V.

A crucial point is that the FP constituent, in which the templatic rule operates, can occupy different positions within InfP.

4.2 *Derivation of the infinitive template*

Up to now, we have been talking about templatic domains in terms of their size: the templatic rule stated in (29) operates over two different projections of FP where the *bigger* contains the *smaller* plus its phrasal adjunct, i.e., PP, hosting a prefix.

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From this perspective, it is the *a*-stems, not the *i/e*-stems or zero stems, what poses a special case, because only in *a*-stems the templatic domain varies in size. In other words, only in *a*-stems the templatic rule (29) targets a different projection of FP. As a consequence, in infinitive *a*-stems, vowel length alternates (cf. *br-á-t* vs. *roze-br-a-t*), but other types of stems show long vowels in both simple and prefixed forms (cf. *(roze-)tř-í-t, (roz-)pí-t*).

However, if the perspective is turned around, then the variation of vowel length seen in infinitive *a*-stems would follow from the fact that in *a*-stems, the templatic rule always targets the same syntactic node, i.e., FP whose sister is an Inf head (see (30 and (31)); otherwise the rule targets the sister either of the Inf head (31) or a PP (32). I will not discuss which interpretation is more appropriate. I will rather show how the particular syntactic constituents are treated phonologically.

Let us start with prefixed *a*-stems where the theme vowel never needs to lengthen because the prefix's vowel, being a part of the templatic domain, always contributes to the required prosodic weight. This is illustrated in (30). The tree in the left part of the table depicts the syntactic structure of the infinitive *se-br-a-t*. The right part represents the phonological structure of the templatic domain which correponds to the upper FP. This domain contains two nuclei associated with the segmental level, and its weight thus equals to 2V. (Recall that the prefix-final nucleus has already associated with its floating vowel during the VP cycle.) Since the minimal weight of the template is 2V, no phonological intervention is needed.

(30) a. *se-br-a-t*: syntactic structure b. templatic domain: W=2V

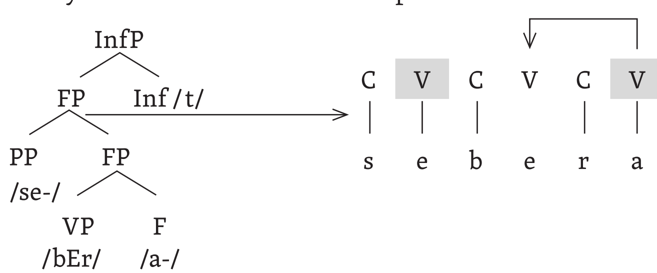
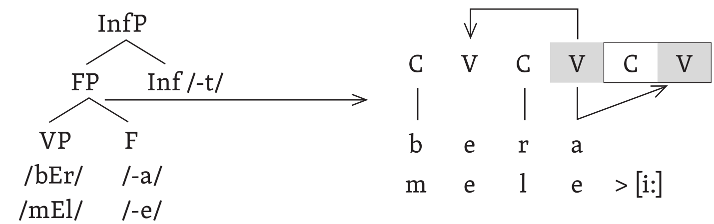
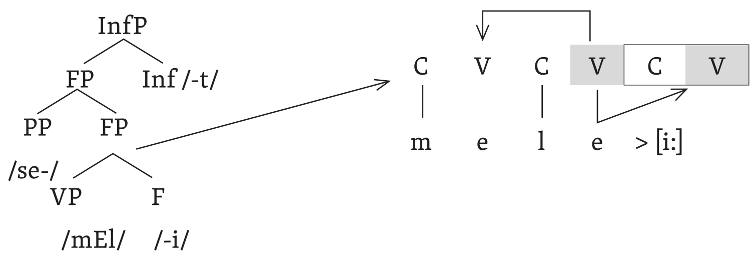


Table (31) shows the structure of simple infinitive stems *br-á(-t)* and *ml-í(-t)* where the templatic domain corresponds to the same syntactic node as in (30), i.e. the FP which is in a sisterhood relation to the Inf head. Since vowels of these stems are lexically short, as evidenced by past participle forms *br-a-l* and *ml-e-l*, the templatic rule triggers their lengthening. Finally, lengthening appears also in the prefixed stem *se-mlí*(-*t*), shown in (32), where the templatic FP is a sister of PP.

(31) a. *br-á-t, ml-í-t*: syntactic structure b. templatic domain: W=2V



(32) a. *se-ml-í-t*: syntactic structure b. templatic domain: W=2V



To sum up, this section brought out further arguments that verbal prefixes undergo phrasal movement out of VP. Only under this assumption, the length alternation pattern in *i/e*-stems and zero stems, where the prefix does not contribute to prosodic weight of the template, can be explained.

