

Tone/ATR interactions in Slovenian*

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Highlights:

- Slovenian contrasts High and Low tones on the unmarked {a, e, i, o, u}, with an epenthetic High tone on underlyingly toneless roots.
- The marked {ε, ɔ, ʌ} have a predictable Low tone, including an epenthetic Low on underlyingly toneless roots.
- Tone distinctions are allowed on [ə] only before [r]
- Word-finally, tone on {ε, ɔ, ʌ, ə} is neutralized to High.
- We offer markedness constraints that penalize High tones on lax vowels and Low tones on marked vowels.
- Phonetic grounding for correlations between tone and vowel quality?

1. Unmarked vowels and their tones

1.1. The realization of tone and stress in Slovenian

Slovenian contrasts two tones, which we label Low and High. Each lexical word has exactly one tone (and one boundary tone, see below):

(1)	'pót	'path'	'pòt	'sweat'
	'kíla	'kilogram'	'kíla	'hernia'
	'šálitsa	'cup'	'šálitsa	'joke' (dim.)

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Most often, tones stay constant throughout nominal paradigms:

(2)	NOM SG	ko'rák	be'dák
	GEN SG	ko'rák-a	be'dák-a
	INST PL	ko'rák-oma	be'dák-oma
		'step'	'fool'

In addition to the tone on the stressed syllable, the final syllable of the word has a boundary tone on it. The boundary tone is Low after High and vice versa (Jurgec forthcoming), contra older descriptions (Toporišič 2000, Herryty 2000, Lenček 1981).

(3)	NOM SG	ko'rák	be'dák
	GEN SG	ko'rák-à	be'dák-á
	INST PL	ko'rák-omà	be'dák-omá
		'step'	'fool'

Stress is clearly marked by vowel reduction, both of the neutralizing and the non-neutralizing kinds (Jurgec 2005a, 2005b, 2006):

(4)	<p>Stressed</p>	<p>Unstressed</p>
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1.2. Well behaved vowels

The least marked vowels {a, e, i, o, u} have the widest distribution. They can appear with either tone anywhere a stressed vowel is allowed: on any syllable of the root or of the word.

(5)	a	ko'rák ~ ko'rák-a be'dák ~ be'dák-a	'step' 'fool'	'mádeř ~ 'mádeř-a 'pàmet ~ 'pàmet-i	'stain' 'wisdom'
	e	je'sén ~ je'sén-i 'splèt ~ 'splèt-a	'autumn' 'the web'	'jézer-o ~ 'jézer-a 'sème ~ 'sèmen-a	'lake' 'seed'
	i	is'pít ~ is'pít-a xřip ~ 'xřib-a	'exam' 'hill'	'rības ~ 'ríbez-a 'klinik-a ~ 'klinik-e	'ribes' 'hospital'
	o	ko'kóf ~ ko'kóf-i o'bòk ~ o'bòka	'chicken' 'arch'	'vójvot ~ 'vójvod-a 'pògrat ~ 'pògrad-a	'duke' 'bed'
	u	pe'rút ~ pe'rút-i 'třük ~ 'třük-a	'wing' 'owl'	'žúpnik ~ 'žúpnik-a 'ùlits-a ~ 'ùlits-e	'priest' 'street'

2. Tone/Stress patterns

With three numbers and six cases, Slovenian nominal paradigms have lots of highly productive morphology. These paradigms come in two flavors:

- (6) Stress falls on the root throughout the paradigm
→ tone is contrastive
- (7) Stress falls outside the root in some members of the paradigm
→ tone is predictable

We conclude that stress is predictable from tone. In the root has a tone in the UR, stress is attracted to it. If the root is toneless in the UR, a tone on a suffix can attract stress outside the root.

2.1. Underlyingly toneless roots

Less than 200 nouns have stress fall outside the root in some members of the nominal paradigm. In all of these roots, tone is *predictable*.

