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THE PHONOLOGICAL REPRESENTATION OF *JER* VOWELS IN CROATIAN

The alternation of vowels with zero in Croatian and the other Slavic languages is a complex phenomenon that has long attracted the attention of linguists. This article examines previous phonological analyses that have been developed to account for these alternations in the contemporary Slavic linguistic systems and proposes an alternative approach to this problem within the theoretical framework of autosegmental phonology. The analysis proposed here accounts for a wider range of Croatian data than these earlier analyses, while at the same time it avoids some of the shortcomings of previous approaches.

The alternation of vowels with zero in Croatian and the other Slavic languages is a complex phenomenon that has long attracted the attention of linguists. As is well known, the so-called "mobile vowels" in the contemporary Slavic phonological systems represent the reflexes of the proto-Slavic lax vowels known as jers. The jers eventually fell together with other vowels in the system or were deleted, depending on the phonological environment. The resulting alternations in the modern languages present problems which may test the descriptive and explanatory power of a given phonological theory, and a number of analyses in different theoretical frameworks have been proposed over the years.

The traditional structuralist analysis posits underlying phonologically null elements (morphophonemic zeros) to explain these alternations. A morphophonemic zero is vocalized when followed by another zero in the representation; e.g. Nsg. ot#c-# → otac, Gsg. ot#c-a → otca → oca. Although this allows us to account for the facts of vowel/zero alternations and to establish a single underlying base form to relate the different surface forms, this solution is open to criticism on certain points. Since the zeros cannot reasonably be viewed as elements belonging to the phonological systems of the languages in question, we are forced to assume the existence of some separate level of morphophonemic representation which would permit the inclusion of such non-phonemic abstract elements. The level of abstraction is even greater in some analyses

which set up more than one type of zero in order to explain different patterns of alternation that occur in some forms.

Another widely adopted solution posits in place of these zeros underlying vowels marked by a special feature, typically [−tense], which differentiates them from other vocalic phonemes. This was first proposed for Russian by Lightner, who posited two underlying lax vowels, $ĭ$ and $ŭ$, which are lowered to merge with other vowels or deleted according to rule. For example, the Russian forms *otec*, G sg. *otca* would be generated as follows:

(1)   otĭc+ŭ   otĭc+a

      otec+ŭ   —   Lower $\left\{ \begin{matrix} ĭ \\ ŭ \end{matrix} \right\} \rightarrow \left\{ \begin{matrix} e \\ o \end{matrix} \right\} / \underline{\quad} C_0 \left\{ \begin{matrix} ĭ \\ ŭ \end{matrix} \right\}$

   otec   otca   Jer Deletion $ĭ, ŭ \rightarrow \emptyset$

(Lightner 1972:39)

Zec has adapted this analysis to Croatian and Serbian and has argued that it is sufficient to posit a single [−tense] vowel $ă$ in the underlying representations. In place of Lower, she posits a rule which simply removes the [−tense] marking in the appropriate environment, allowing the vowel to receive the default [+tense] specification and surface as *a*; otherwise a rule deleting all [−tense] vowels applies (Zec 1994b:116−118).

This type of analysis is appealing because it is obviously consistent with the actual historical developments leading to the alternations in question (as seen above, the underlying lax vowels are even usually referred to as jers in these phonological analyses) and it explains them in synchronic terms without resorting to non-phonological entities such as zeros. However, as has been pointed out by Rubach (1986, 1993), this has certain undesirable repercussions for the phonological systems of the Slavic languages. The assumption that the jers are distinguished from other vowels by their lax quality forces us to introduce the distinctive feature [tense] at the underlying level in languages where it is otherwise redundant. These abstract underlying [−tense] vocalic segments are neutralized in all environments; there is no place where the lax vowels posited in this analysis would actually appear in surface forms and thus there is no firm evidence for the phonological features attributed to them. Furthermore, in languages which distinguish vowel quantity, such as Croatian, the introduction of these jer vowels disrupts the symmetry of the system. Unlike the other vowels, the jers may only occur as short in the underlying representations.