5. Summary

The paper dealt with syntactic and prosodic constituency of the verbal stem in Czech. In the light of two vocalic alternations, namely vowel-zero alternations and vowel length alternations, I first showed that many stems are parsed into two prosodic constituents, [prefix-root] and [root-theme], which are not in a subset-superset relation. I then proposed a solution to this prosodic constituency problem based on phrasal movement of the prefix: the prefix is generated next to the root in VP and when the theme is added, it moves to its specifier.

REFERENCES

Babko-Malaya, Olga. 1999. *Zero Morphology: A Study of Aspect, Argument Structure, and Case*. Ph.D. thesis. Rutgers University.

Caha, Pavel – Scheer, Tobias. 2008. The Syntax and phonology of Czech templatic morphology. In: Antonenko, Andrei et al., eds. *Formal Approaches to Slavic Linguistics. The Stony Brook Meeting, 2007*. Ann Arbor: Michigan Slavic Publications, pp. 68–83.

Caha, Pavel – Ziková, Markéta. 2015. *Vocalic length as evidence for the free/bound particle distinction in Czech*. Talk presented at SinFonIja 8, Ljubljana, 24–26 September.

Caha, Pavel. 2009. *The Nanosyntax of Case*. Ph.D. thesis. CASTL, University of Tromsø.

Cyran, Eugeniusz. 2010. *Complexity scales and licensing in phonology*. Berlin: Mouton de Gruyter.

Gribanova, Vera – Blumenfeld, Lev. 2013. Russian prepositions and prefixes: Unifying prosody and syntax. In: *Proceedings of the 49th Meeting of the Chicago Linguistic Society.*

Gribanova, Vera. 2009. *Composition and Locality: The Morphosyntax and Phonology of the Russian Verbal Complex*. Ph.D. thesis. University of California Santa Cruz.

Gribanova, Vera. 2015. Exponence and morphosyntactically triggered phonological processes in the Russian verbal complex. *Journal of Linguistics*. 51(3), pp. 519–561.

Kaye, Jonathan. 1990. 'Coda' licensing. *Phonology Yearbook*. 7, pp. 301–330.

Newell, Heather. 2008. *Aspects of the morphology and phonology of phases*. Ph.D. thesis. McGill University in Montréal.

Ségéral, Philip – Scheer, Tobias. 2005. What lenition and fortition tells us about GalloRomance Muta cum Liquida. In: Geerts, Twan et al., eds. *Romance Languages and Linguistic Theory*. Amsterdam: Benjamins, pp. 235–267.

Scheer, Tobias – Ziková, Markéta. 2010. The Havlík Pattern and Directional Lower. In: Browne, Wayles et al., eds. *Formal Approaches to Slavic Linguistics. The Second Cornell Meeting 2009*. Ann Arbor: Michigan Slavic Publications, pp. 470–485.

Scheer, Tobias. 2004. *A Lateral Theory of Phonology. Vol. 1: What is CVCV, and Why Should It Be?* Berlin: Mouton de Gruyter.

Samuels, Bridget. 2011. *A minimalist program for phonology*. In: Boeckx, Cedric, ed. *The Oxford Handbook of Linguistic Minimalism*. Cambrigde, MA: Oxford University Press, pp. 574–594.

Šurkalović, Dragana. 2011. Modularity, Linearisation and Phase-Phase Faithfulness in Kayardild. *Iberia*. 3(1), pp. 81–118.

Svenonius, Peter. 2004. Slavic prefixes inside and outside the VP. *Nordlyd*. 32(2), pp. 205–253.

Taraldsen, Knut Tarald. 2000. V-movement and VP-movement in derivations leading to VO-order. In: Svenonius, Peter, ed. *The Derivation of VO and OV*. Amsterdam: John Benjamins, pp. 97–122.

Ulfsbjorninn, Shanti. 2014. *There are no moras: Syllabification in KacipoBalesi (Surmic)*. Ms., UCL, London.

Ziková, Markéta. 2008. *Alternace vokálů s nulou v současné češtině – laterální autosegmentální analýza*. Ph.D. thesis. Masaryk University in Brno.

Ziková, Markéta. 2012. Lexical Prefixes and Templatic Domains: Prefix Lengthening in Czech. In: Ziková, Markéta – Dočekal, Mojmír, eds. *Slavic Languages in Formal Grammar. Proceedings of FDSL 8.5, Brno 2010*. Frankfurt am Main: Peter Lang, pp. 325–338.

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