When the root has {a, e, i, o, u} in it, tone is High when the root is stressed, except for “slips” in the DAT SG and GEN PL:

(8)	NOM SG	'móf	'dùx	'snék
	GEN SG	m0'3-á	du'x-á	sne'g-á
	DAT SG	'móf-u	'dùx-u	'snég-u
	NOM PL	m03-'jé	du'x-jé	sneg-'jé
	GEN PL	'mòř	'dùx	'snék
		'husband'	'spirit'	'snow'
(9)	NOM SG	'stvár		
	GEN SG	stua'r-í		
	DAT SG	'stvár-i		
	NOM PL	stua'r-í		
	GEN PL	stua'r-í or stua'r-ì		
		'thing'		

Stress falls on the root by default, due to FINALSTRESS (=ALIGN(σ,R,root,R)), unless the inflection suffix comes with its own tone:

(10)	/m03-u/	FINSTRESS	ΔPWd:H	ΔPWd:L	DEP(T)
	☞ a. 'móf-u			*	*
	b. 'mòř-u		*!		*
	c. m0'3-ú	*!		*	*

(11)	/m03-á/	NOFLOP	MAX(T)	FINSTRESS	ΔPWd:H
	☞ a. m0'3-á			*	
	b. m0'3-à		*!	*	*
	c. 'móf-a	*!			

A floating tone from a suffix would dock on the root:

(12)	/stvar + i L/	NOFLOP	MAX(T)	FINSTRESS	ΔPWd:H
	☞ a. 'stvár-i				*
	b. stua'r-ì			*!	*
	c. 'stvár-i		*!		

2.2. Roots with underlying tone

The vast majority of masculine nouns with a stressed {a, e, i, o, u} have fixed stress and tone throughout the paradigm:

(13)	NOM SG	ko'rāk	be'dāk
	GEN SG	ko'rāk-a	be'dāk-a
	NOM PL	ko'rāk-i	be'dāk-i
	GEN PL	ko'rāk-ow	be'dāk-ow <i>or</i> be'dāk-ow
		'step'	'fool'

A tone on a suffix will end up unrealized, due to T:ΔPWd and NoFLOP:

(14)	/bedāk + á/	T:ΔPWd	NoFLOP	MAX(T)
	a. 'bedāk-a			*
	b. be'dāk-a		*!	
	c. be'dāk-á	*!		

The vast majority of neuter nouns have Low in the singular and High in the plural and dual:

(15)	NOM SG	'mèst-o	kopit-o
	GEN SG	'mèst-a	kopit-a
	NOM PL	'mést-a	kopít-a
	GEN PL	'mést	kopít
		'city'	'hoof'

The feminines contrast High and Low paradigms, but the INST SG is usually High, and when stress is final, GEN PL is always High. The paradigms below represent the vast majority of feminine nouns:

(16)	NOM SG	'slúz̥b-a	'pàmet	ma'lín-a
	GEN SG	'slúz̥b-e	'pàmet-i	ma'lín-e
	INST SG	'slúz̥b-o	'pàmet-jo	ma'lín-o
	NOM PL	'slúz̥b-e	'pàmet-i	ma'lín-e
	GEN PL	'slúʃp	'pàmet-i	ma'lín
		'work'	'mind'	'raspberry'

Suffixes that have a floating tone trump lexical tone. The underlying Low on *pàmet* is replaced by the floating High of the INST SG due to MAX(float), which prefers the realization of floating tones (Wolf 2005):

(17)	/pàmet + jo H/	MAX(float)	IDENT(T)
	a. 'pàmet-jo		*
	b. 'pàmet-jo	*!	

