

Recent Findings on Tone in Slovenian

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1 Introduction

The South Slavic language Slovenian (or Slovene) is spoken by approx. 2 million in the Republic of Slovenia, in the neighboring countries and several other countries (the United States, Argentina, Australia).

There are two varieties of Slovenian, tonal and non-tonal. The dialectal distribution is presented in Figure 3 (the revised version of Rigler 1968). The pitch-accented variety covers the majority of the central dialects (Dolenjska and Gorenjska region), cf. Figure 1. In Standard Slovenian both tonal and non-tonal versions are allowed (in contrast to Croatian).

1.1 Phonology

Slovenian has two lexical tones, **ACUTE** and **CIRCUMFLEX**. The tone contrast is limited to the stressed syllable, in all pitch-accented dialects, and in Standard Slovenian. Additionally (and with few dialectal exceptions), there is no contrast in short (stressed) vowels.

According to traditional grammar, the main distributional laws of the suprasegmentals in Standard Slovenian are as follows:

- (1) Stress is free but predictable, in Slovenian.
- (2) Long vowels are always stressed.
- (3) If there are no long vowels, the last is stressed = Short vowels can be normally stressed only in word-final position.
- (4) Schwa is always short and can be stressed, regardless of the previous rule.
- (5) /e/ and /o/ cannot be short, and to some authors (cf. Toporišič, 2000: 71-72; see Srebot Rejec, 1988, for a review) also not stressed.
- (6) Long vowels and non-final schwa distinguish two tones, so called *acute* and *circumflex*.

1.2 Morphology

Tonal minimal pairs are predominantly morphological. Some of those are listed in Table 1. However, a limited number (< 100) of not morphologically related words exist, examples are listed in Table 2. These are found in one-, two-, and three-syllables.

	Acute	Circumflex
ONE-SYLLABLES		
vrat ['wra:t]	'neck'	'gen. sg. of vrata, door'
pot ['po:t]	'path, narrow road'	'sweat'
TWO-SYLLABLES		
kila ['ki:la]	'hernia'	'kg'
kura ['ku:ra]	'chicken'	'medical treatment'
mula ['mu:la]	'mule'	'Muslim priest'
THREE-SYLLABLES		
šibica ['ši:bitsa]	'small rod'	'match, coll.'
šalica ['ša:litsa]	'little joke'	'cup, coll.'

Table 1. Lexical minimal pairs in Standard Slovenian.

Context	Word	Form	Acute	Circumflex
Fem. stems (accused)	cesta 'road'	cesto ['tse:sto]	Acc. sg.	Instr. sg.
Past participle	navediti 'to make'	navedila [nare'di:la]	Dual m.	Sg. f.
Fem. vs. m.	vran 'raven'	vrana ['wra:na]	Gen. m.	Nom. f.

Table 2. Examples of morphological minimal pairs in Standard Slovenian.

1.3 Phonetics

The acoustic phonetic studies of Slovenian tones are limited to research of **fundamental frequency**. Vodušek (1961) confirmed that lexical pitch realization differs considerably inter- and intradialectally, but still characterized acute as rising and circumflex as falling. Toporišič (1967, 1968) insisted on high/low distinction. Acute was confirmed as low in tonic and high in post-tonic syllable, circumflex vice versa. In oxitones, acute is low and circumflex high. Neweklovsy (1973) studied Slovenian Carinthian dialects (Koroška) of Zilja, Rož and Podjuna (in Austria). He found great variability, while acute was predominantly rising and circumflex falling. His data confirm the contrast in oxitones, conditioned by sentence intonation. Srebot Rejec (1988) studied pitch contours in Standard Slovenian, as spoken in Ljubljana. The pitch-contours are represented in Figure 2 (from Srebot Rejec 1988: 260).

Author	Characterization of acute	Characterization of circumflex
Vodušek (1961)	rising	falling
Toporišič (1968)	low in tonic, high in post-tonic syllable	high in tonic, low in post-tonic syllable
Neweklovsy (1973)	great differences in dialect realization, mainly low/rising	great differences in dialect realization, mainly high/falling
Srebot Rejec (1988)	See Figure 2.	See Figure 2.

Table 3. Acoustic characterization of Slovenian acute and circumflex tones.

