An Acoustic Analysis of Word Prosody in Ljubljana Slovene

A Senior Honors Thesis

Presented in Partial Fulfillment of the Requirements for graduation with distinction in Linguistics in the undergraduate colleges of The Ohio State University

by

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June 2006

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Background:

Slovene, also known as Slovenian, is spoken in Slovenia. Slovenia was once the northern-most republic of the former, socialist republic of Yugoslavia, and gained its independence in 1991. There are about two million speakers of Slovene, both in Slovenia and abroad, in neighboring Austria, Italy, Hungary, as well as in the United States, Canada, Argentina, and others.

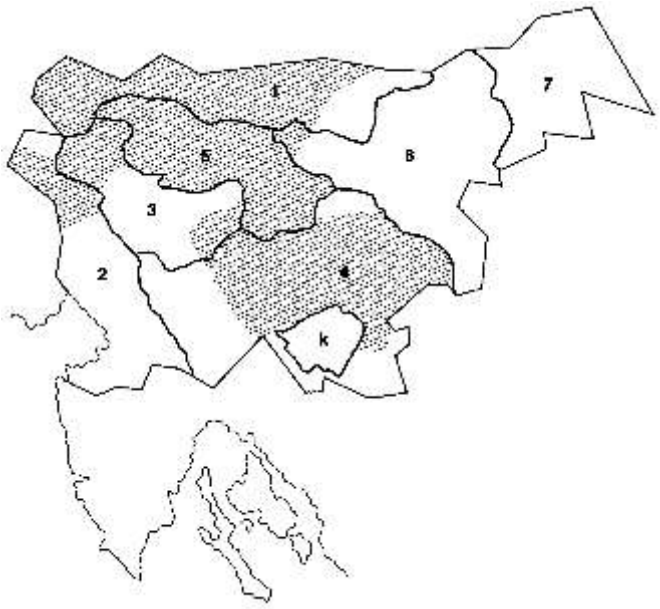
Slovene is closely related to Serbo-Croatian[1]. Both Slovene and Serbo-Croatian are Western South Slavic languages that are assumed to have evolved from a common ancestor. Word tones are present in many West South Slavic dialects. It is assumed that tone existed in Proto-West South Slavic, and at one point, the entire West-South Slavic linguistic area had word tone. Dialects with word tone are conservative, that is, they are the preserving the older prosodic system. Dialects without word tone today are innovative and have undergone a process of tone loss.

Some dialects of Slovene retain word tones and others do not. Slovene dialects that retain word tones can be referred to as "tonemic," and those which do not retain word tones can be referred to as "non-tonemic."

Non-tonemic varieties of Slovene are spoken in the eastern and western regions of the country (the unshaded region in Map 1). Non-tonemic dialects of Slovene are believed to have a length contrast on stressed vowels, as shown with the minimal pair *máh*, "moss," and *màh*, "smoke." Stress is contrastive in non-tonemic Slovene, and can occur on any syllable, as illustrated by the minimal triplet *góvori* , "speeches," *govôri* "speak!," and *govorí* "he speaks."

It is interesting to note that it looks as if there are two separate innovations here, as the non-tonemic regions do not connect in Croatia (see Alexander 2000; 22).

Traditionally, in descriptions of non-tonemic Slovene, the acute diacritic marks long vowels (é) and the grave diacritic marks short, stressed vowels (è). Unstressed vowels are not



Map 1: The tonal and non-tonal dialects of Slovenia, from Lenček 1982

1 Also referred to now as BCS, for Bosnian, Croatian, and Serbian, or BHS, for Bosanski, Hrvatski, and Srpski, which are the names of the languages in BCS. This naming convention came as a result of the political separation of Bosnia and Croatia from Yugoslavia (Later Serbia and Montenegro, and now, Serbia, and Montenegro).

marked with any diacritic. These conventions are used only in linguistic descriptions, and not in the standard orthography.

Tonemic Slovene is spoken in the central region of Slovenia, in Upper and Lower Carniola, Austrian Carinthia, the Upper Soča Valley, Slovene Venetia in Italy, and parts of Bela Krajina, as shown in the shaded region of Map1 (Srebot-Rejec 1). Tonemic dialects of Slovene, like non-tonemic dialects, have a length contrast on stressed vowels. However, unlike non-tonemic varieties, tone is contrastive on long, stressed syllables. This means that pitch can be used to distinguish between words.

Tonemic Slovene has two tones; one rising and one falling. Traditionally, in descriptions of Slovene, the acute diacritic marks the rising tone (é), the circumflex diacritic marks the falling tone (ê). For this reason, the falling tone is often referred to as the circumflex, and the rising tone as the acute. This convention is helpful at times, as dialects may preserve the distinction between the two but realize the accents differently. As in non-tonemic Slovene, the grave diacritic (è) marks short, stressed vowels (on which there is no tone contrast.) Also, like in non-tonemic Slovene, unstressed vowels are not marked. Again, these diacritics are only used in linguistic descriptions, and not in the standard orthography.

Since the Slovene dialects come in both tonemic and non-tonemic varieties, the standard language also permits two prosodic varieties. There is "a more conservative one, based on tone and quantity, which rests on the accentually more archaic Central dialects, and a more innovative one, based on quantity and stress (but not requiring tone), which acknowledges the evolutionary tendencies of the non-central dialects (Lenček 158)." The vowel system of both tonemic and non-tonemic standard Slovene is based on the Upper Carniola, specifically, the dialect spoken in Ljubljana, except for a few features (mainly raising o to u pre-tonically)(Greenberg 23). The Ljubljana dialect has a mostly monopthongal vowel system, including monopthongal reflexes of Old Slavic jat' and long o (Greenberg 23). The vowel inventory of both Standard Slovene and the dialect of Upper Carniola is as follows.

Long			Short		
i		u	i		u
e̯		o̯		e ə o	
	e o̯				
	a			a	

a, e, i, o and u may occur long or short in both Standard Slovene and the Ljubljana dialect. e̯ and o̯ are always long, and ə is always short. Traditionally, in linguistic descriptions (but not in the orthography) the raised e̯ and o̯ are written with a dot diacritic underneath them[2]. In the international phonetic alphabet, e̯ and o̯ can be assigned [e] and [o] respectively, and e and o can be labeled with [ɛ] and [ɔ]. Also, syllabic r can be added to this system, as it can also carry length and tone. The dialect spoken in Ljubljana is said to be tonemic (Greenberg 23).

The History of the Study of Tone in Slovene[3][4]

2 This is usually a solid dot, but for this paper a hollow dot will be used.

3 With the exception of information from Lehiste 1961 and Lehiste and Ivić 1986, the information from this section draws on the fuller presentation given in Srebot-Rejec 1988.

4 There have been other important studies on tone in Slovene that are not relavent to this paper, but are still valuable resources – See Lundberg 2001.

There is a tradition of studying tone in Slovene dating back to 1811, when Valentin Vodnik made its first mention. Since then, there have been a number of important investigations into the topic.

In 1863, Luka Svetec described the contrast not in terms of tone, but in terms of intensity. The contrast was described in terms of the location of the intensity peak over the stressed syllable (and, if applicable, the following syllable.) On non-final syllables, the acute was said to have an intensity peak in the post-accented syllable, and the circumflex was said to peak in the accented syllable. On word-final syllables, the intensity was said to peak early in the accented syllable in the circumflex, and late for the acute.

Father Sanislav Škrabec also described the contrast in terms of intensity in 1866. His work is notable because he was the first to mention the effect of sentence intonation on word accent, and that sentence intonation can neutralize the contrast in certain contexts. Also, Škrabec noted that vowels with the acute accent are longer than vowels with the circumflex accent.

The use of intensity here rather than tone could have something to do with the inherent connection between intensity and tone, as it is more than likely that Svetec and Škrabec were describing a tone contrast here.

In 1897, Matija Valjavec described the contrast in terms of pitch, not intensity. He noted that the tone is not realized only over the accented syllable, but over the post-accented syllable as well. He stated that the circumflex tone starts high over the accented syllable and falls over the post accented syllable, and the acute tone starts low over the accented syllable and rises over the post-accented syllable.

Olaf Broch, a Norwegian scholar, studied Ljubljana Slovene. He described the contrast both in terms of pitch and intensity. He described the acute as low tone, and the circumflex as high tone. Also, he noted that in fast speech the tone contrast could be neutralized.

In 1935 Fran Ramovš described the contrast in terms of tone shape. He described the circumflex as "concave" (with a falling then rising contour, which is referred to as "convex" in this paper) and the acute as convex (with a rising then falling contour, which is referred to as "concave" in this paper)[5].

The first scholar to use instrumental techniques was France Bezlaj in 1939. He used a kymograph to measure voice fundamental frequency. Bezlaj noted the lack of tonal minimal pairs in the language, which is still an issue today. His study consisted of two hundred words, including words with word-final stress and non-final stress. His findings were that for the circumflex tone, 70 per cent of his tokens had rising tone over the first half of the word and falling over the second half. 20 per cent were level with a fall over the second half of the word, and only 10 per cent were falling throughout. 50 per cent of the acute tokens were rising throughout, 25 per cent had a small initial fall followed by a rise, and the remaining words had a falling contour over the second half of the word. It is important to note that most of the circumflex tokens had word-final stress, and most of the acute tokens did not.