Interestingly, floating tones dock onto the vowel that has the underlying tone. If we accept the NOM SG as the base for assessing OO-faithfulness, then OO-IDENT(stress) can do the work:

(18)	NOM SG	'pàmet	NOM SG	be'dāk
	INST SG	'pàmet-jo	GEN PL	be'dāk-ow
		'mind'		'fool'

(19)	/pàmet + jo H/	NoFLOP	OO-IDENT(stress)
	a. 'pàmet-jo		
	b. pa'mét-jo		*

There are other nouns that have tonally non-uniform paradigms. Most often, these nouns have a Low on most members of the paradigm, with the occasional “slip”. Many of them “slip” in the Ø-marked NOM SG when stress is final:

(20)	NOM SG	¹ mɨʃ	lùʃ
	GEN SG	¹ mɨʃ-i	lùʃ-i
	INST SG	¹ mɨʃ-jo	lùʃ-jo
	NOM PL	¹ mɨʃ-i	lùʃ-i
	GEN PL	¹ mɨʃ-i or ¹ mɨʃ-i	lùʃ-i or lùʃ-i
		‘mouse’	‘light’

So we see that most “slips” are with roots that have final stress, in the Ø-marked NOM SG (masculine) and the Ø-marked GEN PL (feminine). There are also “slips”, however, with overtly marked cases.

3. The misbehaving vowels

Tone is *predictable* on the more marked vowels of Slovenian: {ɛ, ə, ʌ} and [ɔ]. We now discuss them in turn.

3.1. The lax mid vowels

With underlyingly toneless roots, the epenthetic tone on [ɛ] and [ɔ] is Low:

(21)	NOM SG	gòr-a	žèŋ-a
	DAT SG	gòr-i	žèŋ-i
	GEN SG	gor-é or gor-è	žen-é or žen-è
	NOM PL	gor-é	žen-é
	GEN PL	gor-á or gor-à	žen-á or žen-à
		‘mountain’	‘wife’

Recall that the epenthetic tone on {a, e, i, o, u} is High:

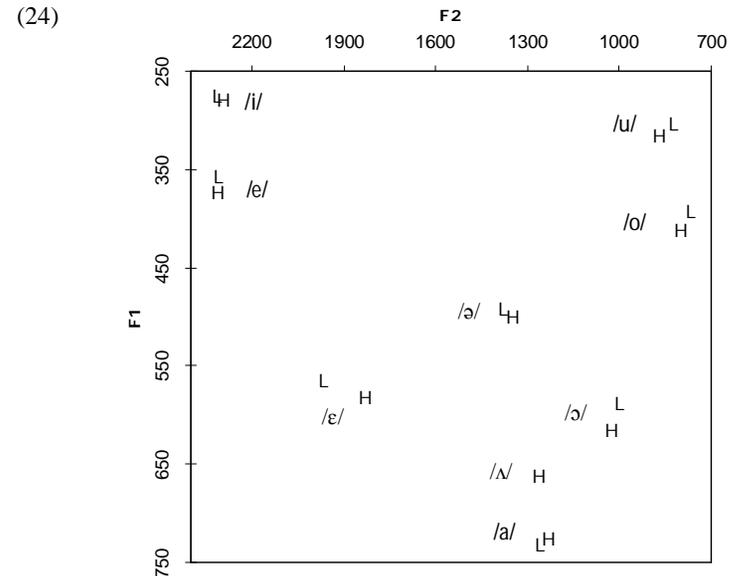
(22)	NOM SG	¹ móʃ
	DAT SG	¹ móʒ-u
		‘husband’

Clearly, some markedness constraint prefers an epenthetic Low on [ɛ] and [ɔ]. The phonetic grounding for the required markedness constraint is reasonable: Higher vowels correlate with higher perceived pitch, and –ATR correlates with lower vowels, so the combination is dispreferred. More formally: *H/[–ATR–low].

(23)	/gòr-a/	*H/[–ATR–low]	ΔPWd:H
	a. ¹ gòr-a		*
	b. ¹ gòr-a	*!	

Correlations between high vowels and high pitch are not common, but a few cases include Fuzhou (Donohue, later today), Kotoko (Odden, afterwards).

