Resolutions of extrasyllabicity in Slovak

JERZY RUBACH and GEERT E. BOOIJ

Abstract

This article argues that an enlightening analysis of the complicated distribution of consonants in Slovak can be given by making use of present-day theories of syllable structure. In particular, it is shown that Slovak makes use of a variety of means to save extrasyllabic consonants. The analysis also lends support to the hypothesis of continuous syllabification, and to the distinction between three types of phonological rule: cyclic, postcyclic, and postlexical rules.

In this article we investigate the various ways in which extrasyllabicity of consonants is resolved in Slovak. Three questions are central in our study:

i. what kinds of mechanisms are used to resolve extrasyllabicity?

ii. how is syllable structure assigned?

iii. at what stage of the derivation does the resolution of extrasyllabicity take place?

With regard to (i) we will demonstrate that Slovak draws generously from the repertoire of universally available mechanisms. In fact it exploits a variety of options:

(1) a. Vowel insertion of two kinds: insertion of an entire vocalic structure (an X slot plus a melody) or insertion of an X slot over a floating segment: sections 2, 4, and 5.

  b. Syllabification of an unlicensed consonant: section 3.

  c. Rule of adjunction: section 3.

  d. Deletion of an extrasyllabic consonant: section 3.

With regard to question (ii), we shall demonstrate that syllable structure is assigned continuously and persists throughout the whole derivation. This confirms the findings of Clements and Keyser (1983), Itô (1986), and Rubach and Booij (1988).
With regard to question (ii) we will see that the resolution of extrasyllabicity is different at different stages of the derivation. It is not possible to assume that extrasyllabic consonants are left untouched until the end of the derivation and that only then are the "rescue mechanisms" enumerated in (1) activated in order to ensure prosodic licensing and permit the segments to be realized phonetically. This follows, on the one hand, from rule interaction that involves the rescued segments (section 3) and, on the other hand, from the fact that the same type of extrasyllabic segment is resolved differently at different stages of the derivation. For instance, the stem-final /l in the imperative /usidl/ is rescued by vowel insertion: \[ usidl + i \] ‘trap’, whereas the /l of /jabl/ and /dabl/ is made syllabic: \[ jabl + k + o \] [jablko] ‘apple’, double [dabl] ‘double game’. Furthermore, the /l in /nies +l/ and /nis +l/, which is also stem-final, triggers \[ o \] insertion in Central Slovak but remains unprosodified and is consequently strayerased in East Slovak: \[ niesol \] versus \[ nis \] ‘he carried’. Finally, the initial extrasyllabic /l in /lpie t/ ‘stick’ exploits adjunction as a rescue strategy. In sum, the resolution of extrasyllabicity is not a trivial matter. Indeed, we are dealing with a complex system of partly complementary and partly mutually exclusive rescue mechanisms.

The task of disentangling this network of problems is facilitated by assuming the framework of lexical phonology, which permits us to resolve the ordering paradox in section 3, among others. In particular, we follow Booij and Rubach (1987), who have enriched the classic model of lexical phonology (Kiparsky 1982; Mohanan 1986) by recognizing a component of lexical postcyclic (word-level) rules as a full-fledged constituent of the grammar in addition to the standardly recognized components of lexical cyclic and postlexical rules. As we demonstrate, different rescue strategies operate in different components.

While resolutions of extrasyllabicity are a central problem in this article, they are not the only theoretical issue that we consider. In section 5 we demonstrate that, counter to Itô’s (1986) assumption, stray erasure does not apply until the late stages of the postlexical phonology or indeed, perhaps, at the end of phonology, which raises the question of whether stray erasure is necessary at all.

This article is organized as follows. Section 1 introduces some background facts about Slovak. Section 2 presents the syllable structure algorithm and demonstrates that Slovak obeys the sonority sequencing generalization. This is essential as only then can we define extrasyllabicity. We establish that syllabification is cyclic and that it applies continuously. Extrasyllabicity is resolved by vocalizing a floating melody segment. In section 3 we use the concept of extrametricality in the analysis of sonorant syllabification. We observe that the derivation of syllabic consonants
displays an asymmetry in the treatment of initial versus medial and final consonants. The former are adjoined while the latter are syllabified. Section 4 presents a rule of o insertion. This mechanism contrasts with the mechanisms mentioned earlier in that it is postcyclic rather than cyclic. In section 5 we look at the resolution of extrasyllabicity in the postlexical component. A summary of the conclusions is given in section 6.

1. Background

To facilitate the subsequent discussion, we now present some background facts about Slovak. The presentation is organized around the problem of the so-called “yers,” which play a central role in Slavic phonology. While yers do not affect syllabification in a direct way, they are a significant source of rescue mechanisms in resolving extrasyllabicity. In particular, they serve as the basis of imperative vocalization in section 2 and vowel vocalization in section 5. They also play a role in understanding how extrametricality operates in Slovak (sections 3 and 4). In this section we briefly summarize the results presented in Kenstowicz and Rubach (1987) and Rubach (1986).

The term “yer” is used with reference to vowels that alternate with zero, a pattern that is characteristic for virtually all vowels of Slovak. Some examples are given in (2):

\begin{align*}
\text{(2) mozog} & \text{ ‘brain’ (masc. nom. sg.)} \rightarrow \text{mozg} \text{ + u (gen.sg.)} \\
\text{vechet’} & \text{ ‘dishrag’ (masc. nom.sg.)} \rightarrow \text{vecht’} + a \text{ (gen.sg.)} \\
\text{kart} + a & \text{ ‘card’ (fem. nom.sg.)} \rightarrow \text{karat} \text{ (gen.pl.)} \\
\text{bôč} + ik & \text{ ‘side’ (diminutive, masc. nom.sg.)} \rightarrow \text{bôč} + k + a \text{ (gen.sg.)}
\end{align*}

This alternation cannot be analyzed as an instance of vowel insertion. In that case, the first example in (2) would have the underlying representation //mozg// and /o/ would be inserted when no suffix follows. This path is evidently false, as there are many words in Slovak that end in -zg and are not subject to o insertion, for instance drobizg ‘little thing’. The opposite view that the alternating vowels are present underlyingly and that they are deleted when an inflectional ending is added is untenable as well. This is shown by the fact that it is unpredictable whether a vowel deletes or not. Thus, next to ovos ‘oats’ → ovos + a (gen.sg.) we have words such as povoz ‘carriage’ → povoz + u (gen.sg.) in which o is retained throughout the paradigm. Evidently, whether a vowel is a yer or not is a property of underlying representations. This has been recognized in the generative literature on Slavic ever since Lightner (1965, 1972). Yers have
been made underlyingly distinct from other vowels. The relevant alterna-
tion is then explained as an instance of yer vocalization in the context of
a following yer and as yer deletion in all the remaining environments.
Zero endings such as that of the masculine nom.sg. and the feminine/
neuter gen.pl. are interpreted as underlying yers. These yers never surface
phonetically as the inflectional ending is the last morpheme of the word.
Thus, mozog 'brain' (nom.sg.) is derived as in (3). Following the tradi-
tional parlance we take the nom.sg. yer to be a -u. (Here and below we
adopt the convention of representing yers as capital letters.)

(3) mozOg + U → mozog + U (by yer vocalization) → mozog (by
yer deletion)

The traditional assumption that zero inflectional endings are yers permits
us to draw a parallel between the vocalization of yers in derivational and
inflectional morphology. The following example comes from Kenstowicz
and Rubach (1987):

(4) a. spol + u 'together'
   b. spol + ok 'community' (nom.sg.) → spol + k + a (gen.sg.)
   c. spol + oč + n + á 'common' (fern. nom.sg.)
   d. spol + eč + en + sk + á 'social' (fern. nom.sg.)

