Interaction of Tone and Stress in Standard Serbian

Draga Zec, Cornell University
and
Elizabeth Zsiga, Georgetown University

Introduction

Prosodic systems are generally of two types. The first type is metrical, in which the prominent syllable, selected by metrical structure, is the bearer of stress. The second type is tonal; that is, it manipulates lexical tone. Standard Serbian belongs to the class of *hybrid* prosodic systems, those that manipulate both stress and tone (Lehiste & Ivić, 1986). The standard Serbian pitch accent system is traditionally described as having two pitch accents (PA), Falling and Rising, each defined by a characteristic pitch shape, as well as by stress, whose correlate is increase in duration.

Figure 1 illustrates the two PA's, as they occur on the initial syllable of trisyllabic words. Figure 1A shows a Falling PA on /'na:mere/ 'intentions', and Figure 1B shows a Rising pitch accent on /'ne:manju/ (a proper name). Both words have initial stress and long accented vowels, but the two pitch accents have different shapes. Each panel shows three pitch tracks, each corresponding to a different preceding context, with the pitch tracks aligned at the beginning of the target word (dashed line). Note that the characteristic pitch shape for each PA is relatively stable, that is, it persists although the previous context is varied.

A. Falling accent B. Rising accent

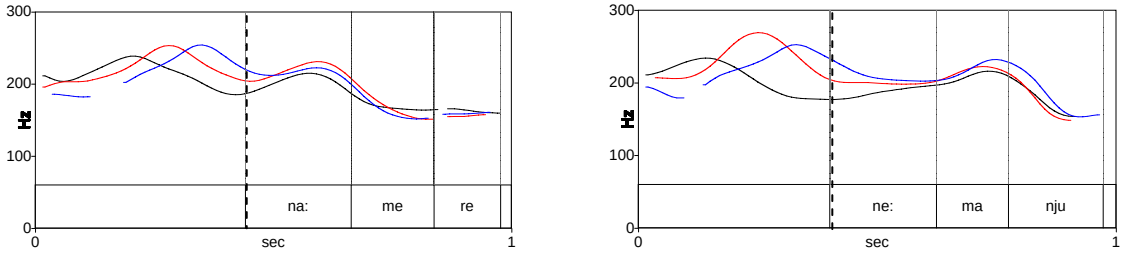


Figure 1. Representative pitch accents for Falling (A) and Rising (B) accents, preceded by three different words. From Zec & Zsiga (2008).

Previous accounts of Serbian pitch accent can roughly be divided into two groups: (i) those that focus on the distribution of PA's but by and large leave pitch shapes out of the picture (e.g., Browne & McCawley 1965, Inkelas & Zec 1988, Zec 1993, 1999, Bethin 1994, 1998); and (ii) those that focus on characteristic pitch shapes and their phonetic interpretation but make no predictions about the phonological distribution of PA's (e.g., Godjevac 2000, Smiljanić and Hualde 2000, Smiljanić 2002). Our goal will be to cover both aspects of this phenomenon.

The typology of hybrid prosodic systems, those that include both tone and stress, is fairly well understood. This topic was recently investigated by de Lacy (2002), following a long tradition of work that goes back to the early 80's. There are three general types of interactions between tone

and stress, as illustrated in (1a-c). (Stress will be indicated by a boldface vowel with an acute accent, and tone is indicated by a vowel with a subscript italic *H* or *L*.) In Type 1 systems (1a), tone governs the place of stress: stress is assigned to the syllable that bears lexical tone. Languages of this type include Cubeo and Golin (Hayes 1995, Morse and Maxwell 1999, de Lacy 2002). In Type 2 systems (1b), stress governs the place of tone: that is, metrical structure determines the place of stress, and then tone is linked to the stressed syllable. Type 2 languages include Ci-Ruri (Massamba 1984), Slave (Rice 1987), East Slavic dialects (Bethin 2006). In Type 3, tone and stress do not interact (1c). In this hypothetical case, stress is initial regardless of the position of the High tone; Angaatiha (Huisman and Lloyd 1981) and Saramaccan (Good 2004) are examples of Type 3 languages.