We should note, however, that there might be a phonetic grounding for the *opposite* correlation between tone and ATR: Since higher F₀ causes higher F₁, High tones should correlate with lower vowels, as reported for Rengao (Yip 2002:32). Phonetically, it may be the case that Slovenian vowels are slightly lower with High tones, but this trend has only barely reached significance in Jurgec (2005a):



In paradigms with fixed stress, which normally *contrast* High and Low tones, [ɛ] and [ɔ] show up with *predictable* tone: Low tone on all members of the paradigm, except the NOM SG and GEN PL:

- (25)
- | | | |
|--------|-----------|--------|
| NOM SG | promét | rép |
| GEN SG | promèt-a | rèp-a |
| NOM PL | promèt-i | rèp-i |
| GEN PL | promét-ow | rép-ow |
| | ‘traffic’ | ‘tail’ |
- (26)
- | | | |
|--------|----------|----------|
| NOM SG | uzrók | brón |
| GEN SG | uzròk-a | bròn-a |
| NOM PL | uzròk-i | bròn-i |
| GEN PL | uzrók-ow | brón-ow |
| | ‘cause’ | ‘bronze’ |

In a few nouns, [ɛ] and [ɔ] can appear as the root’s penult vowel, but the penult gets stressed only in the NOM SG. Again, [ɛ] and [ɔ] show up with a Low tone:

- (27)
- | | | |
|--------|---------|----------|
| NOM SG | tèle | òtje |
| GEN SG | telèt-a | otjèt-a |
| NOM PL | telét-a | otjèt-je |
| GEN PL | telét | otjèt-ow |
| | ‘calf’ | ‘father’ |

Missing from the language are fixed stress paradigms with [ɛ] or [ɔ] and a High tone throughout. We assume that such hypothetical inputs map onto the Low tone paradigms:

- (28)
- | /paték-a/ | *H/[–ATR–lo] | IDENT(T) |
|---------------|--------------|----------|
| ☞ a. pa'tèk-a | | * |
| b. pa'ték-a | *! | |

A floating tone, however, causes [ɛ] or [ɔ] to surface with a High tone:

- (29)
- | /promèt-ow H/ | MAX(float) | *H/[–ATR–lo] | IDENT(T) |
|-----------------|------------|--------------|----------|
| ☞ a. pro'mét-ow | | * | * |
| b. pro'mèt-ow | *! | | * |

With the Ø-marked NOM SG, the High tone can be attributed to two possible sources:

- (30) A floating H on the NOM SG suffix
 (31) A ban on Low tones word-finally, possibly due to contrast preservation

There are two reasons to believe that the second hypothesis is more satisfying:

(A) Diachronically, schwa is turning into [ɛ], and then it acquires a Low tone. When this schwa is non-final in the NOM SG, it keeps its Low tone:

- (32)
- | | Normative form | Innovation |
|--------|----------------|------------------------|
| NOM SG | stə'bár | 'stèbər |
| GEN SG | stə'br-á | 'stèbr-a |
| NOM PL | stə'br-í | 'stèbr-i |
| GEN PL | stə'br-ów | 'stèbr-ow or 'stébr-ow |
| | ‘pillar’ | ‘pillar’ |

(B) Additionally, there are several dialects of Slovenian that ban Low tones from the final syllable, regardless of the vowel:

- (33)
- | | | | |
|---------|------------|------------|------------------------|
| NOM SG | ko'rák | be'dák | (Kostanjevica dialect) |
| GEN SG | ko'rák-a | be'dák-a | |
| INST PL | ko'rák-oma | be'dák-oma | |
| | ‘step’ | ‘fool’ | |

We conclude that the High tone in promét is most probably due to markedness, overriding the underlying tone, and not due to a floating High on the NOM SG.

Pitch is lowered and compressed word-finally, so tonal distinctions word-finally are bad. Formally, we propose the constraint *FINALLOW.