As inspection of the vowel–zero alternations in (4) gives the following
results. The nom.sg. form in (4b) contains a sequence of two yers
//spol + Ok + U//, where the second yer is the nom.sg. ending. In (4c) we
also have two yers //spol + Ok + En + á//. The yer E of the adjectivizing
morpheme -En does not surface in (4c) because it is not followed by a
yer. However, in (4d) the environment of vocalization for -En is met: the
underlying representation contains a sequence of three yers
//spol + Ok + En + Isk + á//.

As has already been mentioned, researchers are in agreement that yers
are underlyingly different from other vowels. The question is how this
difference should be expressed. We follow Kenstowicz and Rubach (1987)
and represent the yers as floating melody matrices. That is, yers differ
from other vowels in that they have no associated X slots, a possibility
that is made available by a theory of three-dimensional representations
in phonology (see Halle and Vergnaud 1980; Clements and Keyser 1983;
and others). Yer vocalization is then a rule of slot insertion:

$$\begin{align*}
X \\
\text{Yer vocalization} & \quad \left\uparrow \right. \\
\rightarrow & \quad \text{V/ --- C V}
\end{align*}$$

where the circle around the vowel denotes a floating matrix.
Vocalized yers carry X slots and are hence available to the rules of syllabification; that is, they can be licensed prosodically. On the other hand, unvocalized yers escape prosodic licensing and are consequently stray-erased at the end of phonology (see section 5).

A second rule that we wish to briefly introduce is the rhythmic law. Consider the following examples:

(6) nom.sg.       dat.pl.  
  blat + o ‘mud’   blat + ám, hence underlying long //ám//  
  dláto ‘chisel’  dlát + am  
  vín + o ‘wine’  vín + am  
  lúk + a ‘meadow’ lúk + am

The generalization is clear: long vowels (that is, complex nuclei) are shortened after a long vowel (more exactly: after a complex nucleus). Since length in the three-dimensional theory is represented at the skeleton as two skeletal slots dominated by a single nucleus, the rhythmic law is a rule that refers to the interface between the skeleton and the nucleus:

(7) \[ \begin{array}{ccc} N & N & N \\ Rhythmic law & X & X \rightarrow X / X / X \end{array} \]

The rhythmic law applies on a projection of nuclei, hence intervening consonants play no role.

Yer vocalization and the rhythmic law are classic examples of cyclic rules. The evidence for this claim has been given in Kestowicz and Rubach (1987). Below we cite two examples from their analysis. The nom.sg. ending of neuter nouns is -o, while the gen.pl. suffix is the yer U. To save space we represent yers graphically as capital letters by which we mean floating melodic segments without an associated skeletal slot. An accent denotes length.

(8) nom.sg.: vedr + o //vedrEr + o// ‘bucket’, kridl + o //kridEl + o// ‘wing’  
  gen.pl.: vedier //vedEr + U//, krídel //kridEl + U//  
  diminutive nom.sg.: vedier + c + e //vedEr + Ec + e//, krídel + c + e //kridEl + Ec + e//  
  diminutive gen.pl.: vedier + iec //vedEr + Ec + U//, krídel + iec //kridEl + Ec + U//

Three points need to be explained. First, the diminutive suffix that surfaces as -c/-iec/-ec is a yer since it shows an alternation between zero and vowels. The same pattern is found in the roots, hence they also have yers. Second, Slovak has a lengthening rule that applies, among other cases,
before the yers of the diminutive suffix and the gen.pl. Third, the lengthened \( e \) (as well as some other vowels, but not all vowels) is further diphthongized and hence we see the surface [\textit{ie}]. We shall simplify the derivation by assuming that diphthongization, \( \dot{e} \rightarrow \textit{ie} \), is postcyclic (but see Kenstowicz and Rubach 1987; Rubach forthcoming). In (9) we derive the gen.pl. forms of the diminutives from (8):

(9) Cycle 2: \( \text{vedEr} + \text{Ec} \quad \text{krídEl} + \text{Ec} \)  

\begin{tabular}{llll}
WFR: diminutive & Yer vocalization & Lengthening & Rhythmic law \\
\( e \) & \( e \) & \( \dot{e} \) & \( e \) \\
\( \dot{e} \) & \( \dot{e} \) & \( \dot{e} \) & \( \dot{e} \) \\
- & - & - & - \\
\end{tabular}

Cycle 3: \( \text{vedér} + \text{Ec} + U \quad \text{krídél} + \text{Ec} + U \)  

\begin{tabular}{llll}
WFR: genitive plural & Yer vocalization & Lengthening & Rhythmic law \\
\( e \) & \( e \) & \( \dot{e} \) & \( \dot{e} \) \\
\( \dot{e} \) & \( \dot{e} \) & \( \dot{e} \) & \( \dot{e} \) \\
\( e \) & \( e \) & \( e \) & \( e \) \\
\end{tabular}

Other rules: \( \text{vedér} + \text{ec} + U \quad \text{krídél} + \text{éc} + U \)  

\begin{tabular}{llll}
Diphthongization & Yer deletion (stray erasure) \\
\( \text{ie} \) & \( \text{ie} \) & \( \theta \) & \( \theta \) \\
\( \theta \) & \( \theta \) & \( \theta \) & \( \theta \) \\
\end{tabular}

Surface form: [\textit{vedier} + \textit{ec}] [\textit{kridel} + \textit{iec}]

Notice that in order for the yers to lengthen, they must first receive an X slot (that is, vocalize), since lengthening, like the rhythmic law, operates on the skeleton, as it is there that length relations are represented. As long as the yers have no X slot they are invisible to lengthening because lengthening adds a second slot to the nucleus that already has a slot. We thus conclude that yer vocalization must be ordered before lengthening. Further, since lengthened vowels may subsequently become short by the rhythmic law (see the derivation in [9]), lengthening precedes the rhythmic law. The order of the rules must therefore be exactly as given in (9).

A complex pattern of alternations in (9) between vowels and zero as well as between short and long nuclei falls out from the cyclic application of the relevant rules without any stipulations. The diminutive suffix //\textit{Ec}// surfaces as long (here: diphthongized) in \textit{kridel} + \textit{iec} because the \( e \) of the second stem syllable is shortened on cycle 2 due to the preceding underlying long \( i \). This \( e \) is not shortened in \textit{vedier} + \textit{ec} because the preceding stem syllable is underlyingly short. Consequently, on cycle 3 when the //\textit{Ec}// of \textit{vedier} + \textit{ec} is vocalized and lengthened, it is preceded by a long vowel. It is therefore subject to the rhythmic law and surfaces phonetically as a short vowel rather than as a diphthong (recall that only long \( \dot{e} \) can diphthongize).
2. Cyclic syllabification

In this section we look at imperative vocalization, a rule that shows how extrasyllabic consonants are rescued by creating a syllable into which they can syllabify. We begin by presenting the syllable structure algorithm (SSA hereafter), which accounts for syllabification in Slovak.

With regard to the SSA we assume with Levin (1985) that syllable structure is characterized as a projection of the primitive category N (that is: nucleus). The rules of the algorithm are as follows:

(10) $N \rightarrow X \ X$  
SSA: N placement $[-\text{cons}] \rightarrow [-\text{cons}]$

$N''$

CV rule $(X) \ X \rightarrow (X) \ X$

Coda rule: erect $N'$ between $N$ and $N''$ to include all the postnuclear Xs

Onset rule: attach the prenuclear Xs to $N''$

A word such as *klam* ‘false impression’ is now syllabified as follows:

(11) $N' \rightarrow X \ X \ X \ N-\Pi \ X \ X \ X \ X \ CV \ rule \ X \ X \ N'' \ Coda \ rule \ X \ X \ X \ N' \ Onset \ rule \ X \ X \ X \ X$

N placement and the CV rule are universal. The CV rule erects $N''$, which is a syllable node (often abbreviated as $\sigma$). Consequently, it must apply
even if the onset is empty as in *akt 'act', hence the X slot in (15) is optional (Levin 1985). On the other hand, the coda rule and the onset rule have language-specific aspects. One clear indication of this fact is the possibility that in some languages the coda rule precedes the onset rule and in some other languages this ordering is reversed. Let us clarify further that we assume with Levin (1985) that the CV rule is endowed with the power to resyllabify segments.