In 1961, Božo Vodušek studied Slovene accent in a number of tonemic dialects, including standard Slovene as spoken in Ljubljana. His findings supported much of the previous research, and confirmed that word finally, the contrast is one of height, and otherwise the contrast is realized over both the stressed syllable and the post-accented syllable.

Lehiste conducted a small study on Slovene in 1961. Lehiste's study consisted of one informant from the city of Ormož. Her informant was interviewed in Standard Slovene, not in her native dialect. She appeared to make a contrast consistent with tonemic varieties of the language in the sense that there were both long and short vowels, and there was also an additional two way contrast on long, stressed vowels. In non-tonemic varieties of Slovene, there are only long and short vowels, and there is no additional contrast on long vowels. However, Lehiste found that this contrast was not one of pitch. Instead, it was one of the nature of stress. Stress

5 In this paper, Srebot-Rejec's use of the terms "convex" and "concave" will be used, with convex meaning falling then rising, and concave meaning rising then falling. Srebot-Rejec and Ramovš use the terms differently.

on long syllables could be either simple (one peaked) or compound ("characterized by two peaks of energy (60)").

This study illustrates one important issue that may arise when dealing with a standard language. Lehiste's informant's native dialect should not retain tone, as Ormož is near Slovenia's eastern boarder with Hungary, and falls well within the non-tonemic region. It appears that the speaker was trying to make a contrast like the tone contrast found in tonemic standard Slovene, but instead of making a contrast of tone, she made a contrast of type of stress. Perhaps this is because she does not natively have tone, and she interpreted the two way contrast on long vowels differently than a tonemic speaker would. This could be because of the nature of a standard language. Standard languages are usually learned in school past the point of native language acquisition. This is unlike dialects of a language, which are acquired from birth to a native level of fluency. A standard language, then, will be spoken a bit differently depending on the characteristics of each speaker's native dialect. Speakers of standard Slovene from Ljubljana, who speak dialect that very similar to the standard language, will speak the standard language differently than speakers of dialects that differ greatly from the standard. Ljubljana native have less to change in their speech to sound standard than speakers from other regions. Lehiste's informant certainly did not have the tone contrast in her standard speech, but she almost certainly did not have tone in her dialect. This suggests that a lack of tone in ones dialect translates into a lack of tone in the standard.

Jože Toporišič, an authority on the Slovene language, also conducted phonetic research on Slovene. In 1968, he studied the speech of a speaker from Lower Carniola. He stated that the contrast is one of tone height, and not tone shape, and that the tone contrast is realized only over the tonic syllable.

Srebot-Rejec's 1988 study is the largest phonetic study done on Slovene as spoken by Ljubljana natives to date. Her study investigated word prosody, vowel duration, and sentence prosody in Standard Slovene as spoken by 3 male Ljubljana natives who are referred to as Ju, Ka, and Pi. Her corpus consisted of 178 nonsense words to investigate vowel duration, 125 words read in isolation, 22 sentences, 5 lexical minimal pairs, and 7 morphological minimal pairs, along with a few more words to investigate vowel duration. Wide band spectrograms were used to measure vowel duration, and narrow band spectrograms were used to measure F0 contours.

Accent was not only analyzed acoustically. Srebot-Rejec also employed the help of two authorities on Slovene tone to help classify words as having either circumflex or acute tone. Her experts were both professors of Slovene who were instrumental in assigning tone to entries in one of the two major dictionaries of Slovene, the SSKJ (Slovar Slovenskega Knjižnega Jezika – Dictionary of the Slovene Literary Language). Srebot-Rejec states that, when listening for tone, one of her experts "listens to both the accented and post-accented syllable" where applicable, and word finally, and also "listens to both pitch and contour (14)." Her other expert "concentrates on the pitch contour of the accented syllable, regardless of whether there is a post-accented syllable or not (14)." This expert feels that tone shape, not tone height, is the contrastive factor. It is important to note that both experts were given the same data, which included both the tonic and post-tonic syllables.

Srebot-Rejec defines Slovene accent in terms of a "jump" between the tonic and post-tonic syllable. If the F0 "jumps" up across the syllable boundary, then the tone is interpreted as rising and therefore acute. If the F0 "jumps" down, then the tone is interpreted as falling and therefore circumflex (Srebot-Rejec 16). The acute tone starts low on the tonic syllable, and rises through the post tonic syllable. The circumflex tone is the opposite, and starts high over the tonic syllable and falls through the post-tonic syllable. On word-final tonic syllables, the tone contrast cannot be realized in terms of a "jump," as there is no post-tonic syllable. In this case, the tone must be realized in terms of shape and height over the tonic syllable alone.

In the past it had been thought that there is a secondary length distinction between the two accents, with the acute being slightly longer than the circumflex (76). However, in her study, it

turned out that this is not the case, and that there was in fact no notable correlation between length and either of the tones.

The question of word-final tone is an interesting one. It is clear that when a post-tonic syllable is present, tone is realized over both the tonic and post-tonic syllable. word-final tone cannot be realized in this way. Srebot-Rejec found that when word-final tone is retained, it is realized in terms of the "steepness of the rise and vowel length (61)." The word-final circumflex accent was "a little shorter, steeper, and has a wider pitch range" than an acute accent in the same position. All of Srebot-Rejec's words were read in the position in two similar frame sentences, *Reci ____ enkrat, ne dvakrat;* "Say ____ one time, not two times," and *Reci ____ dvakrat, ne trikrat;* "Say ____ two times, not three times." The fact that these words were all read in the same sentence position could account for the fact that all of the monosyllabic words had rising intonation, as it is possible that speakers were producing some sort of phrasal rise over the target words.

However, word-final tone was only contrastive for one of her three speakers. The other two speakers, on the other hand, "practically do not use the acute accent on oxytones any longer (79)."

Possibly the most interesting finding in the study is the inconsistency with which words were assigned either circumflex or acute tone. The tone interpreters disagreed on which accent to assign certain tokens. So, in some cases, one interpreter would classify an utterance with the acute tone and the other with the circumflex, or vise versa. They also classified some tokens as 'unaccented,' 'less distinct,' or 'ambiguous.' "Typical circumflexes and acutes are perceived by both (61)" of the listeners as expected. By typical, Srebot-Rejec means with a significant positive "jump" for the acute accent and a negative "jump" for the circumflex accent. In the gray area, though, they seem to have the opposite opinion, with one nearly always choosing circumflex and the other acute for these tokens (61). For Ka, one of her informants, "only a good third of the expected acutes are such realized as acutes, while 2/3 of the expected circumflexes are realized as such (65)." This is a considerable difference in opinion between the two interpreters.

It seems that canonical accent played a role for the interpreters, although it was not the only factor in their decisions. Srebot-Rejec's experts were no doubt biased towards canonical tone, as they were both involved in assigning tone to words in the SSKJ. However, canonical accent was not always assigned, so the two listeners were able to deviate from the prescribed tones. Phonetically acute contours were interpreted with over 90% accuracy by both, but phonetically circumflex contours were interpreted with notably less accuracy; ranging from 32% to 82% depending on the speaker. It seems that "it is not only expected accent" that plays a role for the two, as phonetically acute accents were nearly always interpreted as acute, regardless of the canonical tone (Srebot-Rejec 70-74).

The speakers themselves also seemed to disagree a fair amount on the subject. For Ju, all canonically acute words are realized as such, but only 1/3 of expected circumflex words are. With Ka, though, more than half of the expected acute words have circumflex tone (Srebot-Rejec 75).

Lehiste and Ivić, on their work on the Neo-Štokavian variety of Serbo-Croatian, performed listening tests on the different tones to determine the consistency with which they can be perceived. A number of perceptual tests were performed, but one in particular seems most comparable to the informal accent identification done in Srebot-Rejec's study. Lehiste and Ivić made a randomized tape of recorded tokens and played them back to their main informant (Ivić himself). Ivić could identify the accent patterns of all of the words (92).

Although there is a considerable difference in methodology between the perceptual tasks of the two studies, the difference between the native speakers' perception of tone in Slovene and in Neo-Štokavian is still interesting. The results may shed light on the outlook for tone in Ljubljana. There is no evidence that tone is being lost in Ivić's dialect of Neo-Štokavian, and the accents were perceived with nearly perfect accuracy. There is, however, evidence of tone loss in

Ljubljana, and Srebot-Rejec's experts disagreed considerably and even identified certain forms as "unaccented." This suggests that tone perception is linked with tone loss.

Tone change in Slavonian may parallel tone loss in Slovene. The Slavonian dialect of Serbo-Croatian is spoken around the Croatian city of Osijek. This dialect was also studied by Lehiste and Ivić. At the time of the study, the dialect preserved a five way tone contrast. There was a three way contrast on long, stressed syllables, and a two way contrast on short, stressed syllables.