(1) Types of tone and stress interactions.

a. Type 1: tone attracts stress

CaCa$_{H}$Ca → Ca(C**á**$_{H}$)Ca

b. Type 2: stress attracts tone

Ca(C**á**)Ca → Ca(C**á**$_{H}$)Ca

c. Type 3: tone and stress do not interact

CaCa$_{H}$Ca → (C**á**)Ca$_{H}$ Ca
CaCaCa$_{H}$ → (C**á**)CaCa$_{H}$

In Standard Serbian, the interactions of tone and stress are more complex than in the paradigm cases illustrated in (1). In the Optimality Theory analysis to be presented (Prince and Smolensky 1993) we will argue that the system is bi-stratal (in the sense of Stratal OT, Kiparsky 2000). At the lexical stratum, the stratum that captures the distribution of PA's, the system follows a Type 1 pattern: tone governs the place of stress. At the postlexical stratum, which is characterized by tonal interactions, the system follows a Type 2 pattern: stress governs the place of tone.

The Lexical Stratum: Distribution of Pitch Accents

The surface distribution of Rising and Falling PA's is shown in Table 1.

Table 1. Distribution of Pitch Accents

	Monosyllables	Polysyllables		
		Initial σ	Medial σ	Final σ
Falling	✓	✓		
Rising		✓	✓	

The Falling PA occurs on monosyllables and the initial syllable of polysyllables, while the Rising PA occurs on all syllables of polysyllabic words other than the final. Thus in surface forms the Falling and Rising PA's contrast only on the initial syllables of polysyllabic words –

the case that was illustrated in Figure 1. If Rising and Falling accents consist of contrastive tonal melodies, then the absence of Rising accents on monosyllables and the absence of Falling accents on non-initial syllables is difficult to explain. We will argue, however, that both Rising and Falling accents are lexically represented as a single lexical High, and that their distribution emerges from the interaction of stress and tone at the lexical stratum of the phonology. There are also lexical forms unmarked for tone, the so-called toneless forms, to be addressed below.

The analysis is schematized in (2). In the lexicon, High tones are associated with lexical forms. The High tone may be associated to any syllable, subject to the constraint that each word has at most one High tone. At the lexical stratum of the phonology, stress is assigned to an initial High toned syllable, as in (2a), otherwise to the syllable that immediately precedes the High tone, as in (2b). Stress on the High toned syllable yields a Falling PA, and stress on the syllable preceding the High toned one yields a Rising PA.

(2) Distribution of Pitch Accents.

a. Falling PA

na$_{H}$ mere	→	n**á**$_{H}$ mere	'intentions'
la$_{H}$ v	→	l**á**$_{H}$ v	'lion'

b. Rising PA

nema$_{H}$ nja	→	n**é**ma$_{H}$ nja	proper name
nena$_{H}$	→	n**é**na$_{H}$	proper name
parada$_{H}$	→	par**á**da$_{H}$	'parade'
limunada$_{H}$	→	limun**á**da$_{H}$	'lemonade'

In our representation, the stressed syllable corresponds to the Stress Head, indicated with parentheses, and the High toned syllable corresponds to the Tone Head, indicated with braces; this is shown in (3). Interactions between the two submodules in the Standard Serbian prosodic system will be captured through the manipulations of the two heads. The three possible accent patterns on trisyllables are shown in (3). The High tone may be linked to any syllable. The Stress Head coincides with the Tone Head if the Tone Head is initial, otherwise the Stress Head immediately precedes the Tone Head.