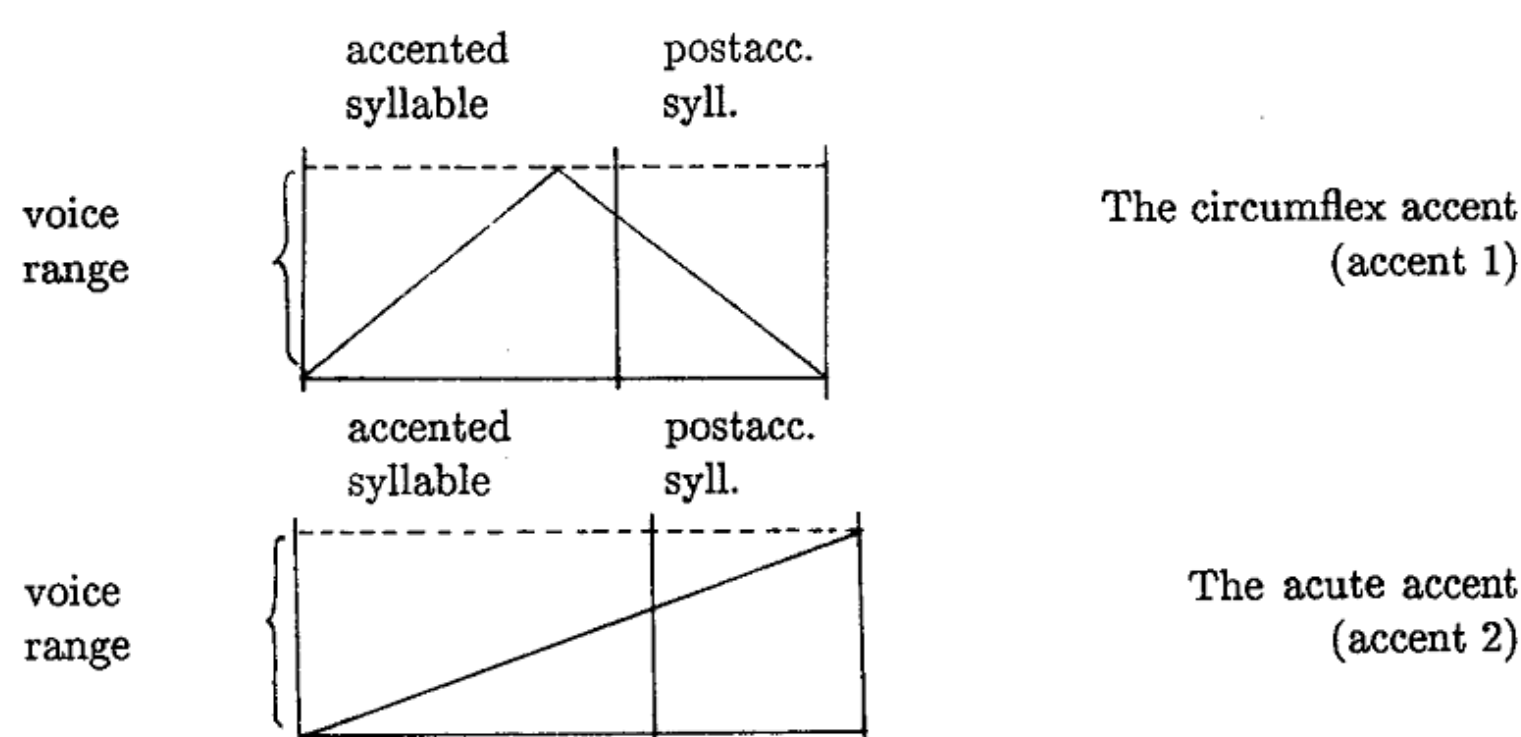


Figure 1. "Schematic contours of the circumflex and the acute accent on a barytone". Reprinted from Srebot Rejec 1988: 260.

In some dialects, lexical-tone contrasts are phonetically realized in three syllables. The research of Kanalska Dolina Valley speech of Zilja dialect (La Val Canale, Italy) by the author (2005, forthcoming) confirmed frequent proparoxitone realizations of the type L-L-H or L-L-LH for acute and H-H-L or H-H-HL for circumflex.

More recent research also included studies of **vowel duration** (Srebot Rejec 1988) and intensity. In respect to vowel duration, no statistically significant contrasts were yet discovered, although the experimental results revealed no difference in duration of traditionally long and short (stressed) vowels (Srebot Rejec 1988, Petek et al. 1996), with the only exception of /a/.

The **intensity** varies considerably more than fundamental frequency (among individual speakers). Figure 2 shows the averaged values of acute and circumflex *kila* (cf. Table 1) as uttered five times by a female speaker from southern Gorenjska. These data show much greater difference in the post-tonic syllable.