The task of the SSA is to organize Xs into syllables. This operation is steered by certain principles, both universal and language-specific. The universal principle is the well-known sonority sequencing generalization (see Selkirk 1984), which can be stated as follows:

(12) Sonority sequencing generalization:
The sonority of segments must decrease toward the edges of the syllable in accordance with the following scale:

For the purposes of Slovak syllabification the SSG must be relaxed in one significant way: there is no requirement of sonority distance for obstruents. That is, fricatives and stops can occur in either order and obstruents of the same class can cluster together. Some examples of onsets and codas are given in (13):

(13) a. skok 'jump', škola 'school', zbožie 'grain', psut 'spoil', pšenica 'wheat', kto 'who', tkat 'weave', dbat 'care', bdieć 'drudge away', všetko 'all'

b. klips 'clip', keks 'cake', fakt 'fact', text 'text', hriest 'scratch'

The sonority sequencing generalization is thus overridden by the following principle of Slovak:

(14) Obstruent sequencing principle:
With obstruents there is no requirement of sonority distance.

Slovak also has constraints on permissible onsets. They prohibit, among others, consonant clusters composed of identical or near-identical segments. In particular, clusters of fricatives both of which are labial or coronal are not permitted. Also excluded are combinations of two stops with the same place of articulation. Thus, for instance, *vw-, *zz-, *zz̪-, and *gk- are ill-formed onsets.

In order to determine which consonants remain extrasyllabic in the derivation, it is crucial to show that the sonority sequencing generalization is indeed respected in Slovak. In this section we present evidence from two sources toward this purpose: native-speaker judgments on permissible syllabification and the role that extrasyllabic consonants play in deriving
the correct form of the imperative. Helpful in this respect is variation (optional resyllabification). In (15) we show that such variation is possible only in the instances in which the sonority sequencing generalization is not violated. Notice that our contrasting pairs involve the same consonants but in a different order:

(15) sed-lo ~ se-dlo 'saddle' vs. fal-da, not *fa-lda 'fold'
    dub-le-ta ~ du-ble-ta 'doublet' vs. kol-ba, not *ko-lba 'rifle butt'
    cyk-lus ~ cy-klus 'cycle' vs. bal-kón, not *ba-lkón 'balcony'
    jad-ro ~ ja-dro 'core' vs. čar-dáš, not *ča-rdáš 'czardas'
    ob-raz ~ o-braz 'picture' vs. far-ba, not *fa-rba 'paint'

The conclusion from (15) that the sonority sequencing generalization is obeyed is corroborated by the behavior of the imperative. A representative sample of the data is given in (16). We quote the 2nd p.sg. form as this form of the verb demonstrates the structure of the stem most clearly. In surface terms the imperative is manifested in four different ways:

(16) a. as a phonetic zero:
    nes + ú 'they carry' – nes
    rozum + ej + ú 'they understand' – rozum + ej
    pros + i + t' 'ask' – pros

b. as a reflex of coronal palatalization, a rule that changes //t d n l// into prepalatal [t’ d’ n’ l’] before front vowels:
    plet + ú 'they weave' – plet'
    min + ú 'they pass' – miň [min’]

c. as a reflex of velar palatalization, a rule that changes //k g χ γ// into postalveolar [č ř š ž] before front vowels:
    piek + l + a 'she baked' – peč
    strieh + l + a 'she guarded' – strež

d. as the vowel i:
   (i) in inherent verbs
       tr + ú 'they rub' – tr + i
       mr + ú 'they die' – mr + i
       začn + ú 'they begin' – začn + i [začn’ + i]
   (ii) in vowel stem verbs
       mysl + ie + t’ 'think' – mysl + i [misl’ + i]
       u + sidl + i + t’ 'trap' – u + sidl + i [u + sidl + i]
       kysl + i + t’ 'make sour' – kysl + i [kisl’ + i]

A common property of the imperatives in (16a)–(16c) is that they can be straightforwardly syllabified, although the imperative morpheme does not surface as a vowel. In contrast, the verbs in (16d) could not be fully syllabified if the imperative did not surface overtly as a vowel. For
example, the clusters in the stems začn ‘begin’ and mysł ‘think’ are ill-formed codas from the point of view of the sonority sequencing generalization: the sonorants are further away from the nucleus than the obstruents. In sum, whether the imperative morpheme surfaces as i or not depends on whether stem-final clusters can be fully syllabified or not. Consequently, the sonority sequencing generalization is the determining factor in the distribution of the zero as opposed to the i ending in the imperative.7

The appearance of the i in (16d) is clearly an instance of a “rescue” strategy. Extrasyllabicity is resolved by inserting a vowel. Let us look more closely at the details of the analysis.

Assuming that i is inserted in (16d) does not solve all the problems. In particular, the question is how we can account for the facts of palatalization in (16b)–(16c). There is no doubt that palatalization is directly connected to the structure of the imperative. One obvious reason is that the examples in (16b)–(16c) are inherent verbs, that is, the roots themselves are verbs. Consequently, palatalization could not be construed to be caused by some other morpheme such as the verbalizing suffixes exemplified in (16dii). We conclude that the imperative must be a front vowel. But then how can we account for the fact that this vowel does not surface in (16a)–(16c)? The answer suggests itself: the imperative morpheme is a yer.8 It does not surface phonetically since the environment of yer vocalization (5) is not met. (Recall that yers are vocalized if they are followed by a yer.) If we assume further that the yer is I rather than E (it must be a front vowel), then the appearance of i in (16d) is understandable. The yer vocalizes if the preceding consonant is extrasyllabic.9 Recall that the circle denotes a floating matrix.

\[ \text{(17) Imperative vocalization } \text{\(i\)} \rightarrow \text{\(i\)} / \text{\(*C\)} \text{---} \]

The representation of the imperative forms in (16a)–(16di) is now as follows. We take one example from each class and let the SSA determine when the consonant is extrasyllabic.

\[ \text{(18)} \]

\[ \text{nes} \text{‘carry’ } \text{plet} \text{‘weave’ } \text{peč} \text{‘bake’ } \text{začn} + \text{i} \text{‘begin’} \]
Imperative vocalization applies to *zacn + i ‘begin’. The unvocalized yers in the remaining examples are stray-erased.

The conclusion from our analysis is that the SSA must apply before imperative vocalization because imperative vocalization is sensitive to the contrast between syllabified and extrasyllabic consonants. If we now establish at what point in the grammar imperative vocalization applies, in particular whether it is cyclic, postcyclic, or postlexical, then we will also know when the SSA begins to apply. The key to the answer lies in the observation that all the verbs in (16di) and most verbs in (16dii) contain underlying yers. This is shown by vowel–zero alternations in the roots:

\[ (19) \]
\[ a. \quad \text{perfective} \quad \text{derived imperfective} \]
\[ \begin{align*}
\text{po + tr + ú ‘they rub’} & \quad \text{po + tier + aj + ú} \\
\text{u + mr + ú ‘they die’} & \quad \text{u + mier + aj + ú} \\
\text{zacn + ú ‘they begin’} & \quad \text{zacín + aj + ú}
\end{align*} \]
\[ b. \quad \text{mysl ‘thought’ (N)} \rightarrow \text{mysl + i (gen.sg.)} \rightarrow \text{mysl + ie + t ‘think’} \\
\text{sidl + o ‘trap’} \rightarrow \text{sidel (gen.pl.)} \rightarrow \text{u + sidl + i + t ‘to trap’, etc.} \]

Vocalization of the yer in the derived imperfectives in (19a) is due to the rule of *derived imperfective raising*, a morphologically conditioned rule that applies before the suffix -aj (see Rubach forthcoming). A further rule lengthens the vocalized vowel. As mentioned earlier, a lengthened e diphthongizes later to ie. Thus, the imperative of the verb ‘rub’ is */tEr+i/>. In (20) we derive tr + i ‘rub’ in order to demonstrate that yer vocalization must be bled hence ordered after imperative vocalization.

\[ (20) \]
\[ \begin{array}{c|c|c|c|c|c|}
\text{XX} & \text{X} & \text{X} & \text{X} & \text{ter + i} & \text{imperfective vocalization (17)} \\
\hline
\text{ter + i} & \text{yer vocalization (5)}
\end{array} \]

If yer vocalization were permitted to apply before imperative vocalization, then the imperative yer would cause the root yer to vocalize and hence we would derive the incorrect *ter*. As explained in section 1, yer vocalization is cyclic. Therefore, given the ordering in (20), imperative vocalization must also be cyclic. Consequently, the SSA, which applies before imperative vocalization, is cyclic as well.