(3) The Stress Head and the Tone Head: three possibilities on tri-syllabic words

a. Falling accent	b. Rising accent, initial stress	c. Rising accent, non-initial stress
H	H	H
({n**á**}) me re	(n**é**) {ma} nja	pa (r**á**) {da}

In order to account for the distribution of pitch accents, we invoke the constraints in (4). STRESSHEAD aligns the stressed syllable with the left edge of the word (McCarthy and Prince 1993); TONEHEAD is associated with the syllable that bears a lexical High; and IDENTHIGH is a faithfulness constraint that requires that the High does not delete, or move away from its lexical position. The Obligatory Contour Principle (OCP), which prohibits more than one High tone

within the word, insures that lexical forms have at most one High tone. The tonal constraints in (4) are of the standard type (cf. Yip 2002).

(4) Constraints on Stress and Tone

a. STRESSHEAD
The metrical, or stress, head is aligned with the left edge of the prosodic word.

b. TONEHEAD
The tonal head corresponds with the syllable linked to the High tone.

c. IDENTHIGH
Correspondent tones must be identical.

d. OCP-HIGH
Multiple High tones are prohibited.

The constraints in (5) coordinate the two heads, making reference to the principle of culminativity. Culminativity is defined as a requirement that a word should have a single most prominent syllable, as proposed by Trubetzkoy (1939) and many others. This exact requirement is stated in our constraint (5a) STRONGCULMINATIVITY. Constraint (5b) WEAKCULMINATIVITY weakens this requirement by allowing more than a single prominent syllable under the condition that they be contiguous. The two constraints partially overlap – what is known in OT as a stringency relation (Prince 1997). Any form that violates WEAKCULMINATIVITY necessarily violates STRONGCULMINATIVITY, but the converse does not hold.

(5) Constraints on the Interaction of Stress and Tone

a. STRONGCULMINATIVITY
If σ_i is a TONEHEAD and σ_j is a STRESSHEAD, then $\sigma_i = \sigma_j$.

b. WEAKCULMINATIVITY
If σ_i is a TONEHEAD and σ_j is a STRESSHEAD, then no syllable may intervene between σ_i and σ_j.

The following tableaux illustrate the operation of these constraints to produce the correct distribution of pitch accents in Standard Serbian.

In tableau (6), forms with an initial High tone get stress on the initial syllable. The winning candidate satisfies all constraints to perfection. All other candidates violate at least one constraint.

(6) Falling pitch accent initial in a polysyllable: na $_H$ mere → ({ná $_H$}) mere

na$_H$mere	IDENTHIGH	TONEHEAD	STRESSHEAD	STRCULMIN
☞ ({ná$_H$}) mere				
(ná) mere	* !			
(ná$_H$) mere		* !		
{na$_H$} (mé) re			* !	*

In tableau (7) we see that forms with a non-initial High are stressed one syllable before the tone bearing syllable. Here the winning candidate violates STRONGCULMINATIVITY, in order to better satisfy STRESSHEAD, which requires that stress should be initial. All other candidates fare worse than the winner. Each violates a constraint ranked higher than STRONGCULMINATIVITY.

(7) Rising pitch accent initial in a polysyllable: nema$_H$nja → (n**é**) {ma$_H$} nja

nema$_H$nja	IDENTHIGH	TONEHEAD	STRESSHEAD	STRCULMIN
☞ (né){ma$_H$}nja				*
ne ({má$_H$}) nja			* !	
(né) ma$_H$nja		* !		
({né$_H$}) ma nja	* * !			

In tableau (8) we see WEAKCULMINATIVITY at work. Crucially, this constraint prevents initial stress on a syllable that is not adjacent to the tone bearing syllable, as in the third candidate. The winning candidate violates both STRESSHEAD and STRONGCULMINATIVITY. It has two heads but, as required by WEAKCULMINATIVITY, they are adjacent. Note that it is the effect of WEAKCULMINATIVITY that makes this a Type 1 system, in which tone governs the place of stress. If this constraint were not ranked this high, we would be dealing with a Type 3 system, in which tone and stress do not interact.