Much theoretical work over the last two decades has focused on the problem of phonological representations, and substantial evidence has been amassed for the assumption of a non-linear type of representation which makes a distinction between a phoneme and the position it occupies in phonological structures. This approach, known as autosegmental phonology,

posits separate syllabic, skeletal and melodic tiers as illustrated below:[1]

(2)   syllabic tier

                 σ

      skeletal tier   X X X
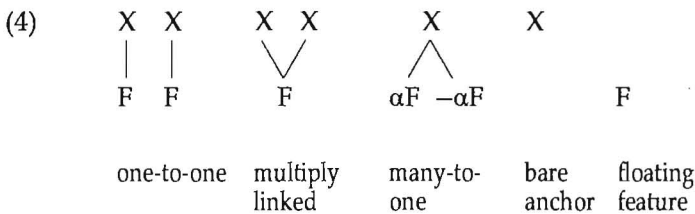
      melodic tier   m i š
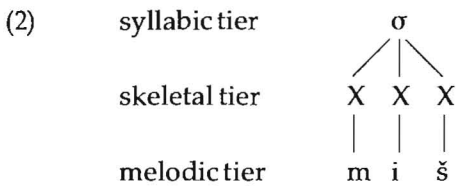
The syllabic tier is typically considered to be non-primitive, since it is derivable by rules of syllabification defined over the skeletal X-slots, which serve to relate the phonological segments (more properly, feature sets) and the prosodic structure (Kenstowicz 1994:426).[2]

With the concept of autonomous tiers, it is not necessary to posit a one-to-one relationship between phonological segments and skeletal slots. For example, the standard representation of a long vowel in this theory has a single feature set linked to two adjacent skeletal slots.

(3)   X X X X

          d   a   n
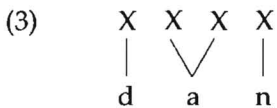
Evidence has been found to support the following types of relationships (Kenstowicz 1994:311; F represents a phonological feature or set of features):
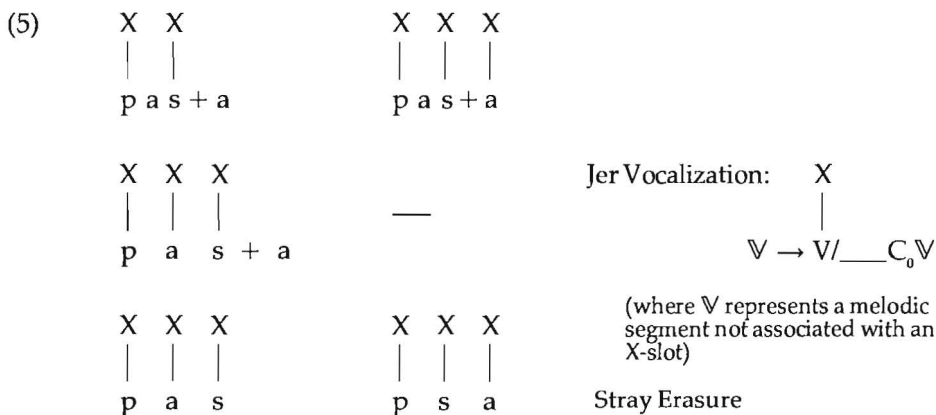
(4)   X X   X X   X   X

      F F   F αF $-\alpha F$ F

      one-to-one multiply   many-to- bare   floating
                  linked   one   anchor feature

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[1] Tonal features would be assigned to a separate tier not shown here. This approach to phonological representations was first developed by McCarthy (1979, 1981) and Clements and Keyser (1983), on the basis of the autosegmental representation of tone developed by Goldsmith (1976).

[2] It has also been argued that the skeletal tier may not necessarily be pre-specified in underlying representations in some languages. For languages which do not have long vowels or geminate consonants the skeletal tier may be derived from the melody (McCarthy and Prince 1988, Goldsmith 1990). However, since Croatian does have distinctive quantity we may ignore this possibility here.

The possibility of mismatches between the skeletal and melodic tiers in this type of non-linear phonological representation suggests an alternative analysis of vowel/zero alternations in Slavic. Rather than assuming that jers carry some arbitrary phonological feature such as [−tense] which never appears on the surface but serves to distinguish the jers from other vowels in the underlying representations, it is possible that the jers are deficient or incomplete in some manner and are not represented on all three tiers.