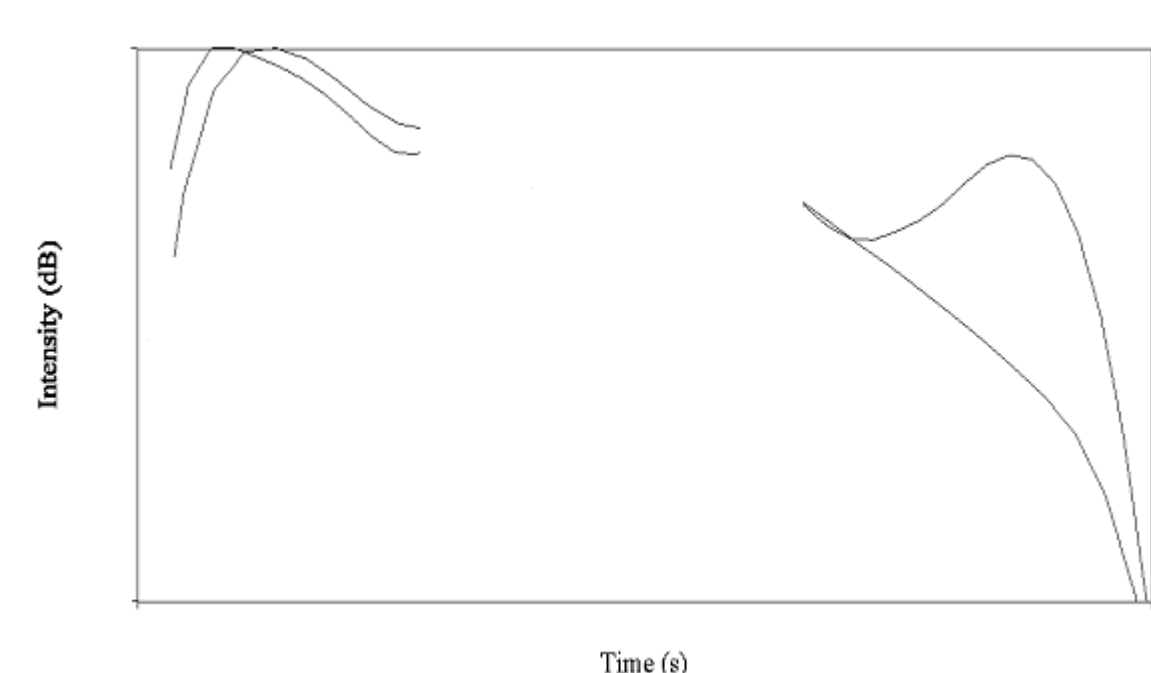


Figure 2. Intensity in [i] and [u] for five utterances of *kila* (acute is represented by the top and circumflex by the bottom line). Measurements were normalized (in time, and intensity).