*FINALLOW is undominated in the Kostanjevica dialect. In the standard dialect, it's only active with the marked vowels of the language:

(34)

/promèt/	*FINALLOW & *[-ATR-lo]	*H/[-ATR-lo]	IDENT(T)
☞ a. pro'mét		*	*
b. pro mèt	*!		

3.2. The low tense vowel

The vowel we transcribe as [Λ] has an F₁ that is higher than [ɛ] and [ɔ]'s, and lower than [a]'s. Its F₂ is the same as [a]'s, and is intermediate between [ɛ]'s and [ɔ]'s. We conclude that it is a central low tense vowel.

The tone on [Λ] is predictable: it is always High. However, [Λ] is only allowed word finally, and non-finally, its correspondent [a] is always Low (with “slips”).

(35)

NOM SG	brát	modrás
GEN SG	bràt-a	modràs-a
NOM PL	bràt-je	modràs-je
GEN PL	bràt-ow <i>or</i> brát-ow	modràs-ow <i>or</i> modrás-ow
	'brother'	'viper'

We assume that the High tone on [brát] is another case of a constraint against a Low tone on a final marked vowel (but it could also come from a floating High on the NOM SG). We conjoin *FINALLOW with *[+ATR +low]:

(36)

/brát/	*FINALLOW & *[+ATR +low]	*H/[-ATR-lo]	IDENT(T)
☞ a. 'brát			*
b. 'brát	*!		

The tougher problem is getting an [a] to surface with a Low tone *only if its UR correspondent is [Λ]*. The problem is independent of one's choice of serial or parallel derivations. First, we need a principle that bans [Λ] non-word-finally:

(37) LICENSE(Λ) = [Λ] must be word final
or
 Λ → [-ATR] / _ σ #

Now, neutralizing the tone on a non-final [Λ] can be done opaquely, referring to [Λ], or transparently, referring to [a]. Neither option is fully satisfying:

Opaquely, we'll need a constraint against a High tone on [Λ], but since [Λ] is [+ATR], it's hard to see what the phonetic grounding would be.

(38) *H/[+ATR+low] (?)
or
 Λ → Á (?)

Transparently, we'll need a constraint against a High tone on [a]. This is plausibly phonetically grounded, in the same way that *H/[-ATR-low] is.

(39) *H/[-ATR]
or
 a → à (but only if the Λ → a rule applied on the same vowel)

The only problem with *H/[-ATR] is that it's not active anywhere else in the language: The epenthetic tone on [a] is High (as in /stuar/ → ['stúár]), and tones contrast freely on [a].

In OT terms, *H/[-ATR] must be conjoined with IDENT(ATR), so that only an [á] that has [Λ] as its input correspondent will be penalized (Łubowicz 2002).

(40)

/brλt + a/	LICENSE(Λ)	*H/[−ATR] & IDENT(ATR)	IDENT(T)
☞ a. 'brāt-a			
b. 'brát-a		*!	*
c. 'brλt-a	*!		

There are no attested underlyingly toneless roots with [Λ].

3.3. Schwa

The distribution of [ə] in Slovenian is predictable: it can only surface where needed to break a cluster, or when no other vowel is available in the word. The tone on [ə] is **predictable when not followed by [r]**.

When stressed and not followed by [r], the tone on [ə] is High. Note that [ə] is normally stressed only when no full vowel is available in the word:

(41)

NOM SG	'pəs	mə'gl-á
GEN SG	'ps-á	mə'gl-é or mə'gl-é or mə'gl-è
NOM PL	'ps-í	mə'gl-é or mə'gl-é
GEN PL	'ps-ów or 'ps-òw	mə'gál or mə'gl-á or mə'gl-à
	'dog'	'fog'

Recent innovations in the standard dialect include a move to fixed stress paradigms, with speakers choosing either High or Low for the non-word-final schwas:

(42)

	Normative	Innovation (a)	Innovation (b)
NOM SG	'kás	'kás	'kás
GEN SG	kə's-á	'kás-a	'kàs-a
NOM PL	kə's-í	'kás-i	'kàs-i
GEN PL	kə's-ów (or ò)	'kás-ow	'kàs-ow
	'repentance'		

For the speakers who prefer the innovative (b) pattern, there is a constraint against High tones on [ə] (*H/ə?). The phonetic grounding for such a preference is unclear...