This idea has been exploited in a number of recent analyses of the jer vowels in Slavic, mostly on the basis of Polish data; for a summary the reader may refer to Szpyra (1995:108—112). Here we will focus on one of these, Rubach's (1986) proposal that the jers should be represented as melodic segments that are not linked to any slot on the skeletal tier. If we apply this approach to Croatian, forms such as *pas*, Gsg. *psa* could be analyzed as follows:

(5)

X X   X X X
| | | | |
p a s + a   p a s + a

X X X
| | | —
p   a   s + a

Jer Vocalization: X
                      |
$V \rightarrow V/\_\_\_C_0 V$

(where V represents a melodic segment not associated with an X-slot)

X X X   X X X
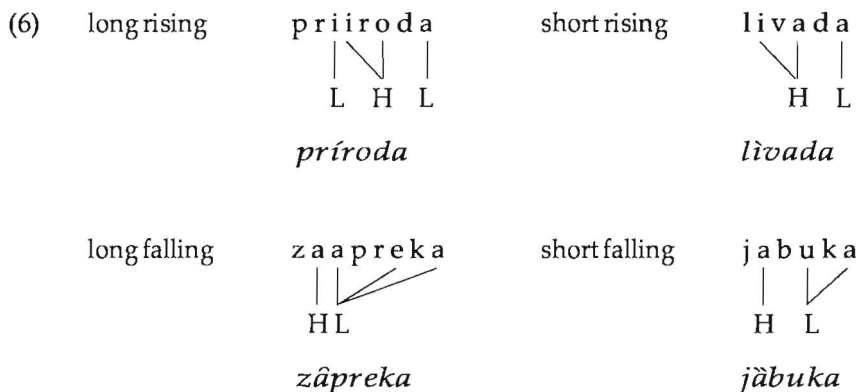| | | | | |
p   a   s   p   s   a   Stray Erasure

(see Rubach 1986, Rubach and Kenstowicz 1987, Rubach 1993)

On this interpretation, the vocalization of the jers is the result of a rule of X-slot assignment, based on the generally accepted assumption in non-linear phonology that a segment must be licensed prosodically in order to be pronounced (Itô 1986, cited by Rubach 1993:140). Jers which do not receive an X-slot by virtue of the rule of Jer Vocalization in (5) cannot be syllabified and therefore cannot be realized phonetically; they are then deleted automatically by the convention of Stray Erasure (Steriade 1982). This analysis has certain advantages over the analysis of the jers as underlying lax vowels. It eliminates the rule of jer deletion, since this is now handled by a convention which has been claimed to be common to all languages. More importantly, it saves us from having to increase the inventory of vowel phonemes in Croatian, and it also solves the problem of absolute neutralization resulting from the assumption that jers are marked as [−tense] at the underlying level. The choice of this particular feature

is arbitrary, since it never appears on vowels in the surface forms; there is no evidence to support the existence at the underlying level of the feature [tense] as opposed to any other.

A number of different phenomena in Croatian provide additional support for this analysis of jers as floating vowels which lack a skeletal slot. We must assume that the jers are deleted only after all morphological processes have applied, since the addition of a suffix or prefix may create the environment for jer vocalization. Within the Lexical Phonology framework adopted here the jer vowels are present throughout the lexical level of the phonology and are deleted by the convention of Stray Erasure, a low-level rule that applies only at the last, post-lexical level. But given the assumption that all prosodic structure is defined over the skeletal tier, the jer vowels that have not been supplied with an X-slot should be invisible to processes that are sensitive to syllable structure and should not be able to support tonal features or stress. These predictions are not made by the analysis of jers as underlying lax vowels.

With respect to tonal features, it has been shown by Inkelas and Zec (1988) that the surface tonal contours in Croatian may be represented as sequences of high (H) and low (L) tones. A rising accent is represented by a H tone linked to two adjacent syllables, while a falling accent has a H tone linked to a single syllable; e.g.

(6)   long rising   p r i i r o d a   short rising   l i v a d a

                          L H L   H L

                          príroda   *lìvada*

        long falling   z a a p r e k a   short falling   j a b u k a

                          H L   H   L

                          zâpreka   *jàbuka*

Note that the skeletal and melodic tiers are conflated in (6) and in some of the following examples in order to simplify the representations. The geminated vowels should be understood as a single feature set linked to two skeletal slots, as shown in (3).

This analysis of the Croatian accents corresponds closely with their phonetic characteristics, according to research by Lehiste and Ivić (1986). Although it is not possible to give a full explication of this analysis here, the following features should be noted. Only the H tone must be represented in the lexical

entries, and this tone is not necessarily prelinked to a specific segment; some morphemes are associated with a floating H-tone. The surface tonal contours are the result of rules of tone linking and spreading, initial H-tone insertion, and default L-tone insertion. The stress falls automatically on the first syllable bearing a H-tone (for details see Zec 1993, 1994b; Langston 1997).