Since syllable structure is assigned cyclically we would expect that the SSA should apply at the beginning of the cycle (the unmarked case).
Derivation (20) shows that this is not sufficient. At some stage the SSA must reapply to assign syllable structure to tr+i ‘rub’ that is only syllabifiable after imperative vocalization. It is therefore clear that the SSA cannot be ordered among (the other) phonological rules. Could we then simply assume that the SSA applies twice: at the beginning and at the end of a cycle? Hardly. Evidence comes from the imperatives of complex (noninherent) verbs. These are the verbs that are derived from nouns or adjectives by adding verbalizing suffixes. Two instances of verbalization have been given in (19b). In msysl+ie+t’ ‘think’ the verbalizing suffix is ie //é// (long é is subsequently diphthongized to ie) while in u + sidl+i+t’ ‘trap’ it is i. However, relevant to our discussion are verbalizations of the type exemplified in (21):

\[(21) \; \text{voz 'carriage' - voz} + i + t' 'carry' - voz (imper.) \]
\[(22) \; \text{let 'flight' - let} + ie + t' 'fly' - let (imper.) \]

Needless to say, the imperative is formed from the verb stem and not from the nominal root. The relevant representations are therefore [[[voz\textsubscript{N} i]\textsubscript{V} I\textsubscript{IMPER} and [[[let\textsubscript{N} é]\textsubscript{V} I\textsubscript{IMPER}]. The verbalizing suffixes do not surface phonetically since Slovak, like all other Slavic languages, has the well-known rule of vowel deletion that was discovered originally by Jakobson (1948):

\[(22) \; \text{Vowel deletion } V \rightarrow \emptyset / \quad \ldots \quad V ]_{\text{VERB}} \]

The derivation of the imperative voz //voz+i+I// ‘carry’ and msysl+i //misEl+é+I// ‘think’ (see 19b) is now as follows. To save space we omit reference to the skeletal tier and represent yers as capital letters.

\[(23) \text{Cycle 1: voz misEl} \]
\[
\begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\end{array}
\begin{array}{c}
\text{voz} \\
\text{misEl} \\
\text{SSA} \\
\end{array}
\begin{array}{c}
\text{no other rule applies} \\
\end{array}
\]

\[
\begin{array}{c}
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Extrasyllabicity in Slovak

If the SSA were not permitted to reapply in the middle of the cycle, then not only *mysl + i* ‘think’ but also *voz* ‘carry’ would trigger — incorrectly — imperative vocalization. After vowel deletion has applied in cycle 3 the ζ is stranded and both *voz* and *mysl + i* end in an unsyllabified consonant. It is only after the reapplication of the SSA that the relevant difference between the two verbs comes to light: *voz* is fully syllabified while *mysl + i* is not, due to the blocking effect of the sonority sequencing generalization. We conclude that the SSA must apply continuously. It is an algorithm and not a phonological rule and hence cannot be ordered. This conclusion is further corroborated by *postcyclic insertion* and *vowel vocalization* in sections 4 and 5, respectively.

To summarize, we have shown that the Slovak SSA is sensitive to sonority relations by demonstrating the role that the sonority sequencing generalization plays in native-speaker judgments on permissible syllabification and in deriving the correct form of the imperative. We have also seen the first type of rescue strategy used in order to resolve extrasyllabicity. It is the insertion of a skeletal slot over a floating vocalic melody.
3. Liquid syllabification

In this section we discuss a different strategy of rescuing extrasyllabic segments: assignment of syllabicity to consonants. The relevant data are gathered in (24):

(24) a. syllabic consonants:
   i. krk [krk] 'neck', krčm+a [krčm+a] 'inn', krst+i+t' [krst'+i+t'] 'baptize', brvn+o [brvn+o] 'wood', dlh [dlx] 'debt', p[lt] [p[lt] 'fence', žlt+y [žlt+i] 'yellow', pln+i+t' [pln'+i+t'] 'fill'
   ii. Sartre [sartr], Sèvres [sevr], double [debl] or [dabl] 'double game', single [singl] 'single game'

b. nonsyllabic consonants:
   i. smrek 'spruce', alarm 'alarm', m/ieko 'milk', film 'film'
   ii. rmut 'sadness', rdest 'water pepper', rdesn+o 'pondweed', /kat+t' 'sob', /stiv+y 'crafty'

A comparison of (24a) and (24bi) clearly indicates that liquids are syllabic if they do not stand next to a vowel. To put it differently, they become syllabic if they cannot syllabify into an onset or a coda. Since liquids are [+ cons], they are not subject to Ν placement of the SSA. They are made syllabic by rule (25). Note: the asterisk means "unsyllabified."

\[ \begin{array}{c|c|c|c} & N & & \\ & & X & X \\ \end{array} \]

(25) Liquid syllabification \[ *L \rightarrow L \]

A question that may be asked is why we could not simply assume that liquids are underlyingly syllabic? This would be a false step. First, there are alternations between syllabic and nonsyllabic liquids, hence the distribution of syllabicity must be rule-governed:

(26) syllabic liquid nonsyllabic liquid
   mudr+c 'sage' mudr+ák 'sage' (pejorative)
   u+m+r+t+n+y 'dead' u+m+r+ie+t' 'die'
   jabl+k+o 'apple' jabl+oñ 'apple-tree'

Second, assuming that liquids are underlingly syllabic would require postulating desyllabification applying before or after a vowel (probably two rules then; compare the data in [24bi]). Third, the occurrence of syllabic liquids is 100% predictable and hence syllabicity should not be
encoded in underlying representations. In sum, (25) is a well-motivated rule of Slovak.

Is liquid syllabification cyclic or postcyclic? The data in (26) seem to suggest that it should be postcyclic since the generalization about the syllability of liquids cannot be made until we know whether consonantal or vocalic suffixes have been added. If liquid syllabification were cyclic, then being a structure-adding rule it would apply on the first cycle and we would have to postulate a rule of desyllabification for words such as mudr + ak 'sage' (pejor.). However, there is overwhelming evidence that liquid syllabification must be cyclic. This conclusion follows from the kind of derivation that is required, and from the interactions between liquid syllabification and cyclic rules.

Consider u + mr + l+c+a 'dead person' (gen.sg.). At the postcyclic level both r and l meet the environment of (25). Yet, it is only r that is syllabic. This result is obtained easily if liquid syllabification applies cyclically: after the r has become syllabic on an earlier cycle, the l is put into the coda by the SSA, and it does not meet the environment of liquid syllabification.13

Another piece of evidence for the cyclicity of liquid syllabification comes from its interaction with the rhythmic law, rule (7):

(27) a. lúk+a 'meadow' → lúk+am (dat.pl.)
    b. vřb+a 'willow' → vřb+am (dat.pl.)