(8) Rising pitch accent non-initial in a polysyllable: parada$_H$ → pa (r**á**) {da$_H$}

parada$_H$	WKCULMIN	IDENTHIGH	TONEHEAD	STRESSHEAD	STRCULMIN
☞ pa (rá){da$_H$}				*	*
pa ra ({dá$_H$})				* * !	
(pá) ra {da$_H$}	* !				*
(pá) ra da		* !			
({pá$_H$}) ra da		* * !			
(pá) ra da$_H$			* !		

Tableau (9) demonstrates that a monosyllable may bear only a falling accent.

(9) Monosyllables have Falling accent: la$_H$v → ({ l**á**$_H$v })

la$_H$v	IDENTHIGH	TONEHEAD	STRESSHEAD	STRCULMIN
☞ ({lá$_H$v})				
(lá$_H$v)		* !		
(láv)	* !			

Note that all output forms in tableaux (6)-(9) have at most one lexical High tone. While these forms also have single High tones in the input, this is not a necessary situation, given the richness of the base (Prince and Smolensky 1993). Tableau (10) demonstrates the high ranking of the OCP constraint, preventing the realization of more than one lexical High tone per word. Crucially, OCP insures that at most one High tone surfaces, because it is ranked higher than IDENTHIGH. The lexical High that survives in the winning candidate insures better satisfaction of STRESSHEAD. (TONEHEAD is not included in this tableau.)

(10) No more than one H per word: na_H me re_H → ({ n**á**$_H$ }) mere

na_Hmere$_H$	OCP-HIGH	WKCULMIN	IDENTHIGH	STRESSHEAD	STRCULMIN
☞ ({$\acute{a}_H$}) mere			*		
({$\acute{a}_H$}) me{re_H}	*!	*			*
na me ({$\acute{e}_H$ })			*	*!*	
na (mé) {re_H}			*	*!	*

In addition to forms with lexical High tones, Serbian also has toneless forms. It is fairly common in tone languages for a subset of forms to be unspecified for tone. In toneless forms, only one head is assigned, the Stress Head, as shown in tableau (11) for *devera* 'brother-in-law, gen sg'. The Stress Head is initial, as required by the corresponding constraint. Since this form does not have a lexical High, it will not have a Tone Head either. Tone related constraints, shaded in the tableau, are inert in this case.

(11) Toneless polysyllable: d e v e r a → (d **é**) v e r a

devera	IDENTHIGH	TONEHEAD	STRESSHEAD	STRCULMIN
☞ (dé) vera				
de (vé) ra			* !	
deve (rá)			* ! *	

As will be shown below, toneless forms and forms with initial lexical Highs are neutralized postlexically. Toneless forms get a High tone on the stressed syllable, and are therefore indistinguishable from Falling PA's. But toneless forms and forms with initial High tones are clearly distinguished at the lexical stratum. As shown in (12), toneless forms and forms with an initial High tone behave differently when they combine with a prefix; here, a negative prefix. In the present tense, in (12a), the verb has an initial lexical High tone. Both the unprefixed and the prefixed forms in (12a) have initial stress, but they differ in PA: the unprefixed form is Falling, the prefixed form is Rising. Unlike the present stem, which has a High tone, the aorist stem is toneless. In the aorist example in (12b), both the unprefixed and the prefixed forms of the verb have initial stress, and will be associated postlexically with initial Highs, and thus indistinguishable from Falling PA's. Postlexically, we get neutralization across tenses in the unprefixed, but not in the prefixed forms.