The Slavonian dialect has an accent pattern that is transitional between the older system found in Čakavian and the Neo-Štokavian pattern. Lehiste and Ivić state that there are several steps involved in changing from Slavonian's more conservative system to the innovative Neo-Štokavian system. The distinction between Slavonian's two falling accents must be neutralized to one falling accent, that is, that of the long falling accent. Non-initial stress must be shifted back (towards the beginning of the word) one syllable. Also, "disyllabic sequences must be created with high pitch and intensity on both the formerly pre-tonic syllable and the formarly accented syllable (91)."

Their informants were in different stages of these steps, and all showed the beginnings of a shift to the Neo-Štokavian accent system. Also, the same speaker produced different variations of words in different stages of the change. One speaker, for example, pronounced the word for "water," *voda*, with both the Slavonian pattern and the shifted Neo-Štokavian pattern in different utterances. Basically, the accent system in Slavonian at the time was in a state of variation, with evidence of innovation in the system.

The speakers in Srebot-Rejec's experiment show a similar alternation. Speakers produced forms consistent with tonemic and non-tonemic Slovene, just as Slavonian speakers produced forms consistent with both Čakavian and Neo-Štokavian Serbo-Croatian. Ljubljana Slovene in 1988 was in a state of variation, and therefore, was most likely undergoing a process of tone change.

Since Srebot-Rejec's study is nearly twenty years old, the situation in Ljubljana could have changed considerably since then with regard to tone. If speakers were losing tone then, it is possible that tone is completely lost now. In fact, there have been accounts of speakers from the city without tone distinctions (Greenberg 160). This suggests that more analysis should be done to determine what the status of tone in Ljubljana really is today. The original goal of this study was to determine if tone is contrastive for younger speakers of Ljubljana Slovene, and if so, what the nature of the contrast is.

Methodology

The original goal of the study was to elicit read speech in the Ljubljana dialect of Slovene. However, this turned out to be rather unnatural for the consultants. Dialect forms are rarely written in Slovene outside of linguistic descriptions, and the act of reading is heavily tied to standard Slovene. For this reason, read speech was elicited in standard Slovene with the assumption that a tone contrast in one's native dialect will translate to a tone contrast in one's standard language. Speakers were also recorded having semi-spontaneous conversations with each other in their dialect.

The purpose of the read speech was to give clear figures of target words to serve as a starting point to analyze the dialect speech. In read speech, words are usually more carefully articulated, and therefore give a clearer picture of what the sounds of the language are. Also, the environment of the target word can be controlled. Sentence prosody and word prosody interact, so the word tones will be realized differently in different positions in the sentence. Controlling the prosodic environment of the target word ensures that the sentence's influence will be the same so that the shapes of the word tones themselves can be studied and compared.

Two word lists were used. The first was created by Peter Jurgec, a phonetician and a native of Slovenia. This list (attached in Appendix A) consists of a number of expected tonal minimal pairs as given in the dictionary (the SSKJ). The target words are given in sentences to give a context in order to ensure the desired word is pronounced as the minimal pairs are spelled the same. In the list that appears in the appendix the minimal pairs are labeled as acute or circumflex. This information was left in the list for this paper, but was not given to the consultants. Only the sentences were present in that list.

It was necessary to use another list, as the first list did not control for the environment of the target words. Three minimal pairs were selected from the first list to create the list given in Appendix B. This list consists of a prompt sentence that gives a context (in order to ensure the correct word is pronounced, as these are minimal pairs and they are spelled the same in the orthography), followed by the target word embedded in a carrier phrase either sentence initially, sentence medially, or sentence finally. This way the prosodic and lexical context of the target word is controlled so the prosodic realization of the minimal pairs can be easily compared. It is important to control the prosodic environment of the target word because the word tones will be realized differently depending on their location in the prosodic phrase, that is, in the sentence. It is important to control the lexical environment because if word tone is present for a speaker, different words around the target word will have different word tones, and this could have an effect on the realization of accent in the target word.

The speakers were then recording having one on one, semi-spontaneous conversations in their dialect with each other about pictures in a picture book.

All recordings were made in December 2005. All consultants consider themselves natives of Ljubljana, and were between the ages of 21 and 27. A total of 6 individuals were recorded, four male and two female. Consultants were recorded either in a quiet room or a recording studio using a hand held, unidirectional microphone directly to a laptop computer. All recordings were made using Praat, and all analysis was done with Praat.

Speaker M1 is 27 years old. His mother is from Ljubljana and his father is from Celje. He speaks English fluently, and also has some competency in German and Russian. He attended the University in Ljubljana, and now he is a journalist and also runs a radio station in Ljubljana.

Speaker M2 is 21 years old. His mother is from Ljubljana and his father is from Maribor. He speaks English fluently as well, an also has some competency in German. He is a student at the University in Ljubljana.

Speaker M4 is 27 years old. He lived in Ljubljana until the age of 18 and currently lives in Ljubljana. His mother is from Celje and his father is from Ljubljana. He lived in New Zealand for two years and in Serbia for two years, and he speaks English and Serbo-Croatian fluently. He played rugby professionally, and now he is studying to become a pilot.

Speaker F2 is 27 years old. Her mother is from Belgrade and her father is from Ljubljana. She speaks English and German. She is a recent graduate from the University in Ljubljana, where she studied Slovene.

Results

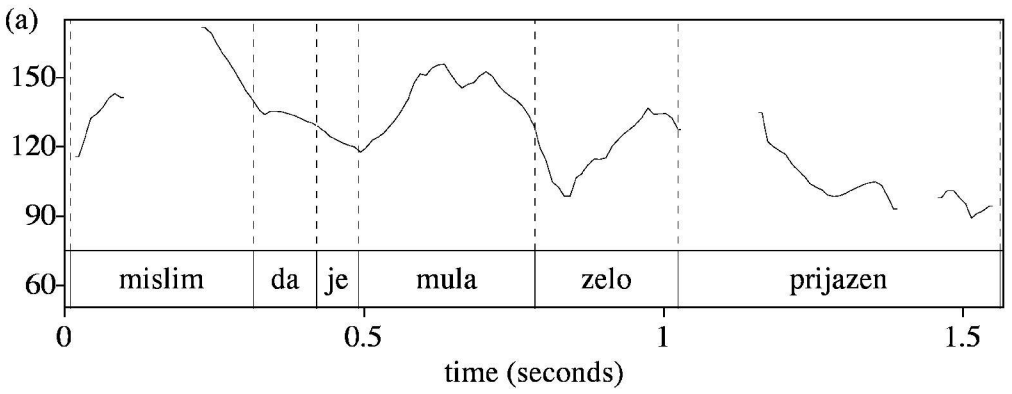
All of the figures given in this paper come from recordings of the list given in Appendix B. Since the word tones are realized differently in different parts of the prosodic phrase, they need to be looked at in various contexts. Expected acute and circumflex tones will be compared in phrase-medial, phrase-initial, and phrase-final position.

The Contrast on Disyllabic Words

The tone figures for disyllabic words are lined up at the syllable boundary. This is because the salient feature to the tone contrast described by Srebot-Rejec was the relative height

of the tone between the end of the first syllable and the beginning of the second syllable.