If the jers are floating vowels with no skeletal slots in the underlying representation, then they cannot serve as possible anchors for tonal features. For example, the rule of H-tone linking as formulated by Langston (1997) states that a floating H-tone will link to the rightmost syllable of the stem. According to the analysis of the jers proposed here they will be ignored by this rule; we see that this automatically results in the correct accentuation in forms such as *jùnāk*, G sg. *junāka*.[3]

(7) j u n a a k   Underlying
                                                            Representation (UR)

          H

j u n a a k + A   j u n a a k + A   Morphology
 | \/ | \/ | (where A represents a
 N N   N N   N   floating vowel and N a
                                                   syllable nucleus)
          H   H

     —   —   Jer Vocalization
                                                   (not applicable)

j u n a a k + A   j u n a a k + a   Tone Linking: link a
 | \/ | \/ | floating H tone to the
 N N   N N   N   rightmost syllable
  ⋮   ⸝
  H   H

j u n a a k + A   j u n a a k + A   Other rules (Tone
 | \/ | \/ | Spreading, Default L
 N N   N N   N   tone Insertion)
  _| | _/
    H   L   H

jùnāk   *junāka*

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[3] Langston (1997) argues that the syllable is the tone-bearing unit in Croatian, while Inkelas and Zec (1988) assume that the tone-bearing unit is the mora; this accounts for the slight differences in the representations in (6) and (7).

In an analysis where the jers are treated as underlying lax vowels, there is nothing to prevent them from being incorporated into the prosodic structure as syllable nuclei, just like any other vowel. The H-tone would link initially to the jer vowel of the N sg. ending, then would have to be delinked and reassociated with the preceding syllable. This is the type of analysis proposed by Zec (1994b:165ff.), who posits two separate rules to account for this process. The alternative analysis proposed here is clearly much simpler.

Langston (1997) also argues that there are three different prosodic types of morphemes in Croatian: those that are linked to a H tone in the underlying lexical representation, those which are associated with a floating H tone, and those that are toneless. However, while all other vowels may be pre-linked to a H tone in the lexicon, there seem to be no morphemes with an inherent H tone linked to a jer vowel.[4] Again, the different behavior of jers and other vowels is an automatic result of the analysis proposed here.

The fact that jers are not included in the syllable structure can also be seen in quantitative adjustments that occur in conjunction with certain derivational and inflectional affixes. For example, some monosyllabic stems undergo shortening when the adjectival suffix -*Ask* is attached;[5] e.g. *grâd: grȁdskī/grȁd-skī, mûž: mȕškī/mȕškī, svijêt: svjȅtskī/svjȅtskī, škôla: škȍlskī/škȍlskī*. Shortening also occurs regularly in stems with a jer vowel in the final syllable and a long rising accent on the preceding syllable; e.g. *bórac* (G *bórca*): *bȍračkī, glúmac: glȕmačkī, súdac: sȕdačkī, svétac: svȅtačkī* (see Babić 1986:359). However, shortening does not normally occur with disyllabic (and polysyllabic) stems of the same accentual type; e.g. *Ènglēz* (G sg. *Engléza*): *ènglēskī, Hȓvāt: hȓvātskī, jùnāk: jùnāčkī, sènāt: sènātskī, vòjnīk: vòjnīčkī*.[6] Even though the jer in the former group of stems is vocalized before this adjectival suffix, they behave like monosyllabic rather than disyllabic stems at the point when this suffix is attached, as is predicted by the analysis proposed here.

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[4] This is what we would expect in terms of the historical origin of the different prosodic types in Croatian. Morphemes that are pre-linked to a H tone are primarily those which carried an acute accent in proto-Slavic.

[5] According to Zec (1994a:241—242), the shortening only applies to monosyllabic stems which are not lexically affiliated with tone in her analysis of the accentuation, but this generalization is not without exceptions; some stems affiliated with tone undergo shortening (e.g. *sûd: sȕdskī*), while some stems that are toneless do not shorten (e.g. *zíma: zîmskī*).

[6] There are a few exceptional forms which exhibit shortening; e.g. *siròmāh: siròmaškī* (see Matešić 1970:189).