(12) Toneless forms (aorist) vs. forms with an initial High (present)

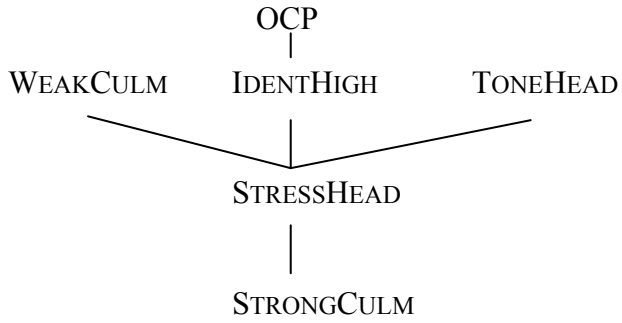
a. Present ({v í$_H$}) d i — 'see, pres, 3sg' (n é){ v i$_H$ } d i — 'not see, pres, 3sg'

b. Aorist (v í) d e — 'see, aorist, 3sg' (n é) v i d e — 'not see, aorist, 3sg'

To summarize, the Falling PA is monosyllabic, with the Stress Head and Tone Head on the same syllable, while the Rising PA is disyllabic, with the Stress Head and the Tone Head on different, but contiguous, syllables. Toneless forms invariably have initial stress.

This is captured by the following constraint ranking:

(13) Lexical stratum: constraint ranking



Three constraints, OCP, WEAKCULMINATIVITY and TONEHEAD are never violated. STRESSHEAD is violated in some forms with a Rising PA, and STRONGCULMINATIVITY is violated in all forms with a Rising PA but not in those with a Falling PA, making the Rising PA more marked than the Falling PA. Crucially, tone manipulation at the lexical stratum is restricted to forms with lexical High tones, insuring that exactly one High is realized, and that it remains in its lexical position. Toneless forms do not acquire High tone at the lexical stratum, nor are any other tones inserted. So, back to the typology we saw earlier, at the lexical stratum we have a Type 1 system, in which tone governs the place of stress.

The Postlexical Stratum: Tonal Specification of Pitch Accents

At the postlexical stratum, we have a Type 2 prosodic system: stress governs the place of tone. While the *distribution* of PAs is decided lexically, postlexical adjustments and additions to the tonal string, made to satisfy constraints on the realization of prominence and of prosodic boundaries, determine the final *shape* of the tonal contours. This is shown in (14), where the input to the postlexical stratum, on the left side of the arrow, corresponds to the output of the lexical stratum.

(14) Postlexical stratum: tonal interactions

a. Toneless

(d é) v e r a → (d é $_{H}$) v e r a

b. Falling PA

({n á $_{H}$ }) m e r e → ({n á $_{H}$ }) m e r e

c. Rising PA

(n é){m a $_{H}$ }nj a → (n é $_{L}$){m a $_{H}$ }nj a

Postlexical changes to the pitch contours are driven by a set of markedness constraints we call Head Salience, listed in (15), which require that a head be associated with a tone; ideally a High tone, but possibly with a Low tone, as a second best. This is shown by the ranking of HEAD/HIGH over HEAD/LOW in (17). Unlike the markedness constraint *Low/Head, proposed by de Lacy

(2002), the constraints in (15) are stated in positive terms, as a requirement for the tonal specification of heads.

(15) Head Salience constraints

a. HEAD/HIGH Head of a prosodic word is associated with a High tone.
b. HEAD/LOW Head of a prosodic word is associated with a Low tone.

The OCP constraint in (4d), which prohibits multiple High tones not only lexically but also postlexically, may block some of the tonal interactions. Faithfulness constraints on tone are listed in (16). As a result of constraint interactions, some tones may be added, deleted, or moved. Tone faithfulness, which was near-inviolate lexically, is low-ranked at the postlexical stratum, as in the ranking in (17).

(16) FAITH constraints

a. DEPHIGH
b. DEPLOW
c. IDENTHIGH

(17) Postlexical stratum: constraint ranking

OCP >> HEAD/HIGH >> HEAD/LOW >> FAITH

Constraint interactions that determine the final shape of the pitch contours, while inert at the lexical stratum, abound at the postlexical stratum. Only lexically specified High tones are present lexically, and they are protected by the highly ranked IDENTHIGH constraint which yields only to the OCP requirement of at most one High tone per word. Because tone insertion must be allowed postlexically, yet is disallowed lexically, we conclude that the two strata have different constraint rankings. As shown in (17), the three faithfulness constraints on tone in (16) all rank below the markedness constraints, those listed in (15) as well as the OCP.