The minimal pair *mula* was chosen because it contains only sonorants, and therefore pitch can be tracked throughout the entire word. *Mûla*, with an expected circumflex accent, means "Muslim leader," and *múla*, with an expected acute accent, means "mule."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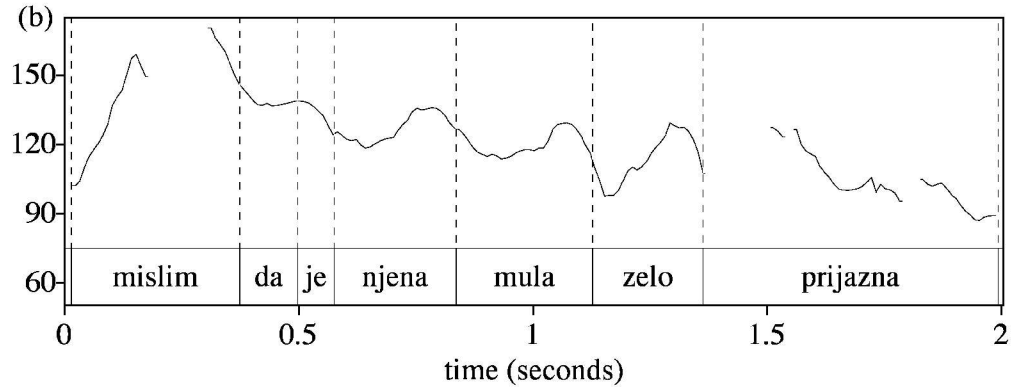
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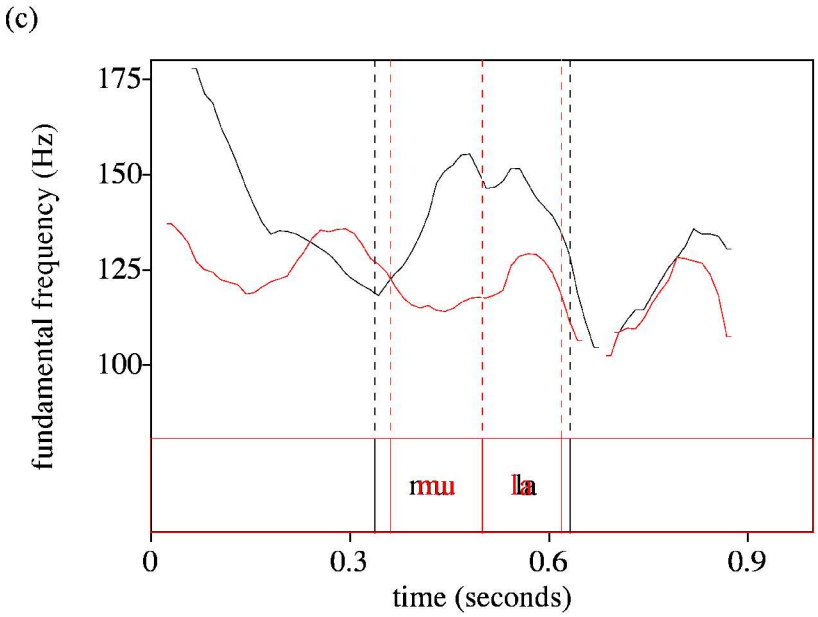
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Figure 1a : Mislim da je Mûla zelo prijazen[6].
Figure 1b : Mislim da je njena múla zelo prijazna.
Figure 1c : M2 - *mula* in phrase-medial position, from the sentences
Black: Mislim da je Mûla zelo prijazen[7].
Red: Mislim da je njena múla zelo prijazna.

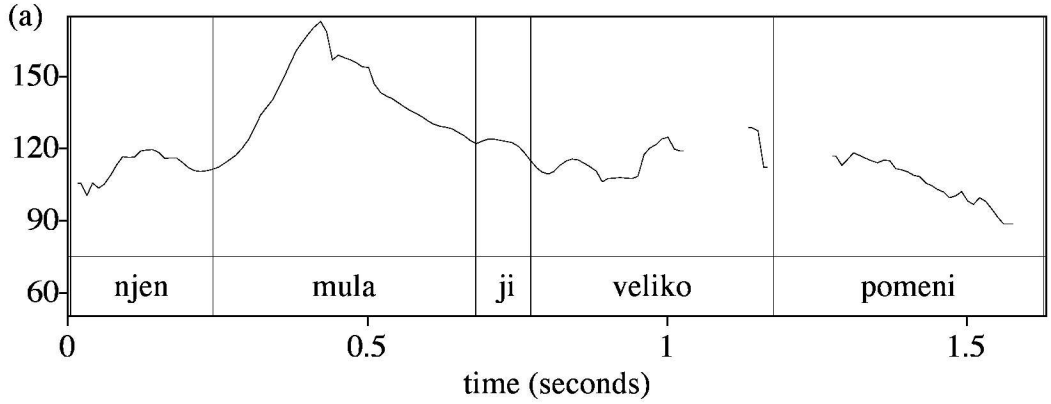
From figure 1c, it looks like M2 is making a clear distinction between the two tones. The circumflex accent in Figure 1 clearly peaks in the tonic syllable and falls through out the post-tonic syllable. The acute accent, on the other hand, is low over the tonic syllable and peaks in the post-tonic syllable. This is consistent with what has been described by Srebot-Rejec and others about the contrast. Also, the circumflex is concave over the tonic syllable (with a rise then a fall) and the acute is convex over the tonic syllable (with a fall then a rise). This is consistent with Ramovš's description of the contrast.

Phrase-medially, the intonation of the sentence is at its peak. This allows for the clearest realization of the word tones, as the phrase intonation does not limit the maximum height of the pitch. This accounts for the clear, expected realization of the tones here.

The words surrounding *mula* in the two sentences also have word tone. The sentence containing the circumflex *mula* is shown in figure 1a, and the acute, in figure 1b. The rise right before the acute *mula* is the post-tonic rise of *njéna,* which has an acute accent. There is no corresponding rise before the circumflex *mula* because the sentences are not exactly the same. The unstressed clitic *je* precedes *mula* here, which does not have an underlying tone. *Je* has a falling contour here. This could be because low tone can mark a word boundary in Slovene. It looks like there are high tones ancored to the second syllable of *mislim,* to *da,* to the post-tonic syllable of *njena*. This explains rises over these syllables. It also looks like there is some downstepping here, as each peak is a bit lower than the peak before. The low before the target *mula* can be explained as a phrasal boundary. Then, it looks like there is a rise tied to the second syllable of *zelo*, and a fall tied to the second syllable of *prijazen*. More work needs to be done to determine if this is indeed the case.

6 These sentences were both intended to be *Mislim da je njen(a) mula zelo prijazen*. A type-o in the word list that was not noticed in time caused them to differ; However, for the purposes of this paper, the phrasal position of the target words are not greatly impacted because of this mistake.

7 These sentences were both intended to be *Mislim da je njen(a) mula zelo prijazen*. A type-o in the word list that was not noticed in time caused them to differ; However, for the purposes of this paper, the phrasal position of the target words are not greatly impacted because of this mistake.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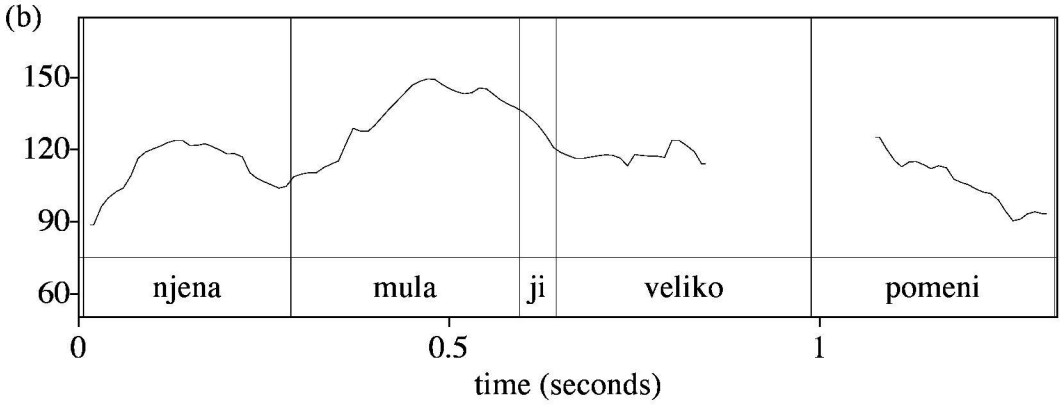
ji
veliko
pomeni
0
0.5
1
1.5
time (seconds)


(b)
150
120
90
60
njena
mula
ji
veliko
pomeni
0
0.5
1
time (seconds)

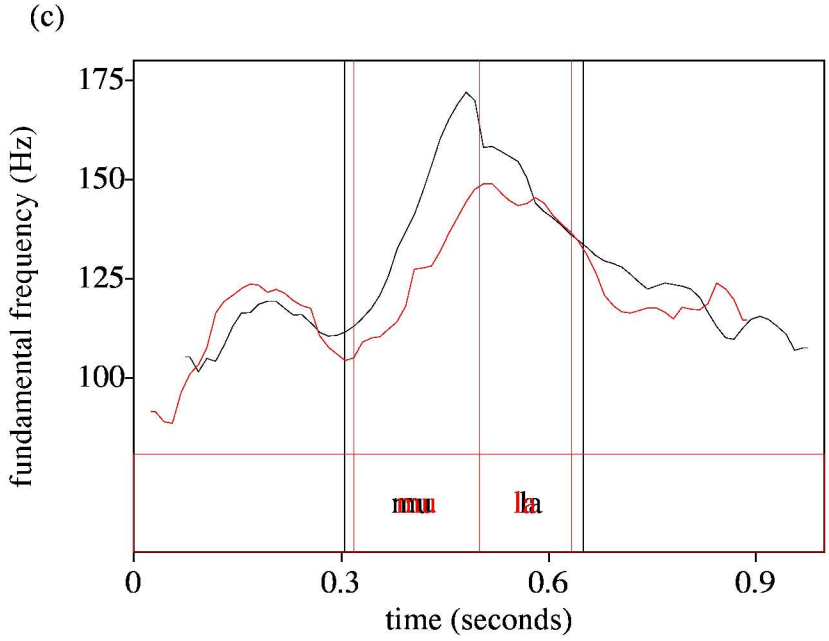

(c)
fundamental frequency (Hz)
175
150
125
100
mu
la
0
0.3
0.6
0.9
time (seconds)

Figure 2a: Njen Mûla ji veliko pomeni.
Figure 2b: Njena múla ji veliko pomeni.
Figure 2c: M2- *mula* in initial position. From the sentences:
Black: Njen Mûla ji veliko pomeni.
Red: Njena múla ji veliko pomeni.