(8)   b o o r A c - A s k   Morphology
        \/
         N

       b o r A c - A s k   Shortening
        | (monosyllabic stems)
        N

       b o r a c - A s k   Jer Vocalization
        | |
        N N

Another type of shortening is found in diminutives formed with the suffixes -*ić*/-*čić*. Here the final syllable of mono- and disyllabic (or polysyllabic) stems is shortened if it is long; e. g. *cvijêt*: *cvjètić*, *grâd*: *gràdić*, *krâlj*: *kràljić*; *jùnāk*: *junàčić*, *kȍmād*: *komàdić*, *ȍblāk*: *oblàčić*; *brijêg*: *brèščić*, *sîn*: *sìnčić*; *bàlkōn*: *balkònčić*: *gȍlūb*: *golùpčić*. Long syllables which do not directly precede the suffix are not shortened; e.g. *bádem*: *bádemić*, *lúpež*: *lúpeščić*, *prórok*: *próročić*; (adj.) *bânov*: *bánović*, *králjev*: *králjević*. However, the initial syllable of stems with a final jer vowel does undergo shortening, indicating that the jer is not part of the syllable structure; e.g. *bûbanj*: *bùbnjić* (< buubAnj-ić), *čámac*: *čàmčić*, *čásak*: *čàščić*, *člának*: *člànčić*, *vrábac*: *vràpčić*. Although it might seem that this could be accounted for in an analysis which treats the jers as underlying lax vowels by assuming that the jer is deleted before this particular rule of shortening applies, this is not possible; the shortening rule is triggered by a specific morphological suffix and must therefore be a lexical rule, while the rule of jer deletion applies only at the post-lexical level (see Rubach 1986:271).

A similar phenomenon is seen in the formation of masculine plurals with the suffix -*ov*. Practically all monosyllabic nouns require this suffix or allow it as a variant, while most disyllabic nouns do not; in the latter it occurs as a variant only with certain nouns with a short falling accent on the initial syllable and a long vowel in the final syllable (Babić et al. 1991:511); e.g. *gȍlub*: N pl. *gȍlubovi*/*gȍlūbi*; *slùčāj*: *slùčajevi*/*slùčāji*, *vìtēz*: *vìtezovi*/*vìtēzi* vs. *glȁgol*: *glȁgoli*, *jèlen*: *jèleni*, *jèzik*: *jèzici*, *svjèdok*: *svjedòci*; *dȍboš*: *dȍboši*, *dókaz*: *dókazi*, *mâjstor*: *mâjstori*, *národ*: *národi*.[7] Once again, stems with a jer vowel in the final

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[7] A few nouns with lengthening of the final stem vowel in the N sg. do allow the suffix, but this may be connected with the generalization of this length to the other forms, e.g. *kāmēn*: pl. *kāmēni*/*kāmenovi*; *pr̀stēn*: pl. *pr̀stēni*/*pr̀stenovi* (Anić 1996); cf. the corresponding entries in Benson (1971): *kāmēn*, G sg. *kāmena*: pl. *kāmeni*/*kāmenovi*; *pr̀stēn*, G sg. *pr̀stena*: pl. *pr̀steni*/*pr̀stenovi*. Otherwise the only exceptions are a handful of borrowings; e.g. *ćilim*: *ćilimovi*/*ćilimi*, *hárem*: *háremovi*/*háremi*.

syllable behave like monosyllabic rather than disyllabic stems; most of these require or allow the suffix *-ov-*, regardless of the accentuation of the stem or the length of the syllable preceding the suffix; e.g. *jȁrac: jȁrčevi, kȁšalj: kȁšljevi, vjȅtar: vjȅtrovi; òganj: ògnjevi, kòtao: kòtlovi, kòlac: kólčevi; čvórak: čvórkovi, máčak: máčkovi, rážanj: rážnjevi, rúčak: rúčkovi*.

The preceding phenomena suggest that the jers are not included as part of the syllable structure in the underlying representations, which supports the analysis of the jers as floating vowels which lack a skeletal slot. If the jers are analyzed as lax vowels, there is nothing to prevent them from being syllabified at the underlying levels since syllabification is generally considered to be a continuous process that operates throughout a derivation (see, for example, McCarthy 1979). The representation of the jers as floating melodic segments has a further implication, however; on this interpretation, logically any vowel should be able to function as a jer (i.e., alternate with zero). Rubach (1993) has convincingly shown that this is the case for Slovak. This feature of the proposed analysis could potentially simplify the description of the complex patterns of alternations that are found in certain verbal forms in Croatian (as well as other Slavic languages); e.g.
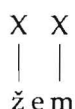
(9)   vowel/zero alternations in verbal forms

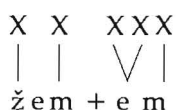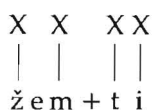|		
tarem	*trti*	a → Ø
berem	*brati*	e → Ø
prostirati	*prostrijeti*	i → Ø
zovem	*zvati*	o → Ø
duti	*dmem*	u → Ø