The dat.pl. suffix has an underlying long vowel, compare slin+a 'saliva' → slin+ám. Notice that the rhythmic law operates regardless of whether the environment is made up by a long vowel, as in (27a), or by a long liquid, as in (27b). Recall now that, first, the rhythmic law is cyclic and, second, it operates on syllable nuclei. Consequently, syllable nuclei over the liquids must be erected prior to the application of the rhythmic law. Therefore liquid syllabification is ordered before the rhythmic law (a cyclic rule) and hence it is cyclic itself (see Booij and Rubach 1987).

That liquid syllabification is cyclic is also shown by its interaction with lengthening, a rule that we mentioned briefly in section 1. The derivation in (9) shows that lengthening precedes the rhythmic law and must therefore be cyclic. Consider now the data in (28). Syllabic liquids in (28a) parallel long vowels in (28b) in that they undergo lengthening. However, nonsyllabic liquids behave differently; compare (28c). It is the vowel that lengthens and not the liquid. Clearly, lengthening operates on syllable nuclei (see note 3), and hence liquids must be made syllabic before they can lengthen. That is, liquid syllabification is ordered before lengthening:
Finally, liquid syllabification interacts with imperative vocalization, rule (17) in section 2. This is made evident by imperatives such as *tlč ‘pestle’, underlying //tlk + I//. (Recall that the yer I is the imperative suffix.) If the liquid were not syllabic, then the final k (č after velar palatalization) would remain unsyllabified and hence it would trigger imperative vocalization. We would thus derive the incorrect *tlč + i for tlč. This problem is avoided if l is made syllabic prior to imperative vocalization. Then, the k is syllabified into the coda and imperative vocalization is blocked, exactly as required. Recall now that imperative vocalization is cyclic. Consequently, liquid syllabification, which precedes it, must also be cyclic. A partial derivation for tlč ‘pestle’ (imper.) is given in (29). For the moment we ignore the cycle:

(29)  

<table>
<thead>
<tr>
<th>tlk + I</th>
</tr>
</thead>
<tbody>
<tr>
<td>σ</td>
</tr>
<tr>
<td>/</td>
</tr>
</tbody>
</table>
| tlk + I | Liquid syllabification (25)
| σ       |
| /       |
| tlk + I | SSA
| —       | Imperative vocalization
| ————   |
| σ       |
| /       |

Surface form: tlč

To summarize, we have adduced four arguments for the cyclicity of liquid syllabification: resolution of the question in which direction the rule applies and three ordering arguments: interaction with the rhythmic law, interaction with lengthening, and interaction with imperative vocalization. We return to the latter in a different connection later in this section.

With the conclusion that liquid syllabification is cyclic, we seem to run into difficulty in (26). In particular, the question is how we can avoid the incorrect application of liquid syllabification to morphemes such as mudr...
in mudr + ák 'sage' (pejor.). The answer is simple if we assume that Slovak is not an exception to the universal rule of final consonant extrametricality (Borowsky 1986). Then, on the first cycle the r in mudr + ák is extrametrical and hence escapes liquid syllabification. On cycle 2 the SSA puts it into the onset of the newly added syllable and liquid syllabification is inapplicable.

Similar evidence for final consonant extrametricality emerges from the consideration of yers in the environment of liquids:

(30) nom.sg. gen.sg. 
   cukor 'sugar' cukr + u 
   sveter 'sweater' svertr + a 
   diabol 'devil' diabl + a 

The syllabification of the final liquid and hence the need for subsequent desyllabification is avoided on the first cycle due to extrametricality. In (31) we compare the derivation of cukor 'sugar', slz + a 'tear', and Sartre.

To save space we omit reference to the skeleton and represent floating matrices (yers) as capital letters. Recall that the masc. nom.sg. ending is the yer //U// and *r means that the r is extrasyllabic.

(31) Cycle 1: cukO(r)EM sl(z)EM sart(r)EM

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\[ \sigma \]

\[ \sigma \]

Yer vocalization (5)

SSA

Liquid syllabification (25)

SSA

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Cycle 2: cukOr + U slz + a sartr + U

\[ \sigma \]

\[ \sigma \]

\[ \sigma \]

\[ \sigma \]

\[ \sigma \]

\[ \sigma \]

* r

* r

SSA
Three interesting observations emerge from this derivation.

First, yers must be able to erase extrametricality since otherwise Sartre could not be derived. The same conclusion follows from the study of the imperative in section 2, where after the addition of the imperative yer the SSA must be able to determine whether the final consonant is syllabifiable or not.

Second, the SSA must apply continuously, which confirms our earlier findings (section 2). This is shown by the fact that the $r$ of cukor must be syllabified after yer vocalization, hence in the middle of the derivation, in order to escape liquid syllabification.

Third, the derivation in (30) shows that yer vocalization is ordered before liquid syllabification so that the $r$ of cukor 'sugar' is not made, incorrectly, syllabic. Recall now that our analysis in section 2 led to the conclusion that imperative vocalization precedes yer vocalization. Recall also that liquid syllabification must apply before imperative vocalization, as shown by (29). We now have an ordering paradox. On the one hand, liquid syllabification must be ordered before imperative vocalization and, on the other hand, it must be ordered after yer vocalization. In sum, the required ordering is liquid syllabification $\rightarrow$ imperative vocalization $\rightarrow$ yer vocalization $\rightarrow$ liquid syllabification. This ordering paradox is solved easily by assuming that the rules apply cyclically. We now give a complete derivation for tlč 'pestle' (imper.) that we introduced earlier in (29). Recall that the asterisk means "unsyllabified."
Now we return to the data in (24bii). The generalization is that word-initial liquids are never syllabic (D’urovič 1973; Pauliny 1979). They thereby contrast with word-medial and word-final liquids. Such an asymmetry is not surprising. It was discovered to exist in Polish and in Czech (Rubach and Booij 1990). Word-initial extrasyllabic liquids must be somehow excluded from the operation of liquid syllabification. Could we simply rewrite rule (25) as (33)?

(33) \[ *L \rightarrow L/C \]
While the statement in (33) yields the correct results in descriptive terms, it is an embarrassment to the theory of syllable structure, because we repeat in the structural description something that already follows from the SSA: consonants cannot be extrasyllabic when they are adjacent to a vowel.

One way of solving the problem is to treat word-initial consonants as extrametrical. This is not very attractive. Unlike final extrametricality, which is a universal principle, initial extrametricality would have to be a language-specific stipulation. More importantly, initial extrametricality would invalidate the otherwise straightforward generalization that prevo-calic j is derived in Slovak if there is an empty onset. Compare j plus vowel versus i plus vowel (two syllables) if a consonant precedes:

(34) jak 'how' vs. dialekt 'dialect'
    jež 'hedgehog' vs. dietetický 'dietetic'
    jola 'type of boat' vs. dioptri + a 'diopter'

The j is predictable here and it is derived from i by gliding, which is part of the SSA. Gliding is blocked if the CV rule has created an onset. To achieve this blocking effect, the word-initial consonant must be visible to the SSA and hence it cannot be extrametrical.

Finally, observe that word-initial extrametricality would offer no more than a partial solution to the problem. After the erasure of extrametricality at the end of the cyclic component the initial liquids in question would remain unprosodified. Consequently, an adjunction rule would have to be postulated in order to license the liquids prosodically and thereby guarantee that they are realized phonetically, that is, that they are not stray-erased at the end of the derivation. This suggests that we might just as well assume that an adjunction rule operates from the very beginning of the derivation, which permits us to give up word-initial extrametricality. The question now is whether this should be an adjunction to the syllable node, as was argued for by Steriade (1982), or to the phonological word node, as is the case in Polish (see Rubach and Booij 1990). This dilemma cannot be resolved here (but see Rubach forthcoming). We assume arbitrarily that Slovak has an adjunction to the syllable node:

(35) Initial adjunction:
  Adjoin initial *C to the syllable node.