One consequence of the Head Salience constraints is that a toneless form will get a High tone on its stressed syllable, incurring the violation of the faithfulness constraint DEPHIGH, as shown in (18).

(18) Postlexical: toneless polysyllable (d é) v e r a → (d é $_{H}$) v e r a

(dé) vera	HEAD/HIGH	HEAD/LOW	DEPHIGH	DEPLOW
☞ (dé $_{H}$) vera		*	*	
(dé $_{L}$) vera	* !			*
(dé) vera	* !	*		

The second consequence of the Head Salience constraints is the differing shape of the two pitch accents. Our previous phonetic research has shown a consistent shape difference between the two accent types: Rising PA's show a flat pitch plateau that extends over the stressed syllable, followed by a quick rise to the pitch maximum on the immediately following syllable. No systematic pitch plateau is detected in the Falling PA's.

These plateaus are clearly seen in the Rising PA's illustrated in Figure 1: pitch is flat, not rising, on the stressed syllable. No such plateau is seen for the Falling PA's, on the left, even when successive peaks are relatively far apart. We interpret this plateau in Rising PA's as the presence of a Low pitch target on the stressed syllable.

Note that under our analysis, the Rising PA has two parts, a low plateau and a high peak, yet it is not lexically bitonal. The Low tone is inserted postlexically as a result of constraint interaction. The independent status of the Low and High tone is further confirmed by our phonetic analysis, which showed that the Low and High are separately time-aligned to the segmental string, instead of their positions being correlated with each other, as would be expected for an underlyingly bitonal lexical PA.

No additional tone is needed in the Falling PA's. Because the Stress Head and Tone Head coincide in these forms, the lexical High is sufficient to satisfy the Head Salience constraints, as in (19).

(19) Postlexical: Falling PA ({n á $_{H}$ }) m e r e → ({n á $_{H}$ }) m e r e

({ná$_{H}$}) mere	HEAD/HIGH	HEAD/LOW	DEP-LOW
☞ ({ná$_{H}$}) me re		*	
({ná$_{H}$}) me$_{L}$ re		*	* !

For the Rising PA's, however, the Tone Head and Stress Head do not coincide, and a tone must be inserted for the Stress Head to satisfy Head Salience. The relevant constraint interactions are presented in tableau (20). The input form *(né){ma $_{H}$} nja*, has a lexical tone on the second syllable and stress on the first syllable due to constraint interactions on the lexical stratum, as shown above in tableau (7). It has already been shown, for the toneless forms, that the Tone Salience constraints outrank constraints on tone faithfulness. However, insertion of the preferred High tone would violate the OCP, as in the second candidate in the tableau. Therefore, a Low tone is inserted instead in the winning candidate. Thus there is Low tone insertion for the Rising PA's, resulting in a pitch plateau on the stressed syllable, but no insertion, and no plateau, for the Falling PA's.

(20) Postlexical: Rising PA (n é){m a $_{H}$ }nj a → (n é $_{L}$){m a $_{H}$ }nj a

(né){ma$_{H}$} nja	OCP	HEAD/HIGH	HEAD/LOW	DEP-HIGH	DEP-LOW
☞ (né$_{L}$){ma$_{H}$} nja		*	*		*
(né$_{H}$){ma$_{H}$} nja	* !		* *	*	
(né){ma$_{H}$} nja		*	* * !		

We turn now to interactions of lexical tone with intonational tones, a crucial type of tonal interaction at the postlexical stratum. The declarative intonation in Serbian requires an utterance-final boundary Low tone, which docks onto the utterance-final syllable. This Low, evident in our own studies, is also proposed by Godjevac (2005) in her ToBI-based description of Serbian. Tonal interactions ensue if there is already a lexical High on the final syllable.