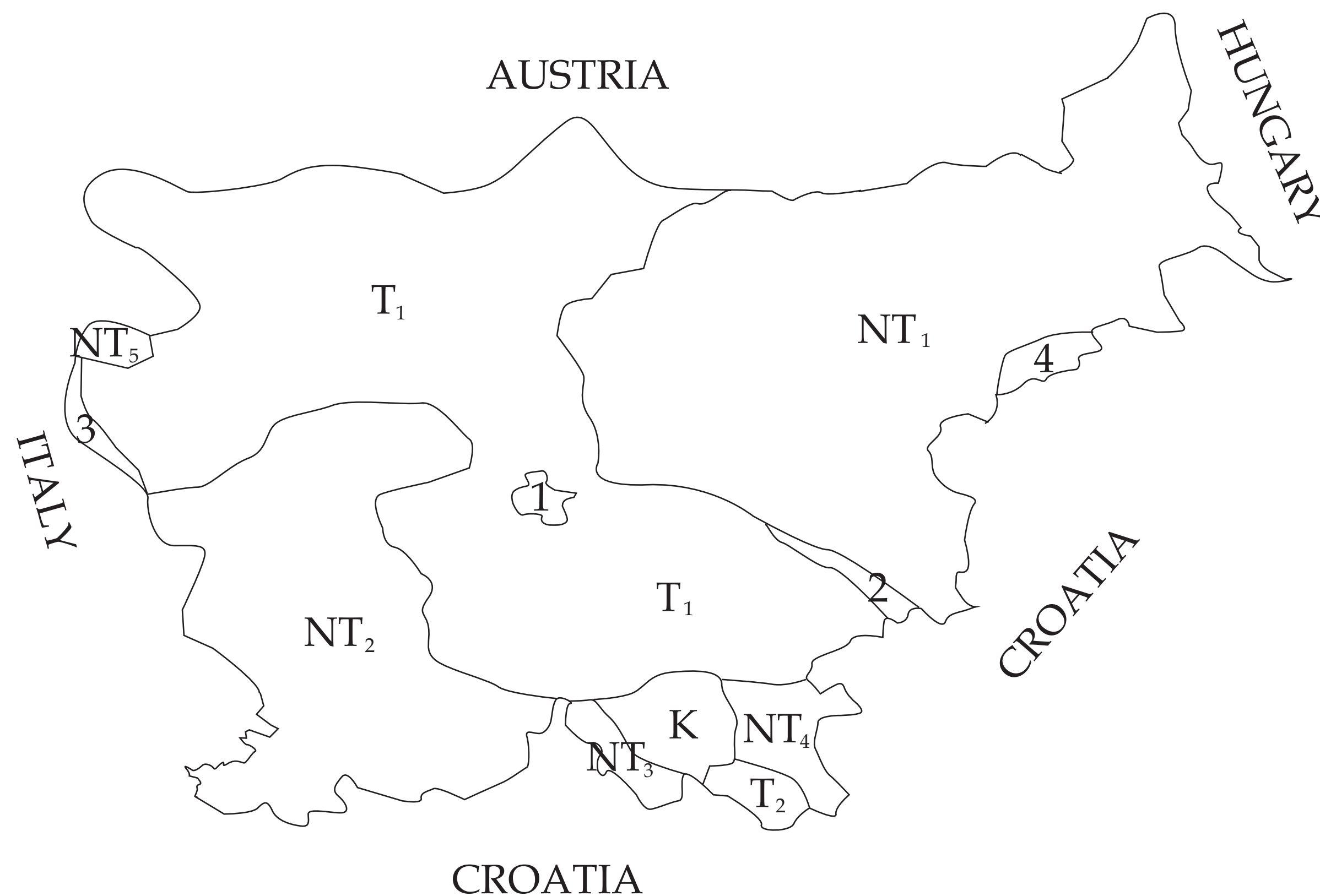
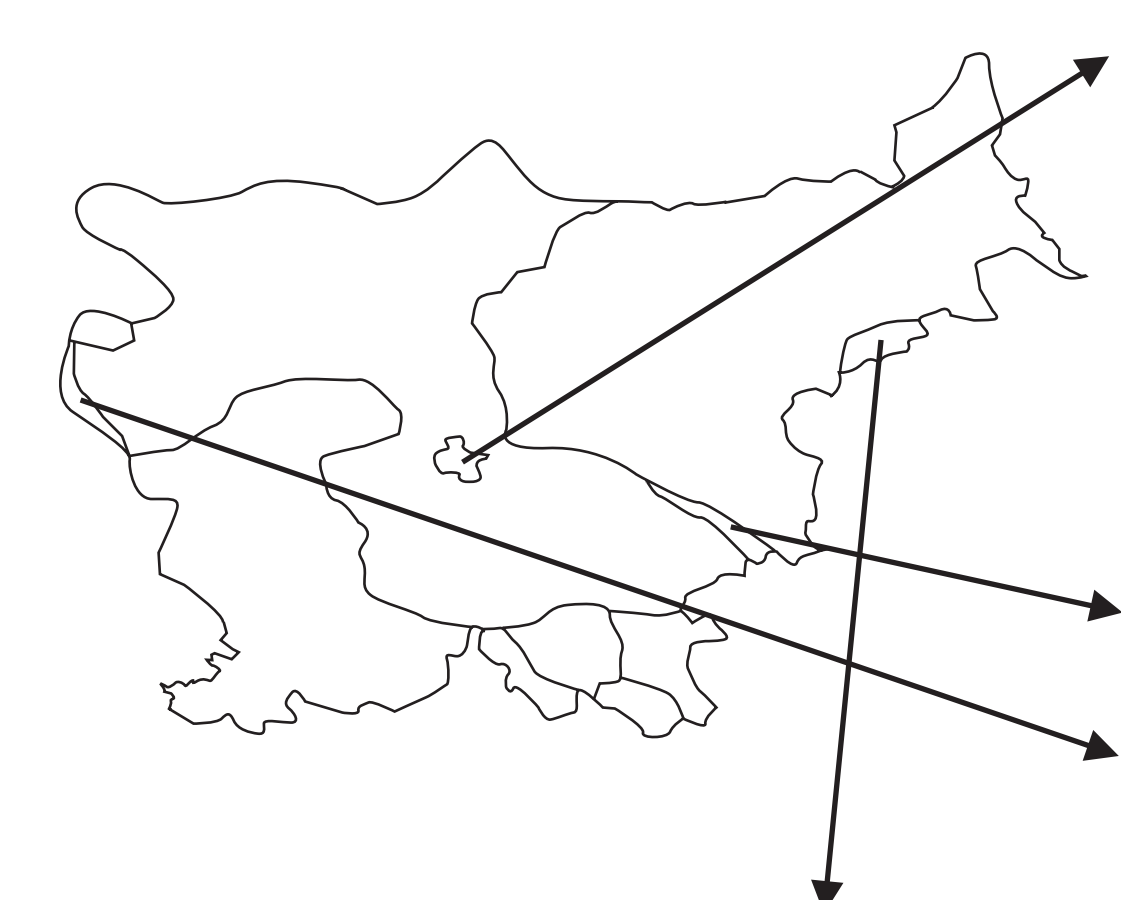


Figure 3. Slovenian speaking territory (The Republic of Slovenia and neighboring countries). T - tonal dialects, NT - non-tonal dialects. T1 - central tonal dialects (majority of Gorenjska and Dolenjska region, part of Rovte region, and Carinthian dialects in Austria), T2 - Southern Bela Krajina. NT1 - Štajerska, Koroška, parts of Gorenjska and Dolenjska region. NT2 - Primorska and part of Rovte and Gorenjska region. NT3 and NT4 - Southern Dolenjska dialects (non-tonal). NT5 - Dialect of Resia. K - Kočevsko, mixed area (German speaking before WW2). Areas 1-4 (areas affected by tone loss) are discussed in the text below. Revised from Rigler 1968: 196.