As shown in Figure 1c, it looks like here, in phrase-initial position, there is a rise in the sentence intonation over *mula* that is causing both the acute and circumflex to have a rise over the tonic. However, there is still a difference in the tone contour of the two words. The circumflex accent has a high peak in the tonic syllable and falls sharply throughout the post-tonic syllable. The acute accent peaks late in the tonic syllable and stays high through the post-tonic syllable, with a less sharp fall through the end of the post-tonic syllable. This is what is expected to happen to the tones when they are both under the influence of rising phrase intonation.

Figures 1a and 1b show the F0 contour of the surrounding sentences, a showing the circumflex and b the acute. It looks like, in both cases, there is a rise ancored to *njen(a)*. Also, it looks like there is a slight fall between *njen(a)* and *mula*. This could be because low pitch is singles word boundaries. Again, more work needs to be done in order to understand exactly what is going on here.

In order to understand how the word tones are realized phrase-finally for M2, first it is important to understand what the word tones, if present, should look like phrase-finally.

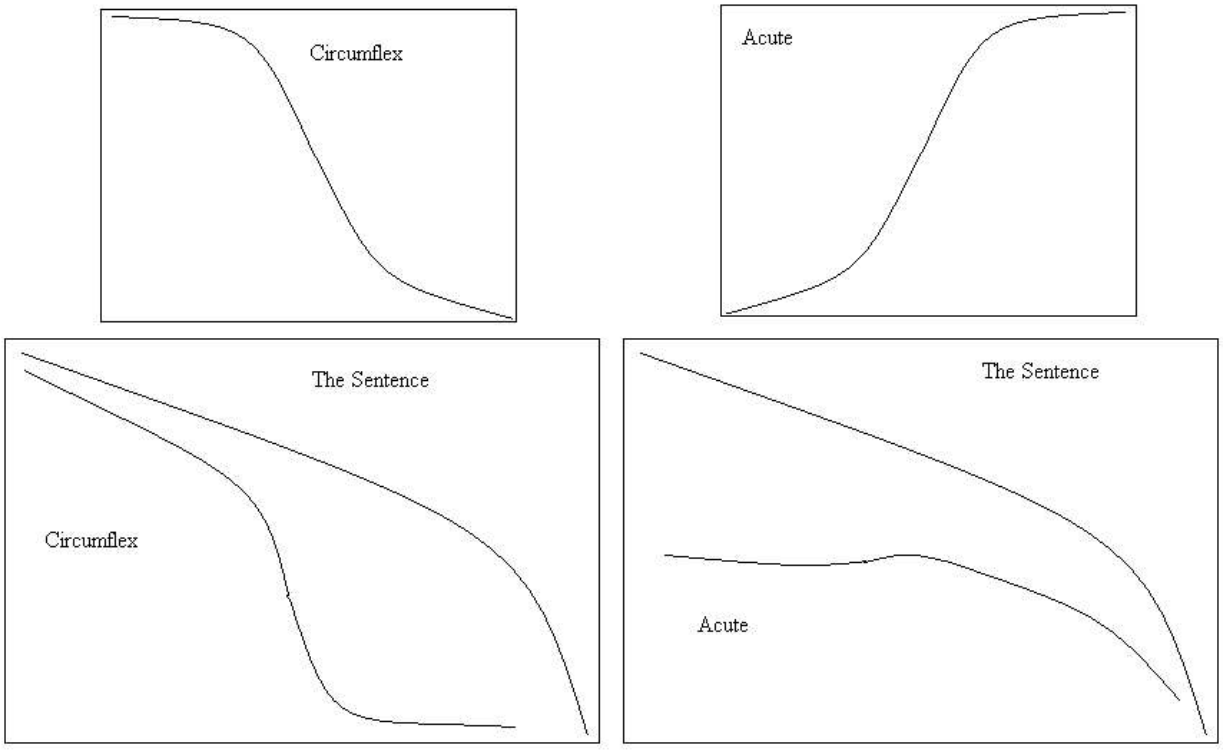


Figure 3: Idealized and Phrase-Final Tone Shapes

The two contours on the top of Figure 3 show what the underlying tone shapes probably look like. This is without the influence of the sentence's intonation. Sentence finally (which is also prosodic phrase-finally) the intonation of the sentence is often falling. If this is the case,

then the word tones will have a more limited range in which to be realized, so they will appear "squashed" over the post-tonic syllable. The bottom two contours in figure 3 represent the word tones as realized sentence finally. The line on top represents the intonation of the sentence, which acts as a ceiling for the realization of the word tones. The circumflex tone, then, will look a bit like it does in other positions, with a higher tone on the tonic syllable and a sharp fall through the post-tonic syllable. The acute tone, though, will look considerably different. The tonic syllable will also have a falling contour, although it may not be as steep as the post-tonic syllable for the circumflex tone.

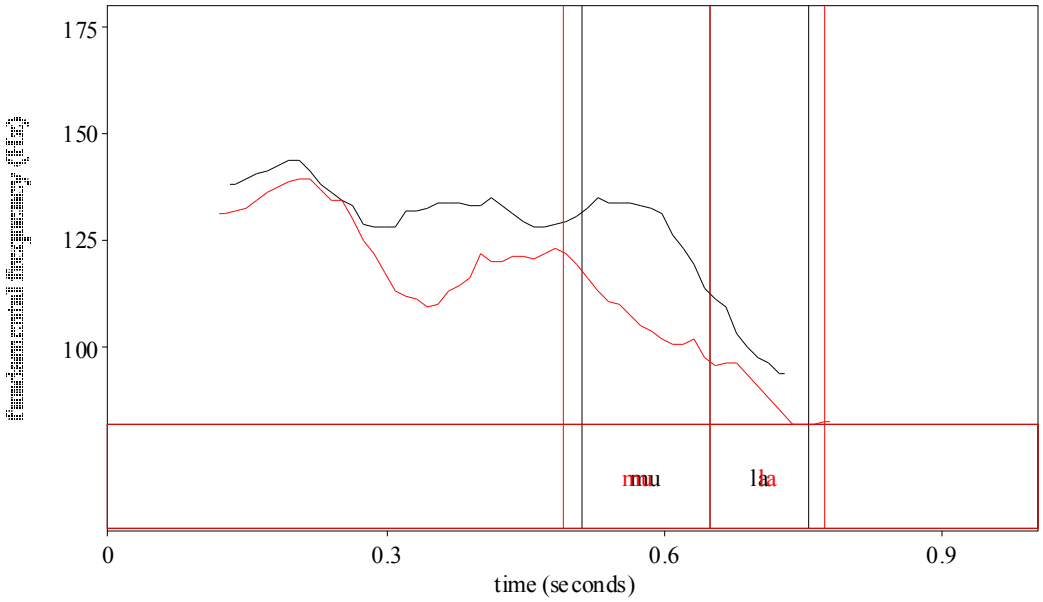


Figure 4: M2- *mula* in final position. From the sentences:
Black: To je njen Mûla.
Red: To je njena múla.

Figure 4 shows M2's acute and circumflex tones as realized sentence finally. The circumflex tone looks as it is expected to look, and is high over the tonic syllable with a sharp fall over the post-tonic syllable. The acute tone is significantly lower over the tonic syllable with less of a fall over the post-tonic syllable. Also, over the tonic syllable, the acute tone is concave, and the circumflex tone is convex, just like M2's phrase-medial words shown in figure 1. So, this is what is expected, and it looks like M2 clearly has the contrast here.

M1 also appears to have the tone contrast on disyllabic words, but he appears to be in a state of transition. M1 hesitated when reading one of the phrase-medial sentences, so that data cannot be used. Instead only the phrase-initial and phrase-final pairs will be analyzed.

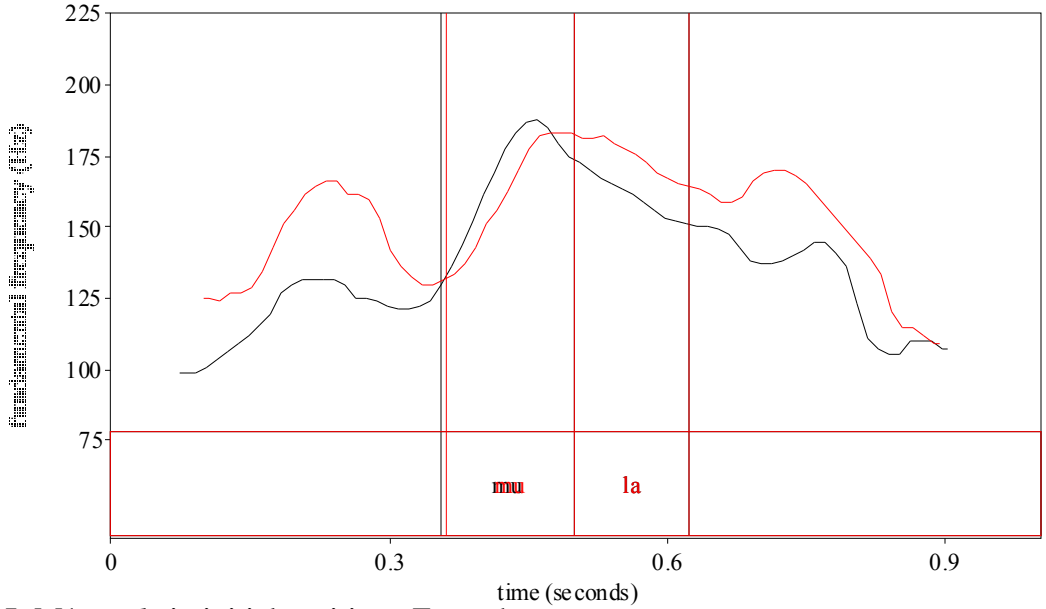


Figure 5: M1- *mula* in initial position. From the sentences:
Black: Njen Mûla ji veliko pomeni.
Red: Njena múla ji veliko pomeni.