In forms where the lexical High is non-final, the final syllable is free to receive the intonational tone. This is illustrated in tableau (21) with the same input form *Nemanja* (a proper name) as in (20), but this time also specified for an intonational L_I. As we saw in tableau (20), a Low is inserted on the stressed syllable postlexically to satisfy the Head Salience constraints and the OCP. The intonational tone L_I is realized on the final syllable, as in the winning first candidate, in order to satisfy the faithfulness constraint MAX(L_I) that protects the boundary Low tone. Because the final syllable is not associated with a lexical High tone, there are no interactions between the lexical High and the intonational L_I. We will see below that MAX(L_I), which requires the realization of this boundary tone, must be high-ranked.

(21) Postlexical: Realization of intonational L_I on a toneless final syllable

(né){ma$_H$} nja, L_I	MAX(L_I)	OCP	HEAD/HIGH	HEAD/LOW	DEP-HIGH	DEP-LOW
☞ (né$_L$){ma$_H$} nja$_L$			*	*		*
(né$_H$){ma$_H$} nja$_L$		* !		* *	*	
(né$_L$){ma$_H$} nja	* !		*	*		

The high-ranking of MAX(L_I) is seen in utterance-final realizations of forms with a lexical High on the final syllable. In utterance-initial position, a lexical High on the final syllable is realized as expected, as shown in tableau (22): the disyllabic input form *(né:){na$_H$}* with a Rising PA has stress on the first syllable, on a long vowel, and a lexical High on the second. Thus, tableau (22) is, in all respects, parallel with tableau (20).

(22) Postlexical: Forms with a High toned final syllable utterance initially
(né){na$_H$} → (né$_L$){na$_H$}

(né){na$_H$}	OCP	HEAD/HIGH	HEAD/LOW	DEP-HIGH	DEP-LOW
☞ (né$_L$){na$_H$}		*	*		*
(né$_H$){na$_H$}	* !		* *	*	
(né){na$_H$}		*	* * !		

In utterance-final position, however, this form is realized with a High tone on the first syllable, and a Low on the second. In Figure 2 are given pitch tracks showing the the difference between the utterance-initial and utterance-final realizations of the disyllabic form *Nena*.

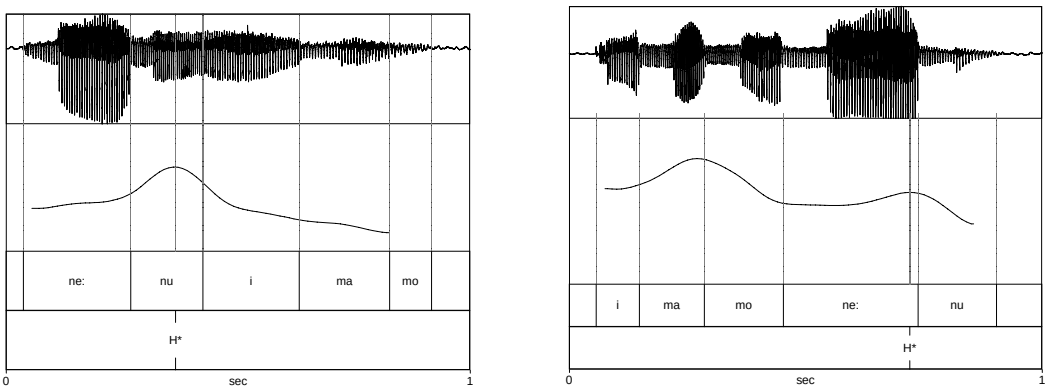


Figure 2. Tone shift in di-syllables with Rising PA utterance-initially (left) and utterance-finally (right).

On the left is the form *Nenu* in utterance-initial position, with the expected plateau on the first syllable and pitch peak on the second. On the right is this same form in utterance-final position, with the peak shifted from the second syllable to the first. The peak is realized late in the first syllable, but our analysis shows that in utterance final position the peak is consistently reached before the end of the first vowel.