2 Tone loss and related processes in contemporary Slovenian

There are several seemingly unrelated processes of tone loss in Slovenian. In the following section phonetic and phonological (morphological, lexical etc.) will be discussed.

2.1 Phonetic data



The data of Srebot Rejec (1988, 2000) suggest that tone contrast is in process of neutralization in speech of educated Slovenian, living in Ljubljana, believed to be the most prominent in standardization process. The author also questions the relevance of vowel duration in Slovenian (cf. Petek et al. 1996). She concludes: "The lexical (phonological) function of the two accents is on the wane, while the phonetic characteristics, *the sing-song effect*, is retained." (Srebot Rejec 2000: 66, emphasis is mine.) It is this kind of sing-song effect, that was used in speech synthesis of Slovenian (Gros 2000). [The area is labeled 1 in Figure 3.]

Geographically, progressive loss of tone contrast is reported in Eastern Dolenjska region (Vera Smole, personal communication) [2], in Western Nadžica dialect (Roberto Dapit, personal communication) [3]. In the latter, this can be attributed also to decline in language competence and performance (to Italian and/or Friulian).

Lundberg (2003) examines tone loss in Eastern Halozce dialect experimentally and discovers no tonal contrast (e.g. in respect to Kajkavian pitch realization). [Halozce area is indicated by number 4 in Figure 3.] The contrast was previously reported by Zorko (1998).

Research by the author (2005, forthcoming) indicates not only two varieties of SS but also an intermediate class of speakers both from stressed- and pitch-accented dialects in origin. These do not have systematic pitch contrasts, evidently, but have a certain pitch contour on lexical level, independent of sentence intonation (called "sing-song effect" in Srebot Rejec 2005: 66). It is sometimes complemented by a progressive laryngealization in the form of creaky voice phonation (Jurgec 2005). Similar processes are extensively documented in tone languages.

In dialects, or in Standard Slovenian (Srebot Rejec 1988), where quantitative contrast is neutralized, the vowel is perceived as circumflex in tone. Traditionally, short vowels were also considered as circumflex (lacking the counterpart acute and short vowels).

2.2 Phonological data

Circumflex is considered non-marked phonologically. (Some of the reasons of its unmarkedness in contrast to acute will be discussed in the following section.)

The oxitones have no contrast (even in monosyllables) in some of Slovenian dialects (see Rigler 1980). Srebot Rejec 2000 corroborates this experimentally, although she recognizes the phonological contrast in speech of one (out of three) of her informants. In Standard Slovenian however, these contrasts are preserved.

The increasing number of frequent English loanwords in the late 20th century has circumflex tone by default (i.e. more than 80%, according to Jurgec 2004). These contribute to marginalization of acute tone (the frequency of acute in general is 37%, approx.). Figure 4 presents the difference in acute vs. circumflex lexical items in general lexica (Slovenian Orthography, 2001) and in neologisms (the archives of the Fran Ramovš Institute of Slovenian Language, N = 498).