The expected acute shown in figure 5 peaks over the syllable boundary and stays high throughout the post-tonic syllable. The expected circumflex clearly peaks in the tonic syllable and falls sharply throughout the post-tonic syllable. This figure looks strikingly like M2's corresponding utterances as shown in figure 2. This suggests that the two speakers are making the same kind of contrast between the acute and the circumflex accent word initially.

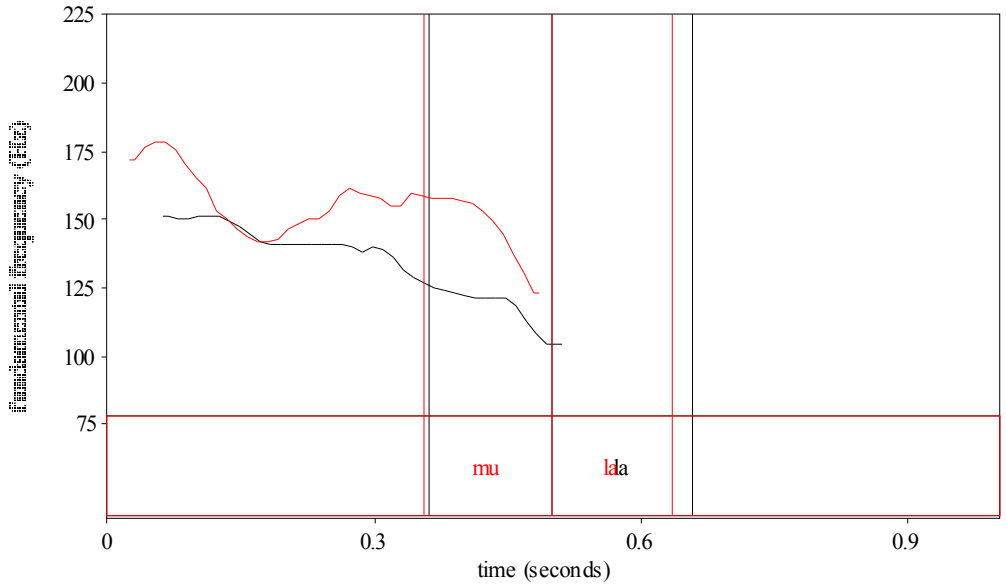


Figure 6: M1- *mula* in final position. From the sentences:
Black: To je njen Mûla.
Red: To je njena múla.

Figure 6 is interesting because it appears that the acute and the circumflex tone are switched. Phrase-finally, the circumflex is expected to be higher and convex over the tonic syllable with a sharp fall over the post-tonic, and the acute is expected to be concave and low over the tonic syllable with a less steep fall over the post-tonic. M1 appears to have switched the two, with the circumflex clearly lower and convex over the tonic, and the acute clearly higher and concave over the tonic.

This suggests that M1 is in a state similar to that of Srebot-Rejec's speakers. Her speakers did consistently produce words with tone, but the speakers did not always produce the expected tone or the same tone as other speakers. Perhaps M1 has tone in the sense that all words are produced with tone, but he is in a state that is transitional to tone loss. He is not confident about the underlying tone of words, and sometimes confuses the two tones and produces the wrong one.

F2 appears to have lost the tone contrast all together.

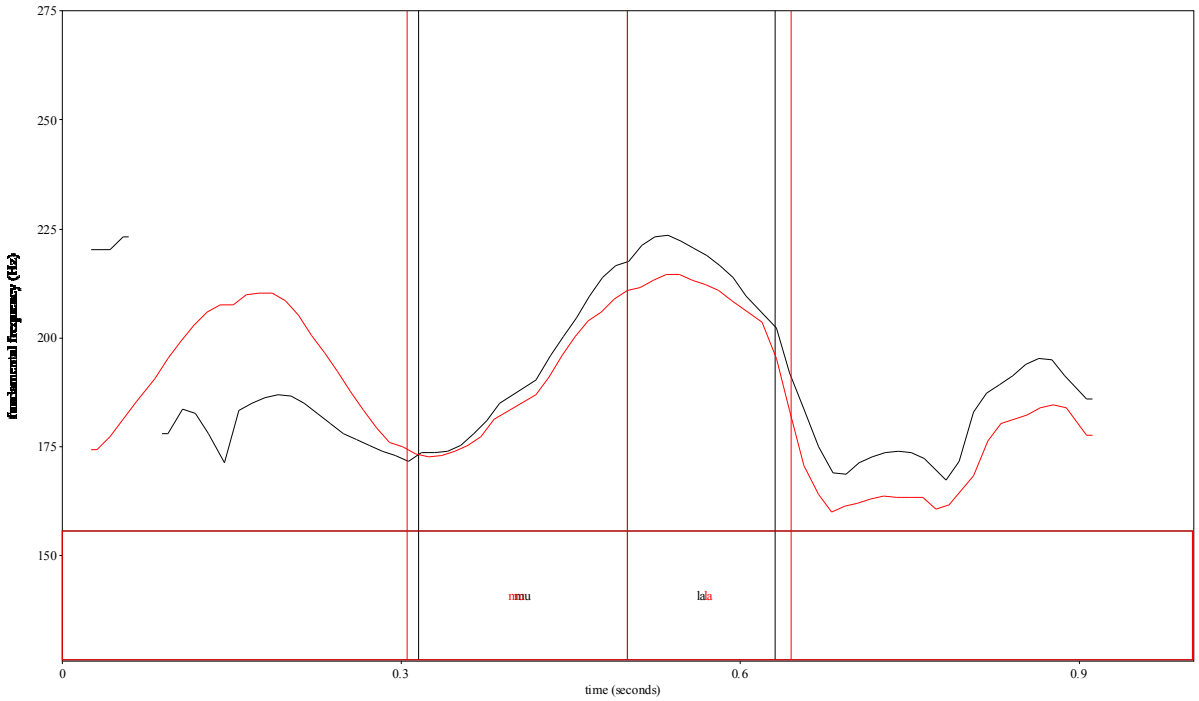


Figure 7 : F2 - *mula* in phrase-medial position, from the sentences
Black: Mislim da je Mûla zelo prijazen.
Red: Mislim da je njena múla zelo prijazna.

From figure 7, it is clear that F2 does not make a tone contrast on "mula." Both the expected acute and the expected circumflex peak in the post-tonic syllable, which suggests that the acute tone has been generalized.

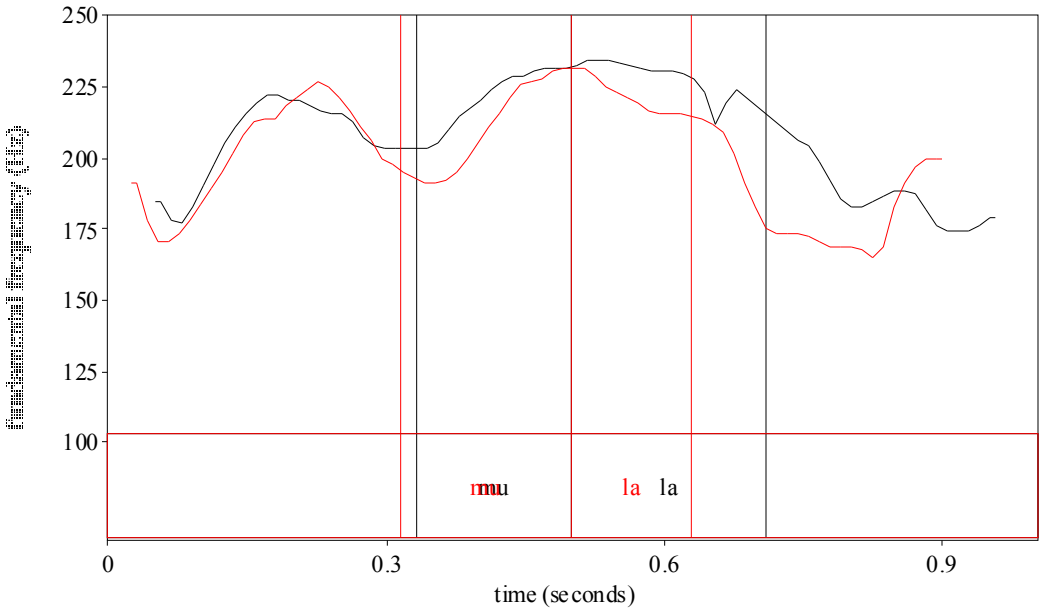


Figure 8: F2- *mula* in initial position. From the sentences:
Black: Njen Mûla ji veliko pomeni.
Red: Njena múla ji veliko pomeni.