If we assume further that initial adjunction applies in the cyclic component before liquid syllabification, then the asymmetry between the initial and the medial/final extrasyllabic consonants is explained. We can also
Extrasyllabicity in Slovak

719

uphold the generalization about the distribution of j and i in (34) because initial consonants are not extrametrical.

To summarize, we have come across a second way of resolving extrametricality in Slovak, which is to syllabify a consonant. We have strengthened our earlier observation that the SSA must apply continuously, and we have discovered that Slovak complies with the universal final consonant extrametricality. An asymmetry between the initial and the medial/final extrasyllabic consonants that has emerged in our discussion has been accounted for by postulating a rule of initial adjunction. In the next section we look at a slightly different effect of the same asymmetry.

4. Postcylic insertion

In this section we will show that resolution of extrasyllabicity takes place also in the postcyclic component. The interest of the analysis lies in the fact that extrametricality is resolved in different ways in the same position (word-finally), depending on whether it arises in the cyclic or in the postcyclic component. Consider the alternation between o and zero before the past participle morpheme -t:

(36) Infinitive Past participle Gloss

<table>
<thead>
<tr>
<th></th>
<th>masculine</th>
<th>feminine</th>
<th>neuter</th>
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</thead>
<tbody>
<tr>
<td><em>hryz</em> + t'</td>
<td>hryz + ol</td>
<td>hryz + l + a</td>
<td>hryz + l + o</td>
</tr>
<tr>
<td>nies + t'</td>
<td>nies + ol</td>
<td>nies + l + a</td>
<td>nies + l + o</td>
</tr>
<tr>
<td>riec + t'</td>
<td>reik + ol</td>
<td>reik + l + a</td>
<td>reik + l + o</td>
</tr>
<tr>
<td>piec + t'</td>
<td>piek + ol</td>
<td>piek + l + a</td>
<td>piek + l + o</td>
</tr>
</tbody>
</table>

Given our findings so far that vowel–zero alternations can be traced back to underlying yers, our first guess is that the alternating o is a yer. Notice that for this explanation to go through it is necessary to assume not only that the alternating o is a yer but also that the masculine gender morpheme is a yer. The latter is necessary in order to induce the application of yer vocalization to the former. That is, *hryz* + ol 'he bit' would have to come from underlying //hryz + Ol + U/>. The feminine and the neuter forms have "regular" vowels as gender markers, hence yer vocalization is inapplicable: //hryz + Ol + a/, //hryz + Ol + o//. But this interpretation is blatantly incorrect; neither the alternating o nor the masculine gender ending can be yers. Consequently, the o must come from insertion and the masculine gender is simply zero. This conclusion is justified as follows.

Consider the alternation of n and zero in the following verbs. The inflectional forms are the same as those in (36).
(37) pad + n + út'pad + ol pad + l + a pad + l + o
chud + n + út' chud + ol chud + l + a chud + l + o
stih + n + út' stih + ol stih + l + a stih + l + o
‘fall’
‘lose weight’
‘manage’

If the alternating o were a yer, then the underlying representation of pad + ol ‘he fell’ would be //pad + n + Ol//. This, however, is incorrect, as the n deletes in the past participle and, as we know from other data, nasal deletion, which deletes nasals before a consonant, is blocked by an intervening yer; compare altán + k + a ‘summer house’ (dimin.), UR //altán + Ok + a//. (The yer of the diminutive suffix is seen on the surface in the gen.pl. altán + ok.)

The second assumption, that the masculine gender marker is a yer, is also untenable. Consider, for instance, the verb zamk + n + út’ ‘lock’. It is derived from the noun zámok ‘lock’, which contains a yer:

(38) zámok (nom.sg.) – zamk + a (gen.sg.) – zamk + n + út’ ‘to lock’ – zamk + ol ‘he locked’ – zamk + l + a ‘she locked’ – zamk + l + o ‘it locked’

If the masculine gender marker were a yer, then zamk + ol would be represented as //zamOk + n + l + U//, and as /zamOk + l + U/ after nasal deletion. This form would be subject to yer vocalization, and we would derive the incorrect *zamok + ol for zamk + ol.

To summarize, neither the alternating o nor the masculine gender marker is a yer. Consequently, the o must come from insertion. The rule applies if the l is extrasyllabic, that is, in the masculine form, for instance /hriz + l/.

(39) o insertion 0 → o / --- *L

Notice, however, that the environment of (39) is identical to that of liquid syllabification (25). This seems to be a problem since the two rules perform incompatible operations. According to (39) extrasyllabicity of liquids is resolved by inserting a vowel, but according to (25) it is resolved by syllabifying the consonant. How can these rules be reconciled? Both rules appear to apply in the same context, that is word-finally. Thus, the *r of Sartre and the *l of double /daib/ ‘double game’ are syllabified, while the *l of hrýz + ol /hriz + l/ ‘he bit’ triggers o insertion. Things fall into place when we look at the details of the analysis.

First of all, notice that the two rules have a different status. Liquid syllabification is crucially cyclic since it interacts with other cyclic rules and participates in what would have been ordering paradoxes if the rule had not been cyclic. In contrast, o insertion cannot be cyclic. Observe that only the masculine but not the feminine and the neuter forms in
Extrasyllabicity in Slovak

(36)–(37) undergo o insertion. This is understandable if the rule is postcyclic, as it then applies at the word level after all the suffixes have been added. On cycle 3 the l in hrýž+l+a ‘she bit’ and hrýž+l+o ‘it bit’ is syllabified by the SSA, while the l in hrýž+ol /hríž+l/ ‘he bit’ is not. Consequently, only the masculine form triggers o insertion.

By assigning o insertion to the postcyclic component we explain why words such as krk ‘neck’ and Sartre /sátr/ do not undergo the rule: at the postcyclic level the liquid is syllabic due to cyclic liquid syllabification. However, we must also explain how it is possible for hrýž+ol /hríž+l/ ‘he bit’ to escape liquid syllabification. The answer lies in final consonant extrametricality. Both the r of /sátr/ and the l of /hríž+l/ are extrametrical. However, Sartre, being a noun, takes the nom.sg. ending, which is a yer. The yer erases extrametricality and makes the r available to liquid syllabification. In contrast, the l of /hríž+l/ is never followed by a yer since, as we have pointed out (see [38]), the masculine gender marker is zero. Thus, the l remains extrasyllabic and hence invisible to liquid syllabification. In accordance with the standard assumptions, the extrametricality that has not been erased earlier by the peripherality condition is erased by convention at the end of the component, here, the cyclic component. This opens /hríž+l/ to o insertion.

To sum up our discussion, we derive hrýž+ol ‘he bit’ and hrýž+l+a ‘she bit’, which we contrast with the derivation of Sartre given earlier in (31). We omit reference to the skeleton and represent yers as capital letters.

(40) hriz + l hriz + l + a sartr + U

Cycle 1:

<table>
<thead>
<tr>
<th>Cycle 1</th>
<th>hrí(z)_EM</th>
<th>hrí(z)_EM</th>
<th>sart(r)_EM</th>
</tr>
</thead>
<tbody>
<tr>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>SSA</td>
</tr>
<tr>
<td>hri(z)_EM</td>
<td>hri(z)_EM</td>
<td>sart(r)_EM</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Liquid</td>
<td>syllabification (25)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Cycle 2</th>
<th>hriz + (l)_EM</th>
<th>hriz + (l)_EM</th>
<th>sartr + U</th>
</tr>
</thead>
<tbody>
<tr>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>SSA</td>
</tr>
<tr>
<td>hriz + (l)_EM</td>
<td>hriz + (l)_EM</td>
<td>*_r</td>
<td>SSA</td>
</tr>
</tbody>
</table>
Incidentally, we can now see why initial adjunction is located in the cyclic component. It is now clear why *mut *sadness* and *stiv + y* *crafty* do not trigger *o* insertion: the liquids have been prosodified.