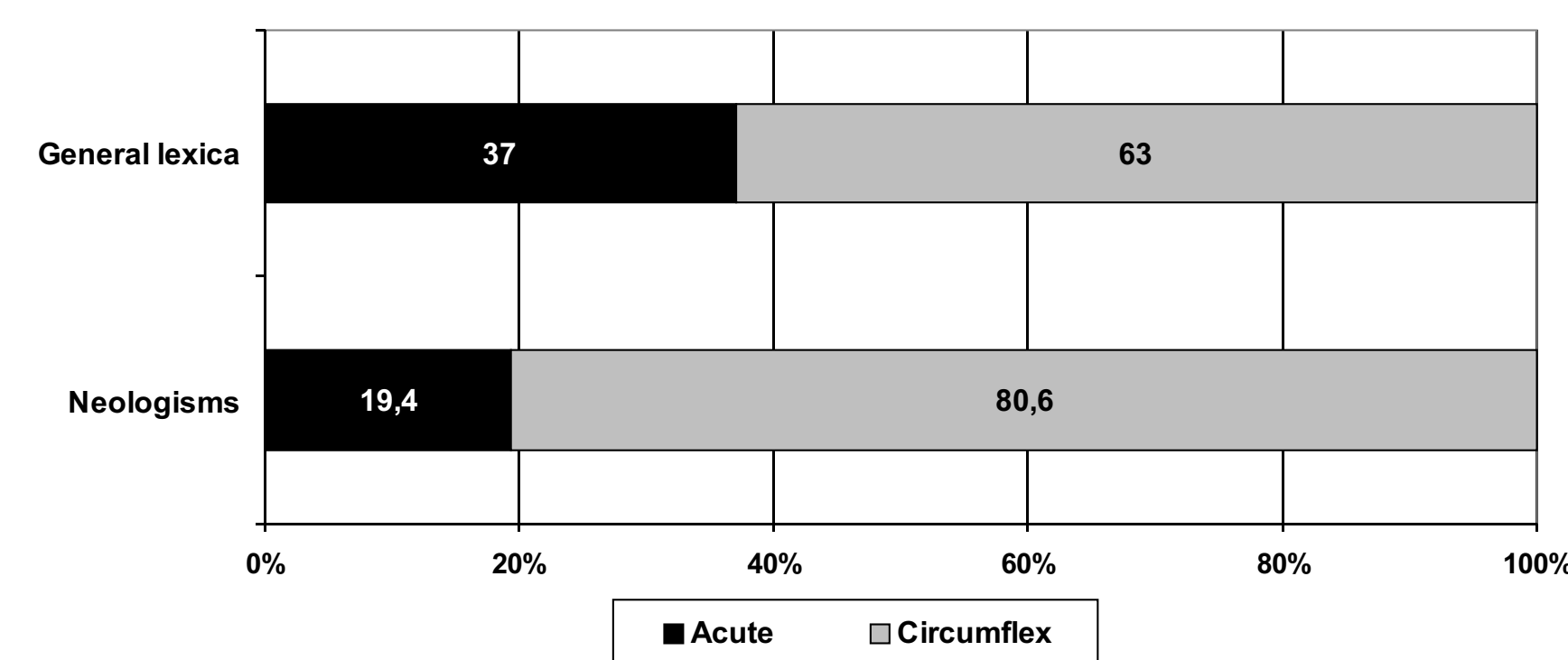


Figure 4. Percentage of acute and circumflex lexical items in general (in Slovenian Orthography, 2001) and in neologisms (the archives of the Fran Ramovš Institute of Slovenian Language, N = 498).

Morphologically, many acute basic forms have circumflex or variant circumflex or acute dependant forms, but never reverse, i.e. circumflex lexical items predominantly preserve tone morphologically. Examples are listed in Table 4.

Context	Word	Form
Gen. pl.	koza 'goat' ['kO:za]	koz ['kO:z]
Inst. pl.	brati 'brothers' ['bra:ti]	(z) brati ['bra:ti] / ['bra:ti]
Preas.	delati 'to work' ['de:lati]	delam ['de:lam]

Table 4. Examples of morphologically conditioned changes in lexical tone.

It is also worth noticing, that due to diachronic reasons (e.g. retraction of the acute tone, final lengthening of the acute) certain tones are limited to certain positions (or less likely to occur there). In connection to segmental variables, /o/ and /e/ are predominantly circumflex, while /O/ and /E/ are most commonly acute in tone.

There are no restrictions in monosyllables in regard to tone. In two-syllables, paroxitones are predominantly acute in tone. In three-syllables, paroxitones are predominantly circumflex in tone, while proparoxitones are in majority acute in tone.

3 Formant frequencies evidence

The extensive study of Standard Slovenian formant frequencies revealed considerable differences between the tonal and the non-tonal variety. The results will be presented in the following section.

A 241 one-, two- and three-syllable word corpus was compiled according to suprasegmental criteria (stress, tone and duration). The following phonological criteria was considered: number of syllables, position of the stressed vowel, stress, position of the unstressed vowel, quantity of the stressed vowel and tone of the long (also stressed) vowel. The preferred segmental structure was CV(CVCV), where C represents a consonant, ideally voiceless plosive, than obstruent and rarely sonorant.

Ten subjects were chosen (representative by sex, dialect of origin etc.), five of them with a contrasting lexical tone. Five speakers are from Central Slovenia, i.e. born and living in Ljubljana [i.e. area 1 in Figure 3], majority of the others have lived there at least for 4 years. The speakers were aged 35 in average, at the time of recording. Recordings were taken in studio of Department of Phonetics in Zagreb in March and April 2004. Sampling frequency of 44.1 kHz was used, at a 16-bit rate. The first four formants of a total of 5,960 vowels were measured semi-automatically using Praat (version 4.2.etc.). Typically, individual formant stable state was measured, where possible. Alternatively, central point, or averaged value of transient was measured. Standard Praat settings of LPC based formant estimates were used. Doubtful cases (4.59%) were dismissed as irrelevant. Altogether, 21,220 readings were acknowledged. Statistical analysis followed; average values, standard deviation and confidence intervals were calculated. Analysis of variance (ANOVA) was performed using Excel and SPSS programs. Data was averaged and plotted to F1-F2 diagrams (Figures 5 & 6).