Figure 8 also suggests that the tone contrast has been neutralized on 'mula.' Both the acute and circumflex contours peak in the post-tonic syllable, which also suggests that the acute tone has been generalized.

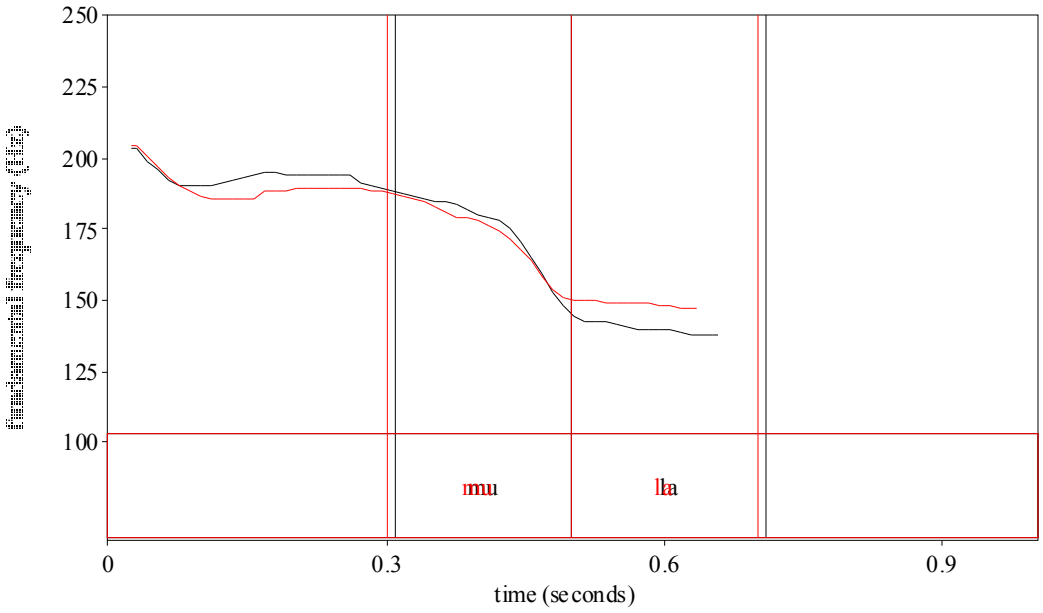


Figure 9: F2- *mula* in final position. From the sentences:
Black: To je njen Mûla.
Red: To je njena múla.

Figure 9 further suggests that there is no tone contrast on 'mula.' In fact, the contours nearly match up on top of each other. As this is phrase-final, overall falling intonation should be expected here, whether the acute or circumflex tone is generalized. However, since there is not a sharp fall over the post-tonic syllable (as would be expected if the circumflex tone was generalized), it can also be said that F2 has generalized the acute here.

It is possible that F2 could be in a state of transition between the tonal and non-tonal systems. In order to be sure, it is important to look at higher frequency words that are acquired early in addition to words like 'Mula,' meaning 'Muslim leader,' that are lower frequency and are usually acquired later. If F2 generalized the acute on high frequency words that were acquired early, then it suggests that she has generalized the acute tone for all words in the language. If she makes a contrast on these words, though, it suggests that she is in a state of tone loss, only retaining the pitch distinctions on higher frequency words.

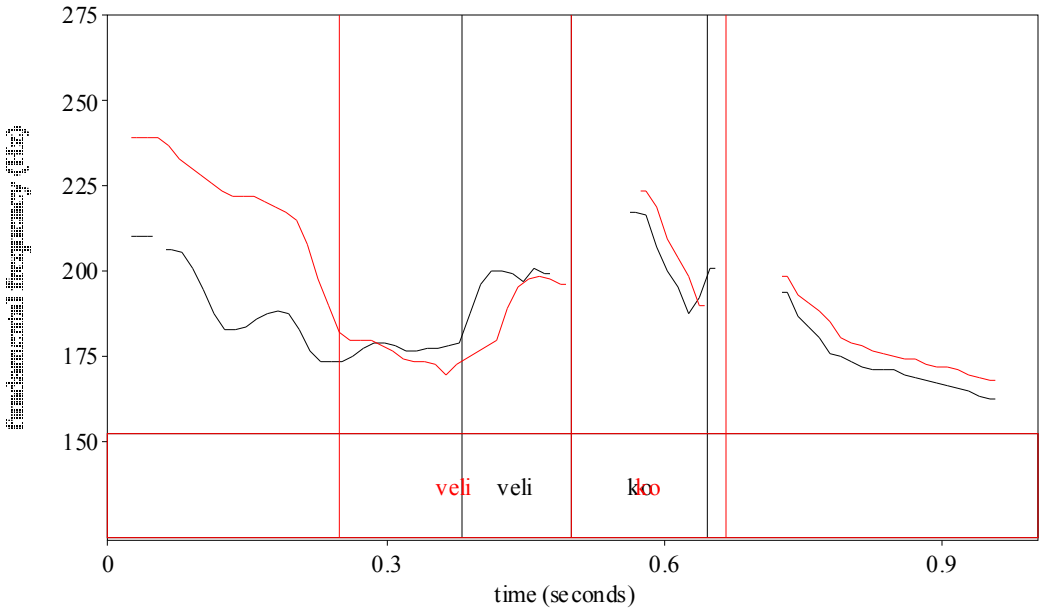


Figure 10: F2 – *velíko* from the sentences:
Black: Njen Mula je velíko pomeni.
Red: Njena mula je velíko pomeni.

Figure 10 shows two different utterances of veliko for F2 lined up at the syllable boundary. This is not a minimal pair. Both the red line and the black line represent the F0 contour for two utterances of the word *veliko*, meaning "big" or "very." This word acute tone for tonemic speakers. It is clear that the F0 peak is in the post-tonic syllable, which suggests that F2 is pronouncing the word with the acute accent, as is expected.

If F2 has indeed generalized the acute tone, then a word like *prekrâsen*, an expected circumflex, should also have acute tone.

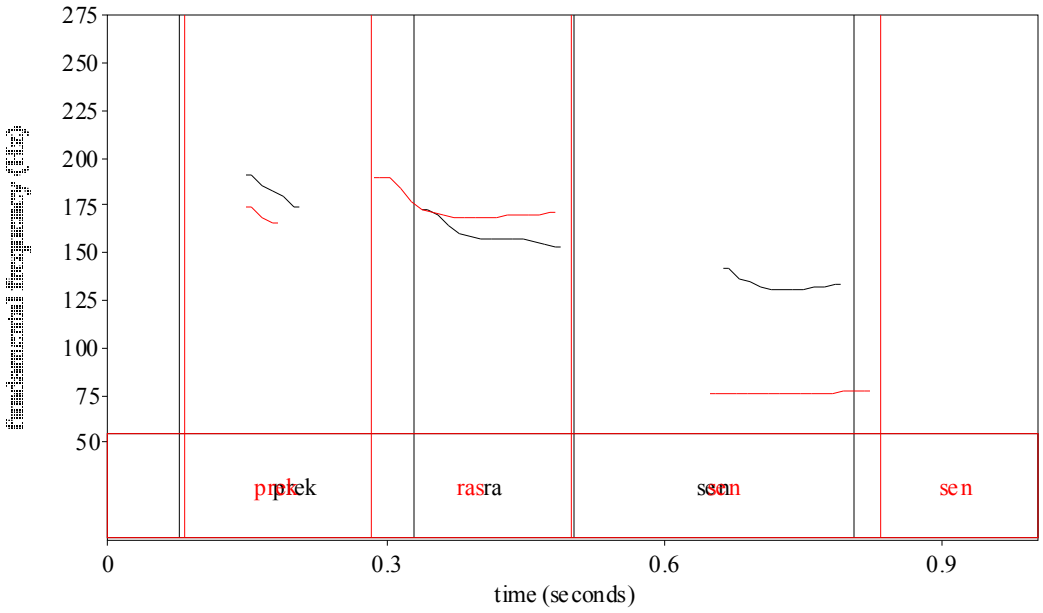


Figure 11: F2 – *prekrâsen/prekrâsna* from the sentences:
Red: Mislim, da je njen pot prekrâsen.
Black: Mislim, da je njena pot prekrâsna.