The underlying segments responsible for the vowel/zero alternations in these verbal forms behave like jer vowels, since they provide the conditioning environment for jer vocalization; e.g. *izabrati* vs. *izbrojiti; odapeti* vs. *otpasti; razastrijeti* vs. *rastrojiti*. But while in other grammatical categories only *a* alternates with zero, here we see that the alternations in the verb involve all five vowel phonemes. Moreover, the alternations in these verbs cannot be explained by the normal rule for jer vocalization. Although such verbs constitute a small, closed group that presents a number of irregularities, in a synchronic analysis it would be highly desirable to provide a unified account for all the vowel/zero alternations if possible. Analyses operating with zeros or underlying lax vowels would require special rules for each type of verb in order to produce the correct vowels in the correct grammatical forms. With the non-linear approach advocated here, the different vowels are already there in the underlying representations, and as we will see, the alternation between a vowel in some forms and zero in others can be largely accounted for by more general phonological rules and conventions. This is not the case with previous analyses of the jer vowels.

First let us consider verbs of the type *žeti*: *žmem*. As proposed by Jakobson (1971:124) for Russian, we can assume that the stem terminates in a nasal consonant and that there is a rule which deletes this nasal before another consonant at the morpheme boundary. With a non-linear phonological representation, however, a deletion rule may logically take more than one form: for example, it is possible for the melodic segment to be deleted while leaving the skeletal slot intact. If we assume that the Slavic nasal deletion rule takes this form, it leaves an open slot that can then support the *e* of the stem (see Rubach 1993:153—4 for this type of verb in Slovak). It is not necessary to have a language-specific rule to link this vowel to the skeletal tier; it is assumed that a floating segment will automatically associate to an available X-slot unless prevented by some constraint.
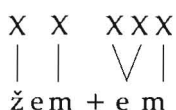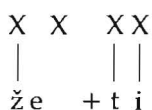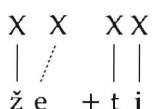
(10) *žeti* : *žmem*

```
X  X                              UR
|  |
ž e m


X  X   X X        X  X   X X X    Morphology
|  |   | |        |  |    V  |
ž e m + t i       ž e m + e  m


X  X   X X        X  X   X X X    Nasal Deletion:
|      | |        |  |    V  |    [+nasal] → Ø/___+C]verb
ž e   + t i       ž e m + e  m


X  X   X X                        Docking by convention
| /    | |            —
ž e   + t i


                  X  X   X X X    Stray Erasure
                  |  |    V  |
                  ž  m + e  m
```
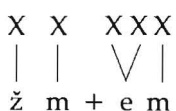
This allows us to account neatly for the vocalization of the *e* in the infinitive, *l*-participle, aorist, past active and past passive participles as opposed to the other forms of the verb. It must be emphasized that this deletion of a melody segment followed by relinking of an adjacent segment to the open slot on the skeletal tier is not simply an ad hoc device invented to explain these verbal

forms. The same type of deletion and relinking process that we see here has been invoked to explain compensatory lengthening effects in numerous languages, and this is viewed as representing a natural type of phonological process. However, it should also be pointed out that while this analysis explains the presence of *e* as opposed to zero in the forms in which it occurs, it does not take into account the fact that the *e* here actually appears in the surface forms as a long vowel. The standard representation of a long vowel is a melodic segment linked to two X-slots, but in the derivation given in (10) there is only one X-slot available for the *e*. The length of this vowel must be attributed to a separate rule. But note that this rule is also necessary to account for similar quantitative alternations that occur in other verbal forms; e.g. *prȁti*: *l*-pple. *prála*, PPP *prána*.