The results proved the individual accent types to be much further apart in the tonal variety of Standard Slovenian than in the non-tonal (cf. Figure 5 for averaged values and Figure 6 for tonal vs. non-tonal variety). In the former, there were no statistically significant differences either in F1 or F2 between all three tones for /i/ and /@/ (0.155 < p < 0.27), or between acute vs. circumflex and short /a/. Elsewhere, contrasts are statistically significant at least in one of the formants, typically F2 for front vowels and F1 for back vowels (0.000 < p < 0.04). On the other hand, individual tone contrasts are statistically insignificant in both F1 and F2 (0.362 < p < 0.708) for all phonemes in the non-tonal variety of Standard Slovenian, with the exception of acute vs. circumflex and short /E/ in F2 (p = 0.004). The results prove some degree of dependency between fundamental and higher formant frequencies as well as still existing tonal contrast in pitch-accented Standard Slovenian.

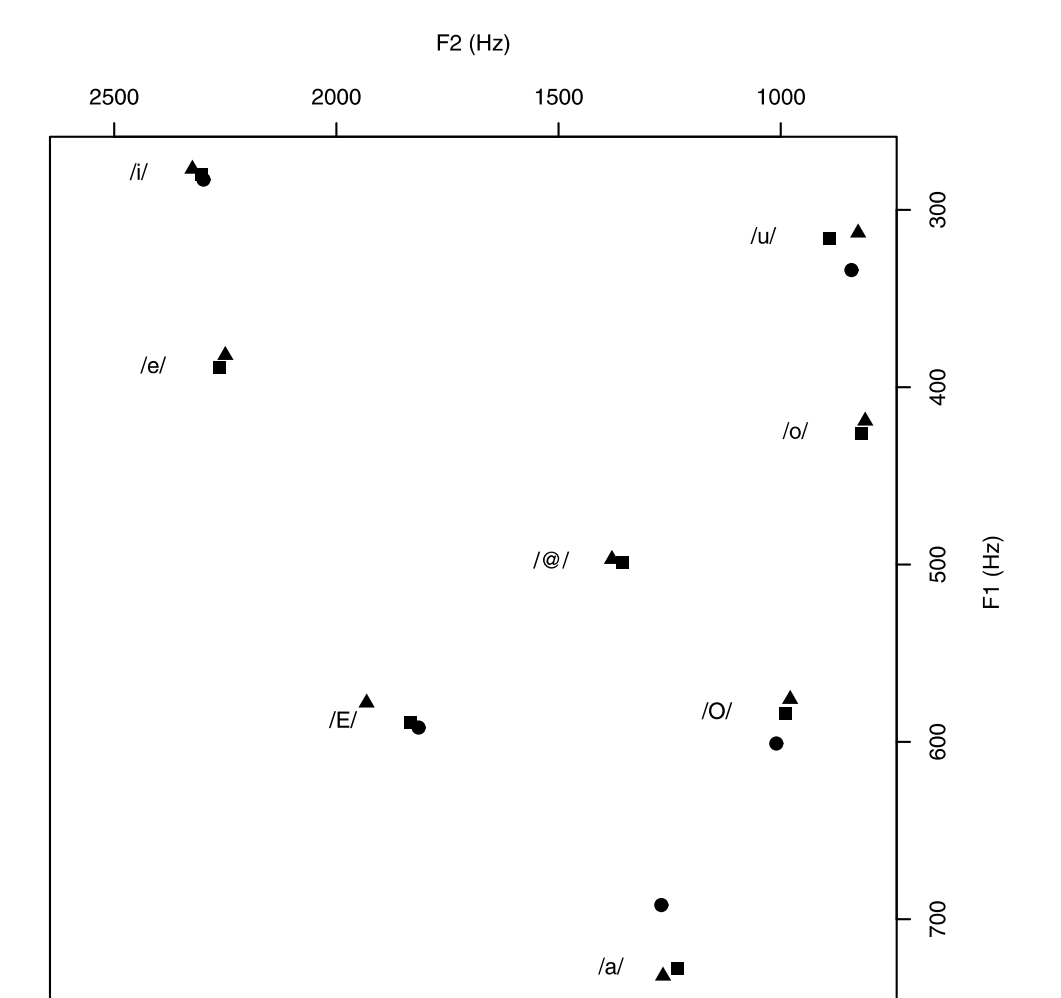


Figure 5. Figure 6. F1-F2 vowel space of Standard Slovenian, tonal and non-tonal combined (acute, circumflex, short).