Interestingly, the facts of Central Slovak (an educated standard dialect) that we have just analyzed contrast with those of East Slovak precisely with respect to the treatment of * in the masculine gender past participles. According to Pauliny (1963) the difference is as follows:

(41) Central Slovak  East Slovak  Gloss

<table>
<thead>
<tr>
<th>nies + ol</th>
<th>nis</th>
<th>'he carried'</th>
</tr>
</thead>
<tbody>
<tr>
<td>piek + ol</td>
<td>pik</td>
<td>'he baked'</td>
</tr>
<tr>
<td>vied + ol</td>
<td>vid</td>
<td>'he led'</td>
</tr>
</tbody>
</table>
At an earlier derivational stage nis, pik, and vid are /nis + l/, /pik + l/, and /vid + l/, but East Slovak does not have the rule of o insertion. Consequently, l remains extrasyllabic, and it deletes by stray erasure as an unlicensed segment.

To summarize, extrasyllabicity is resolved differently in different components of the phonology. In the cyclic component liquids are syllabified, while in the postcyclic component they trigger o insertion. Thus, the distinction of the cyclic and the postcyclic components advanced by Booij and Rubach (1987) is crucial to the correct handling of the data. Furthermore, the SSA must apply continuously not only in the cyclic component but also postcyclically. This is necessary in order to determine whether a segment is extrasyllabic and in order to resyllabify codas as onsets once the vowel has been inserted (see the fate of z in hryzol in [40]). In the next section we show that the SSA must also apply postlexically and that certain extrasyllabic consonants are rescued by vowel insertion in the postlexicon.

5. Postlexical insertion

Consider the distribution of the consonantal and the vocalic forms of the proclitic prepositions20 in (42):

(42) a. v–vo ‘in’: v ruke ‘in the hand’ vs. vo vernosti ‘in the faithfulness’, vo vlastnostiach ‘in the properties’, vo fonologickej štrukture ‘in the phonological structure’
   b. z–zo ‘from’: z lúky ‘from the meadow’ vs. zo závisti ‘from envy’, zo zlata ‘from gold’, zo sedla ‘from the saddle’, zo železa ‘from gold’
   c. s–so [zo]21 ‘with’: s matkou ‘with the mother’ vs. so synom ‘with the son’, so zubami ‘with the teeth’, so šatami ‘with the clothes’
   d. k–ku [gu] ‘to’: k lekárovi ‘to the doctor’ vs. ku konfliktu ‘to the conflict’, ku grošu ‘to money’

The vocalic form of the preposition appears if the next word begins with the same or nearly the same consonant. This is further confirmed by pairs such as vo vode ‘in the water’ vs. k vode ‘to the water’ and zo zlata ‘from gold’ vs. v zlate ‘in the gold’. We seem to have discovered yet another rule of vowel insertion. Let us establish the environment in which it applies. The identity or near identity of the relevant consonants is not sufficient. Other prepositions such as bez ‘without’ have a constant shape regardless of whether the following word begins with an identical conso-
nant, for instance, bez zlata ‘without the gold’. Evidently, the difference between bez zlata and zo zlata ‘from gold’ lies in the fact that the z of bez is in the coda while the z of zo is extrasyllabic at the stage before vowel insertion has applied: /z zlata/. The distribution of the consonantal vs. the vocalic prepositions in (42) is thus governed by syllable structure, specifically by constraints on onsets that prohibit the syllabification of identical or near-identical consonants (see section 1 earlier). Schematically:

\[ \emptyset \rightarrow \begin{cases} o \\ u \end{cases} / \ast C \]  

Now we face the problem of how to predict whether the inserted vowel should be o or u. There is no doubt that this has nothing to do with the nature of the preceding consonant (v, z, or k) since, unsurprisingly, Slovak has many words in which o appears after velars and u after v or z, for instance, kôň ‘horse’, vulkán ‘volcano’, zub ‘tooth’. Our dilemma is solved by observing that there is every reason to believe that v, z, and k should be represented with final yers: //vO//, //zO//, and //gU//. The evidence comes, on the one hand, from the behavior of prefixes and, on the other hand, from the treatment of lexicalized phrases.

In Slovak, as in other Slavic languages, most prepositions are identical to prefixes, and the behavior of these two classes of morphemes is parallel. The insertion rule required for prepositions is also required for prefixes. Compare:

\[ \begin{align*}
\text{a. } \text{pisat' 'write'} & \rightarrow v + \text{pisat' 'write in'} \text{ versus } \text{valit' 'push'} \rightarrow vo + \text{valit' 'push in'} \\
\text{b. } \text{letiet' 'fly'} & \rightarrow z + \text{letiet' 'fly down'} \text{ versus } \text{zeleniet' 'become green'} \rightarrow zo + \text{zeleniet'} \text{ (perfective)} \\
& \text{ziviet' 'become grey'} \rightarrow zo + \text{siviet'} \text{ (perfective)} \\
& \text{žitnúť 'become yellow'} \rightarrow zo + \text{žitnúť} \text{ (perfective)} \\
& \text{šaliet' 'be mad'} \rightarrow zo + \text{šaliet'} \text{ 'become mad'}
\end{align*} \]

There is no doubt that the prefixes end in yers. This is documented by the fact that yer vocalization (5) is applicable whenever the root morpheme has a yer. For instance, we established in (19) that the root of tr + e + t' ‘rub’ has a yer and is hence represented as //tEr//. Now it is understandable why the prefixes z- and v- appear as zo- and vo- when they are appended to //tEr//: zo + tr + ie + t' ‘rub out’, vo + tr + ie + t' ‘rub in’. The representations are //zO + tEr-// and //vO + tEr-//, respectively. However, yer vocalization cannot be behind the vocalic forms of the prefixes in (44). The reason is that they are evidently not followed by a
yer in the root morpheme. The vocalization in (44) must be due to the same rule as the vocalization exhibited by the prepositions in (42).

A different type of evidence for the presence of yers in the prepositions is drawn from the structure of lexicalized prepositional phrases. We are interested here in lexicalizations that involve nouns containing yers. Consider the following:

(45) a. deň 'day' → dňa + i (gen.sg.)
    čest' 'honor' → ct + i (gen.sg.)
    b. zo dňa na deň 'routinely' (literally: 'from day to day')
    ku cti 'in honor'

The prepositional phrases are lexicalized as idiomatic expressions. They are therefore listed in the lexicon and hence available to yer vocalization, which derives the vowel in the preposition.²²

We conclude that the prepositions under discussion end in yers: v //vO// 'in', z //zO// 'from', s //sO// 'with', and k //gU// 'to'. The problem that arose in connection with the statement of (43) has now disappeared. We are dealing here with a vocalization rule and not with vowel insertion. The melody segments //O// and //U// are hence part of the underlying representation and their distribution need not be predicted.

(46) Vowel vocalization \[ \mathcal{X} \rightarrow \mathcal{V} \rightarrow \mathcal{V}/ \star \mathcal{C} \]

Evidently (46) is postlexical since it applies to prepositional phrases such as those in (42) that are derived by the syntax.²³

The postlexical status of (46) has interesting consequences for stray erasure. It requires that the yers of the prepositions in (42) and of the prefixes in (44) should not be stray-erased until the postlexical derivation. This runs counter to Itô's (1986) claim that stray erasure applies at the end of the cycle.