We attribute this difference to a tonal crowding effect in utterance-final realization: both the lexical High and the intonational L_I should ideally dock on the final syllable, but only one can due to a prohibition against tonal contours. The winner is the intonational boundary Low tone. Because the final syllable is linked to a Low tone, the stressed syllable is free to associate with a High tone, satisfying better the Tone Salience constraints.

The relevant constraint interactions are shown in (23). Both MAX(L_I), which prohibits deletion of the boundary L_I, and a further constraint, NOCONTOUR, which prohibits more than one tone docked to the same syllable, must be undominated in this case, forcing realization of the boundary L_I on the final syllable and the accompanying supression of the lexical High. The High on the stressed syllable could be inserted, as in toneless forms, or it could be that the lexical High shifted from the final to the stressed syllable, a tonal realignment that according to Yip (2002:84-86) incurs violations both against delinking from the original syllable and against linking to the immediately preceding one. In either case, faithfulness violations are incurred. While we have no way of choosing between these alternatives – hence a generic faithfulness constraint – we lean towards the solution of a realigned lexical High. Under this scenario, all pitch maxima in forms with lexical tone would correspond to a lexical High tone.

(23) Postlexical: Forms with a High toned final syllable utterance finally

(né){na$_{H}$} → (né$_{H}$){na$_{L}$}

(né){na$_{H}$}, L_I	MAX(L_I)	NOCONTOUR	HEAD/HIGH	HEAD/LOW	FAITH
☞ (né$_{H}$){na$_{L}$}			*	*	* *
(né$_{L}$){na$_{H\,L}$}		* !	*	*	*
(né$_{L}$){na$_{H}$}	* !		*	*	*

Concluding remarks

Our approach, we would argue, provides a unified account of a range of phenomena governing the interaction of stress and tone in Standard Serbian, including lexical, postlexical and phonetic, and resulting in a unique mixed system. The distribution of PA's is captured lexically, with the place of stress predictable from the place of lexically specified High tones. Simply stated, tone attracts stress. PA type is predictable from the interaction of tone and stress: any syllable may be lexically specified as High, and high ranking of faithfulness constraints on tone prevent lexical Highs from moving or deleting. The constraint STRESSHEAD requires that stress be as far left as possible. If the High tone is word initial, stress and tone heads coincide, thus satisfying STRONG CULMINATIVITY and resulting in a Falling PA. If the High tone is non-initial, stress and tone heads do not coincide, resulting in a Rising PA. While violationg STRONG CULMINATIVITY, such cases obey the less restrictive WEAK CULMINATIVITY.

Postlexically, stress attracts tone. Tonal insertion and realignment evidenced postlexically show that tonal faithfulness constraints are low-ranked at this stratum. First, High tones are inserted on toneless forms, in particular, on their initial stressed syllables. Second, Low tones are inserted on stressed syllables immediately followed by a High tone. As a result, all initial High tones yield Falling PA's, and non-initial Highs yield Rising PA's. Intonational boundary Low tone on utterance final syllable may disrupt this pattern, by forcing the shift of a final lexical High tone to a preceding syllable.

The phonetic shapes of PA's follow directly from this phonological characterization. Falling PA's are simple High tones, interpreted as a smooth rise to, and a fall from, the peak on the stressed syllable. Rising PA's are Low tones on the stressed syllable, interpreted as a plateau on the stressed syllable, followed by rise to the High on the post-stress syllable. Both Falling and Rising PA's are lexically H* with the shape difference between them derived from the interaction of stress and tone.

In sum, with the simple underlying representation – a High tone on any syllable in the word – differences in the distribution of stress, and in the shape of Rising and Falling PA's, arise solely due to constraint interaction. This allows for capturing differences across dialects in terms of minimally different constraint ranking at the lexical or postlexical stratum, and suggests a promising direction for future work.

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