When a schwa is needed next to an [r], it's epenthesized before it, never after it, e.g.: /rt/ → ['ǎrt], *['rǎt] 'cape'.

Before [r], the tone on [ə] is **contrastive**, except word-finally:

(43)

NOM SG	'pǎrst	'tǎrst
GEN SG	'pǎrst-a	'tǎrst-a
NOM PL	'pǎrst-i	'tǎrst-i
GEN PL	'pǎrst-ow or 'pǎrst-ow	'tǎrst-ow
	'finger'	'reed'

What makes a Low tone bad on a final [ə]? Since [ə] probably lacks an ATR value, maybe it's just that [ə] is a bad vowel:

(44)

/pǎrst/	*FINALLOW & *ə	IDENT(T)
☞ a. 'pǎrst		*
b. 'pǎrst	*!	

How come tone is contrastive on [ə] only when followed by [r]?

(45) If [ə] is realized lower before [r], then it's more sonorous, and less liable to lose its tone. We haven't done the necessary measurements, but we know that [r] makes preceding front vowels lax (Jurgec 2007).

(46) Schwa is always epenthetic in actual lexical items (when underlying, it chain-shifts to ε). Opaquely, tonal contrasts are removed from obstruents, but kept on /r/. When a schwa is epenthesized to break a cluster, the [r]'s tone is realized on the schwa.

4. Marked vowels in loanwords

Evidence for the markedness of High tones on {ε, ə} comes from loanword phonology, where these vowels are raised to fit the High tone:

(47)	Native [+ATR]	Native [-ATR]	Foreign [+ATR]
	'rók 'hand' GEN PL	'rók 'deadline'	'rók 'rock'
	'ós 'wasp' GEN PL	'ós 'axis'	'ós 'Oz'
	'mětj 'sword'	'mětj 'calf' GEN PL	'mětj 'match'

Recall that in the native vocabulary, {ε, ə} surface with a Low tone (except finally), so a hypothetical /paték-a/ would come out Low:

(48)	/paték-a/	IDENT(ATR)	*H/[-ATR-lo]	IDENT(T)
	a. pa'ték-a			*
	b. pa'ték-a		*!	
	c. pa'ték-a	*!		

In the loanword phonology, where only High tones are allowed (with a few exceptions), the vowel must change to fit the tone:

(49)	/mětj/	ΔPWd:H	*H/[-ATR-lo]	IDENT(ATR)
	a. 'mětj			*
	b. 'mětj		*!	
	c. 'mětj	*!		
	d. 'mětj	*!		*

5. Conclusions

- Slovenian tones contrast on {a, e, i, o, u}, but not on {ε, ə, ʌ}. Tones contrast on [ə] only before [r].
- The markedness constraint *H/[-ATR-lo] causes unfaithfulness to tones in the native phonology and unfaithfulness to ATR in the loanword phonology.

- Word-finally, tone on {ε, ə, ʌ, ə} is neutralized to High.
- Constraints that cause neutralization medially: *H/[-ATR-lo], *H/[-ATR]&IDENT(ATR), and maybe *H/ə.
- High tones on medial {ε, ə, ʌ, ə} with certain overtly marked cases are attributed to floating tones, with a high ranking MAX(float).
- Constraints that cause neutralization word-finally:
 - *FINALLOW & *[-ATR-lo]
 - *FINALLOW & *[+ATR+lo]
 - *FINALLOW & *ə
 - And in some non-standard dialects: *FINALLOW
- Puzzling conflicting evidence about the phonetic grounding for correlations between vowel quality and tone.

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