To summarize, rescue rules for extrasyllabic consonants extend as far as the postlexical component. This means that the SSA must also apply postlexically. In the instance discussed here, the SSA syllabifies the prepositions and the prefixes whenever this is permitted by the universal and the language-specific principles and constraints. Consequently, some prepositions/prefixes do and some do not trigger vowel vocalization. After this rule, the SSA applies again to assign syllable structure to the newly vocalized syllable, which confirms our earlier assertion that the SSA is continuous.
6. Conclusion

Our analysis shows that in Slovak extrasyllabicity is resolved in a number of ways, ranging from vocalization of floating segments, vowel insertion, and syllabification of extrasyllabic consonants to deletion and adjacency. Determining which mechanisms are used in the resolution of extrasyllabicity is made possible, on the one hand, by the assumption that the syllable structure algorithm applies continuously, and, on the other hand, by the view that phonological derivation is organized in accordance with the principles of lexical phonology. In particular, the claim of Booij and Rubach (1987) that there are two lexical components (cyclic and postcyclic) is upheld. With regard to more detailed matters, our analysis indicates that there is an asymmetry between extrasyllabic consonants in the word-initial and the word-final positions. Finally, the validity of stray erasure as a universal principle of cyclic derivation is called into question. What we find is that stray erasure needs to be delayed until the postlexical derivation. Thus, either the component in which stray erasure operates is a language-specific setting or stray erasure is a rule rather than a principle of universal grammar.

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Notes

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1. Let us note some technical problems. We use double slashes to denote underlying representations, single slashes for intermediate stages of derivation, and the traditional square brackets for phonetic representation. We depart from the IPA transcription symbols in the following instances:

[č]: alveolar affricates
[ć]: postalveolar affricates
[ś]: postalveolar fricatives
[t' d' n' l'] prepalatal stops, nasal and lateral, respectively
[â]: front low vowel
Note also that an accent over a vowel or a consonant means "long"; for instance, [ä], [ı]. The Slovak data used in this article come from standard descriptions such as Letz (1950), Zauner (1966), Stanislav (1977), Pauliny (1979), and Kráľ (1988). They were complemented by a questionnaire that was administered to a group of native speakers. We are particularly grateful to Peter Durčo for his help with carrying out this task. We would also like to thank L’ubomir D’urovič for consultation.

2. As we shall see in section 4, reference to the nucleus rather than merely to a long vowel is appropriate. The rhythmic law applies after any complex nucleus, be it a long vowel, a long syllabic consonant, or a diphthong (see Kenstowicz and Rubach 1987).

3. Lengthening is written as follows:

\[
\begin{align*}
N & \quad N \\
\mid & \quad / \\
X \rightarrow X \ X/ \text{ in some environments (see Kenstowicz and Rubach 1987).}
\end{align*}
\]

4. This particular form of the SSA is not crucial for our purposes.

5. Slovak and Polish, respectively, are an illustration of these options; see Rubach and Booij (1988) and Rubach (forthcoming).

6. [čš] are postalveolar affricates, while ě is the underlying voiced velar fricative //y//; see Rubach (forthcoming).

7. Attention should be drawn to the fact that according to the standard sources i may also appear when the stem ends in two consonants, even if they constitute a well-formed cluster. However, then the occurrence of i is always optional, that is, we have variation such as urč~urč+i ‘determine’, roz + ūňť ~ roz + ūňť+i ‘solve’. One way of solving this problem is to assume that the dialects that permit i in these words do not allow the coda rule to reiterate in the cyclic component.

8. There are some other indications that the imperative must be a yer. Let us mention two. Slovak, like other Slavic languages, has a rule deleting j before consonants, compare čuj + ū ‘they feel’ vs. ču + i ‘to feel’, underlying //čuj + t’//. This rule does not apply in the imperative, for instance čuj+te ‘feel’ (2n p.pl.). Similarly, the rule that deletes nasals before consonants is also blocked: min+ie ‘pass’ (2nd p.pl.). This blocking is understandable if the imperative is a yer, as then the glide and the nasal are not adjacent to a consonant: the representations are //čuj + I + te// and //min + I + te//, respectively.

9. This solution has been inspired by Bethin’s (forthcoming) analysis of Polish. The Polish equivalent of the Slovak imperative -i is -įj, which Bethin analyzes as a sequence of two yers. Vocalization is due to the extrasyllabicity of the preceding consonant.

10. Some verbs do not have an underlying yer, for example kysl+i + ĭ, a verbalization of the adjective kysl+ţi ‘sour’. Yet, the imperative is kysl+i. This shows that the presence of a yer in the stem is not a factor in determining whether imperative vocalization should apply.

11. That initial liquids are nonsyllabic is confirmed by stress, which is word-initial in Slovak. Words such as žlt+i ‘yellow’ are stressed on the liquid while all the words in (24bii) are stressed on the vowel.

12. If we ignore the onomatopoetic hm ‘hm’, it is indeed only liquids that can be syllabic in Slovak.

13. As pointed out to us by a reviewer, the best test for checking whether cyclicality is at play here would be to look at morpheme-internal clusters of two unsyllabified liquids: the hypothetical CLLC. If only one liquid could be syllabic in such clusters, then we would have a clear indication that liquid syllabification is a directional rule applying left-to-right or right-to-left, whatever the facts would be. However, such clusters do
not occur morpheme-internally. For \( u + mr + l + c + a \) ‘dead person’ (gen.sg.) the direction in which the rule applies follows from the cycle. That is, it is the cycle and not an arbitrary marking of directionality that ensures the correct derivation. The morphological structure of \( u + mr + l + c + a \) is prefix + root + adjectival (past participle) morpheme + nominalizing suffix + inflectional ending.

14. This is an inherent verb, that is, the stem ends in a consonant and it has no verbalizing vocalic suffix.

15. Recognizing final extrametricality does affect our earlier analysis except for one technical change. The \( z \) in \( voz \) in (23) is extrametrical on the first cycle. On cycle 2 its extrametricality is erased by the peripherality condition, which requires that only constituent-final segments may be extrametrical. The CV rule syllabifies the \( z \) into the onset of the new syllable that is created by adding \( i \) on cycle 2. Note also that in accordance with the standard assumptions we interpret extrametricality as invisibility at the skeleton, that is, slots are extrametrical but melodies are not. This is sufficient to preclude, correctly, the SSA from applying to extrametrical segments: the SSA operates on the skeleton and hence requires that the slots be visible.

16. Before the infinitive -\( t' \), \( k \) becomes \( c \) by an allomorphy rule; see Rubach (forthcoming).

17. The \( u \) in the infinitive comes from insertion; see Rubach (forthcoming).

18. Nasal deletion accounts for alternations such as \( zača + t' \) ‘begin’ \( \rightarrow začn + u \) ‘they begin’. The underlying \( n \) does not surface in the infinitive form because it is followed by the consonant \( i' \), which triggers nasal deletion.

19. The only indication that the masculine gender might have a yer is the alternation in the verb for ‘go’: \( šie + l \) ‘he went’ \( \rightarrow š + l + a \) ‘she went’. However, this verb has clearly suppletive forms. Thus, the infinitive is \( ist' \) and the 3rd p.sg. present is \( id+e \).

20. Internal brackets between proclitics and their hosts are erased by rule or convention.

21. The difference between \( z/zo \) and \( s/so \) is merely orthographic.

22. For an almost identical analysis of lexicalized phrases in Polish, see Rubach (1985).

23. Extrasyllabic consonants of the prefixes in (44) are not inputs to initial adjunction since, in Slovak, as in other Slavic languages, prefixes form special domains for syllabification. This fact is expressed formally by what Rubach and Booij (1990) call the prosodification constraint. Its function is to block all rules deriving prosodic structure across the [ bracket, that is, across prefixes and across constituents of a compound (see Rubach and Booij 1990). Consequently, the prefix \( v \) escapes initial adjunction in \( vo + valit' \) ‘push in’, etc. At the postcyclic level the bracket [ dividing the prefix and the stem is not present, an effect of bracket erasure at the end of the component (here, the cyclic component). However, then initial adjunction is no longer operative. Recall that for independent reasons we assigned initial adjunction to the class of cyclic rules. This decision is now corroborated.

References