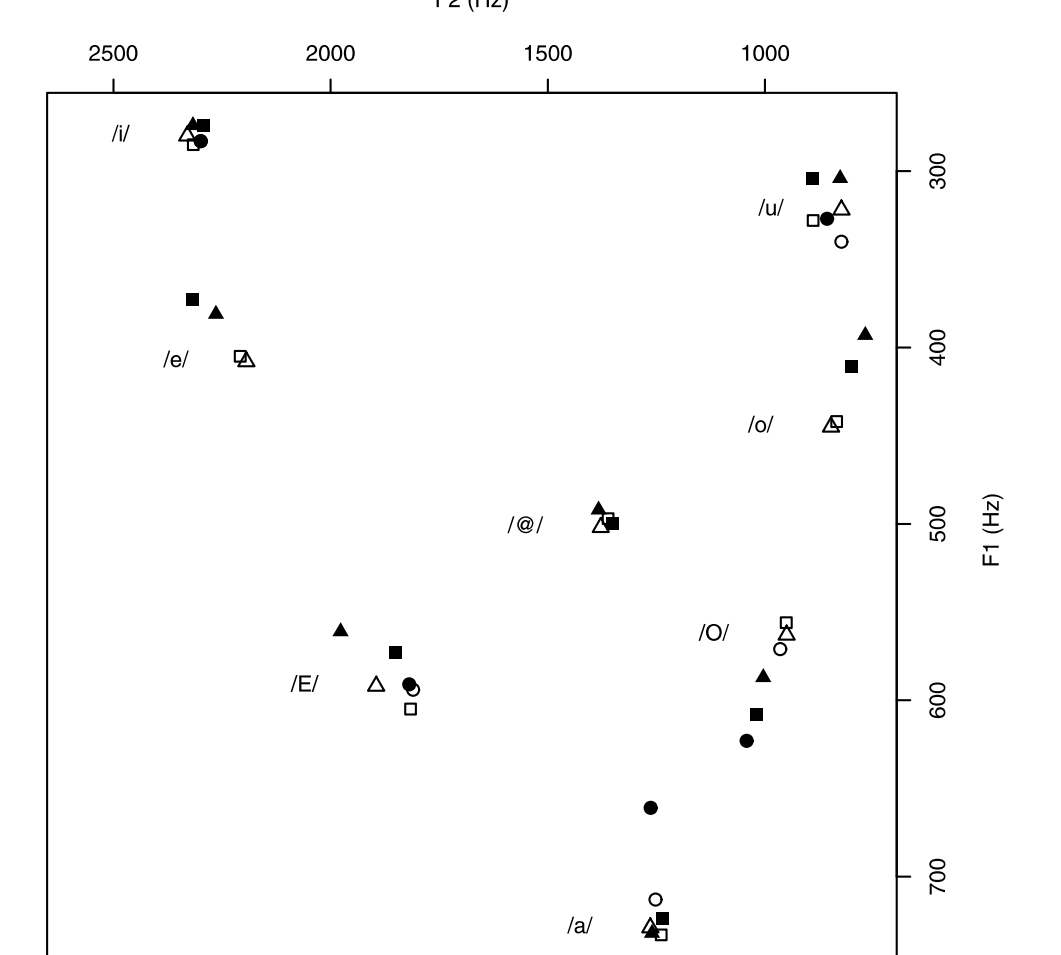


Figure 6. F1-F2 vowel space of non-tonal (acute, circumflex, short) and tonal (acute, circumflex, short) varieties of Standard Slovenian.

4 Conclusion

In typological perspective, Slovenian is a pitch-accented language, where tone contrast is limited to the stressed syllable. Only long vowels (and inherently short schwa) bare tonal contrast. For now, statistically significant differences in intonation, intensity and formant frequencies were acknowledged, while duration was considered non-significant. Duration is however, largely correlated to stress and phrase position (Srebot Rejec 1988; Zemljak 2004, for dialectal data).

While several processes of tone loss are in progress (or there are areas that have only recently lost tone contrasts, such as Halozce and Eastern Dolenjska), the tone is being preserved on the dialectal level. Phonologically, the most problematic is the realization in oxitones, where in several dialects, no contrast is found. As circumflex is the unmarked tone in Slovenian, it is found in vast majority of loan words.

On the other hand, the Standard Slovenian is being generally (theoretically and practically) reduced to stress-accented variety, as noted by Rigler (1968), non-tonal speakers "cannot learn" the morphological distribution of the tones in Slovenian. Furthermore, non-tonal variety is being nowadays regarded as more neutral, and thus being preferred in public use (cf. Tivadar & Jurgec 2003). Still, the pitch-accented variety of Standard Slovenian can be heard daily on the radio and television.

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