Verbs of the type *brati*: *berem* can be treated in much the same way as the stems ending in a nasal consonant. Once again, a bare skeletal slot which can serve as an anchor for the floating vowel is provided by a phonological rule, as shown in (11) below. In this case, it is the rule which deletes the final vowel of a verbal stem before a vocalic ending (Jakobson 1971:124). Here the process is somewhat more complicated than in example (10). The floating *e* cannot associate directly to the slot previously linked to the *a* due to a universal convention that bars the crossing of association lines. We must assume that the *r* delinks and reassociates to the bare X-slot to its right, followed by docking of the *e* to the slot vacated by the *r*. Although this might seem less natural than the type of delinking and reassociation already seen in the stems terminating in a nasal consonant, this kind of "double flop" has been adduced to explain non-local compensatory lengthening effects in a number of languages (see Hayes 1989:265–6). In fact, precisely this type of rule would be needed to explain the historical process of compensatory lengthening in Slavic resulting from the loss of the weak jers (e.g. **bogъ* > *bôg*).
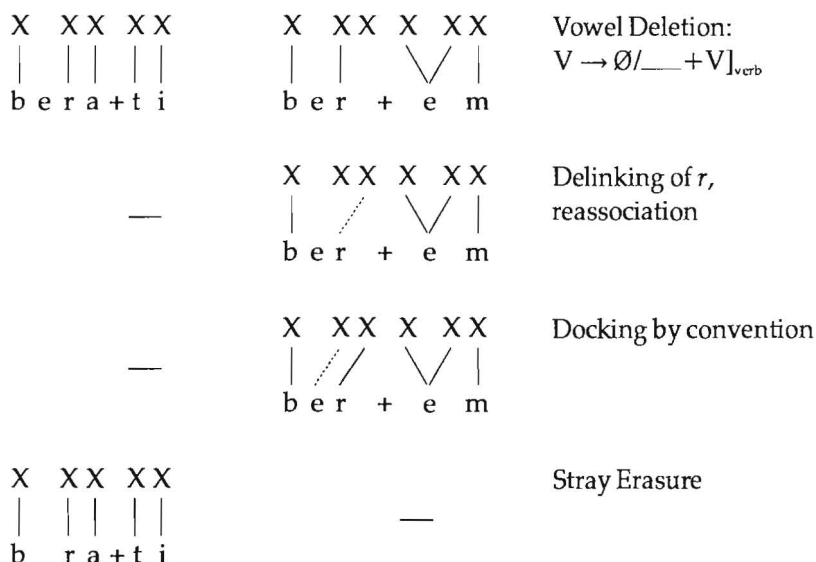
(11) *brati* : *berem*

```
X  X X                              UR
|  | |
b  e r a


X  X X  X X        X  X X  X  X X   Morphology
|  | |  | |        |  | |   \/  |
b  e r a+ t i      b  e r a+  e  m
```

```
X  XX XX         X  XX X XX       Vowel Deletion:
|  ||| ||         |  |   \/ |      V → Ø/___+V]verb
b e r a + t i    b e r + e  m
```

```
                 X  XX X XX        Delinking of r,
   —              |  /   \/ |       reassociation
                 b e r + e  m
```

```
                 X  XX X XX        Docking by convention
   —              | // \/ |
                 b e r + e  m
```

```
X  XX XX                           Stray Erasure
|  || ||              —
b   r a + t i
```
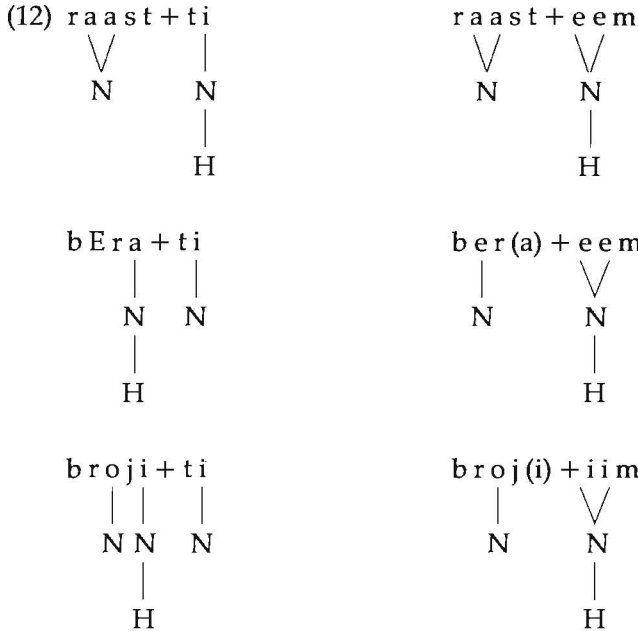
Here again we see that the non-linear representation provides a phonological justification for the vowel/zero alternations in these forms. Moreover, this approach has the added advantage that it automatically accounts for the different vocalism in verbs such as *zvati: zovem, klati: koljem* as opposed to *brati: berem, prati: perem*. The *o* or *e* is simply there already in the base form on this interpretation, while in an analysis operating with underlying lax vowels or zeros the different vocalism would have to be specified by rule.

Similar analyses may be applied to the other types of verbs which exhibit vowel/zero alternations; e.g. *-suti: -spem, duti: dmem*, etc. However, at first glance verbs such as *umrijeti: umrem*, imperfective *umirati; prostrijeti: prostrem*, imperfective *prostirati* appear to constitute exceptions to the analysis proposed here. Since the imperfective forms show that the underlying representations of these stems must contain a jer vowel, one might expect the same vocalization of this jer vowel in the present tense that we see in *brati*; e.g. **umirem*. If we assume that the stem terminates in *-ije* (e.g. *umĭrije-*), the deletion of this diphthong before the vocalic endings of the present tense should free up an X-slot and allow the jer of the stem to vocalize. However, given this assumption for the underlying form we would require a special rule to delete this diphthong in the *l*-participle and past passive participle (*prostrla, prostrt* instead of **prostrijela, *prostrijet*); there is no general rule to explain why the *-ije* should be deleted before a consonant. Furthermore, the accentuation of the infinitive forms of these verbs diverges from that of other verbs whose stems end in a vowel. Stems ending in a consonant allow a H tone to be linked to the *i* of the infinitive ending, resulting in a rising accent on the preceding syllable of the

stem after the application of the relevant rules; e.g. inf. *pèći*: pres. t. *pèčēm*, *plèsti*: *plètēm*, *rásti*: *rástēm*, *dúpsti*: *dúbēm*, etc.[8] Stems ending in a vowel, on the other hand, never have a H tone linked to the infinitive ending (i.e., they never have a rising accent on the syllable preceding this ending), although they do allow a rising accent on the penultimate syllable in other grammatical forms; e.g. *brȁti*: *bèrēm*, *zvȁti*: *zòvēm*, *bròjiti*: *bròjīm*, *žèljeti*: *žèlīm*, *dŕžati*: *dŕžīm*.

```
(12)  r a a s t + t i            r a a s t + e e m
         \/        |                \/        \/
         N         N                N         N
                   |                          |
                   H                          H


      b E r a + t i               b e r (a) + e e m
         |   |   |                   |        \/
         N   N                       N         N
         |                                     |
         H                                     H


      b r o j i + t i             b r o j (i) + i i m
         | |   |   |                 |          \/
         N N   N                     N           N
         |                                       |
         H                                       H
```

(prior to the operation of Tone Spreading and other rules)

Verbs like *mrijéti, strijéti* behave in this respect like stems ending in a consonant rather than stems ending in a vowel.[9] Given this evidence, it seems preferable to suppose that the *-ije* is supplied by rule in the infinitive and aorist forms, rather than being present as part of the stem in the underlying representation. Assuming that the underlying representations for these verbal

[8] These infinitive forms may also carry a falling accent, but this is an innovation; cf. Russian forms such as *plestí, rastí* where the accent is on the ending.

[9] These infinitive forms may also carry a falling accent, as indicated in ftn. 8. Note that the prefixed forms do not allow a rising accent on the syllable preceding the infinitive ending (*ùmrijeti, pròstrijeti*), but this is a general rule of štokavian accentuation which also applies to stems ending in a consonant: cf. *plèsti/plèsti: ìsplesti/*isplèsti, žèti/žéti: sàžēti/*sažéti.

stems are actually *mIr-*, *stIr-*, our analysis then correctly predicts that the jer will not vocalize in any of the inflected forms of these verbs. The vocalization of the jer vowel in the derived imperfective forms must be triggered by a special rule, but this is also the case in all other analyses that have been proposed in the past.

As has been demonstrated here, the description of vowel/zero alternations afforded by the representation of the jers as floating vowels seems in many respects preferable to analyses operating with morphophonemic zeros or underlying lax vowels. It avoids certain problems created by these analyses, and correctly predicts that the jers are not part of the syllable structure at the underlying level unless they are supplied with an X slot by rule; consequently they are are also unable to support suprasegmental features of tone or stress. The non-linear representation also allows us to account for the special vowel/zero alternations of the verbal forms considered here with a minimum of lexically specified rules, unlike previous analyses. The phonological representation of the jer vowels advocated here presents interesting possibilities for future research.

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Fonološka reprezentacija jerova u hrvatskom

Sažetak

Alternacija samoglasnika s nulom u hrvatskom i drugim slavenskim jezicima složena je pojava koja već duže vrijeme privlači pozornost lingvista. Autor daje pregled prijašnjih fonoloških analiza u kojima se nastojalo objasniti takve alternacije u suvremenim slavenskim jezičnim sustavima i predlaže alternativni pristup tom problemu unutar teorijskog okvira autosegmentalne fonologije. Ova analiza objašnjava širi raspon hrvatskih podataka nego prijašnje analize, te izbjegava neke nedostatke prijašnjih pristupa.

Ključne riječi: hrvatski jezik, fonologija hrvatskoga, jerovi
Key words: Croatian language, phonology of Croatian, jer vowels