Figure 11 shows the F0 contour for two of F2's utterances of the word “prekrasen,” meaning “excellent” or “vital,” which has an expected circumflex tone. Again, this is two utterances of the same word, and not a minimal pair. This is in phrase-final position, so that must be considered when analyzing the figure. The tone shape over the tonic syllable is concave, which is what is expected of the acute tone, for both utterances. Also, the tone on the post-tonic syllable is flat, which is also consistent with the acute tone. This suggests that F2 has generalized the acute tone pattern for all words, and does not have the tone contrast.

M4 appears to have neutralized the tone contrast as well. However, unlike F2, it appears that he has generalized the circumflex tone contour.

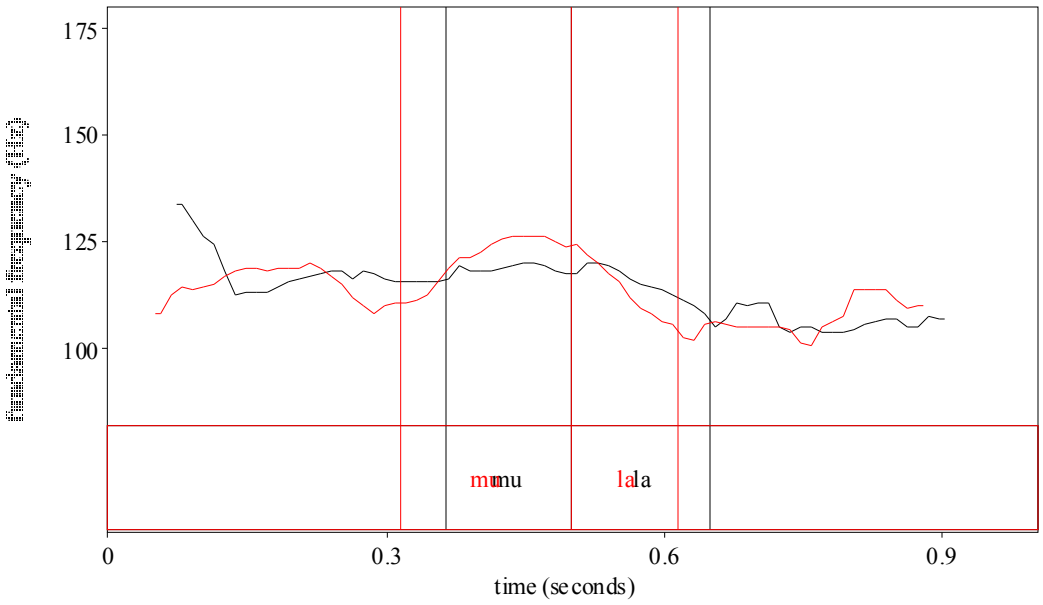


Figure 12: M4 – *mula* in initial position. From the sentences:
Black: Njen Mûla ji veliko pomeni.
Red: Njena múla ji veliko pomeni.

From figure 12, it looks like M4 does not have the tone contrast. The expected acute tone peaks in the tonic syllable and falls through the post-tonic syllable. This is what is expected of the circumflex tone. The expected circumflex, on the other hand, is very flat. It stays level through the tonic syllable and falls through the post-tonic syllable. this is what is expected of the circumflex accent. It looks like M4 is generalizing the circumflex accent.

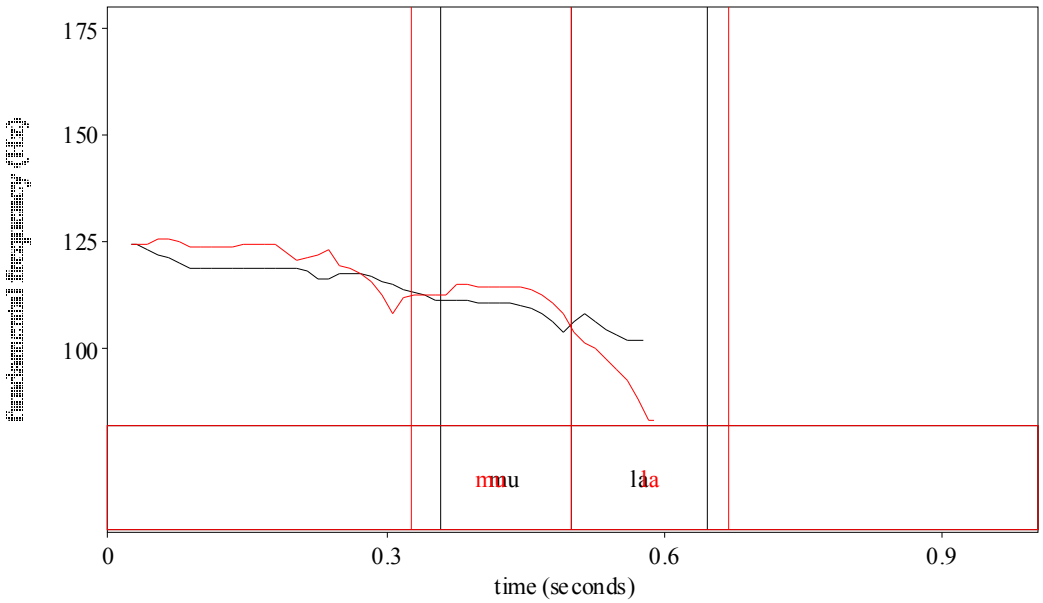


Figure 13: M4- *mula* in final position. From the sentences:
Black: To je njen Mûla.
Red: To je njena múla.

In figure 13, it also looks like M4 is not making a tone contrast. Both the expected acute and the expected circumflex have a convex contour over the tonic syllable. This is consistent with the circumflex accent in sentence final position. If there were a tone contrast here, the acute should be relatively low over the tonic syllable, and the circumflex, relatively high. Again, this suggests that M4 has generalized the circumflex pattern for these two words.

To really know if M4 is generalizing the circumflex accent, it is helpful to look at the realization of an expected acute accent on a high frequency word as was done with F2. So, the word *veliko* can also be examined for M4.

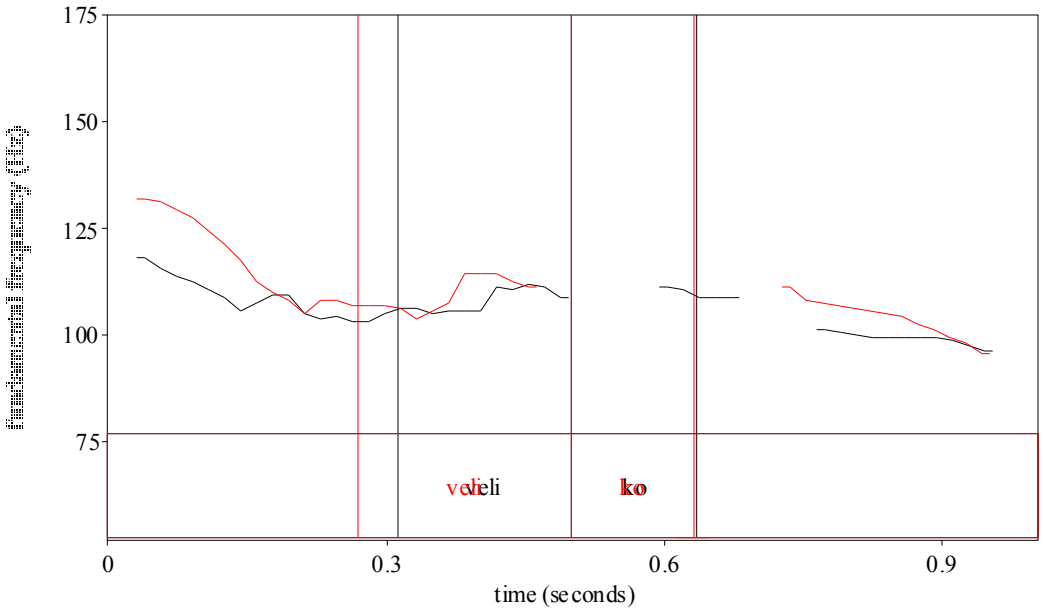


Figure 14- *velíko* from the sentences:
Black: Njen Mula ji velíko pomeni.
Red: Njena mula ji velíko pomeni.

From figure 14, it is clear that M4 is generalizing the circumflex accent even for high frequency words such as *veliko*. Both utterances of *veliko* (which, again, is not a minimal pair, but two utterances of the same word with an expected acute accent) show the same, concave pattern over the tonic. For one of the utterances, M4 devoiced the post-tonic syllable. However, for the other, it is clear that the post-tonic syllable does not show a significant rise as would be expected with the acute accent. For that utterance (shown in black), M4's F0 clearly peaks in the tonic syllable, as is expected with the circumflex tone.

The Contrast Word Finally: Monosyllabic Words

The tone contrast word finally will be illustrated using monosyllabic words, although using a word with multiple syllables and final stress would illustrate the same contrast. The figures for monosyllabic words were made by aligning the ends of the target vowels. This is because, in Srebot-Rejec's description, the most important feature of the tone contrast for the speaker that made it on monosyllabic words was he steepness of the rise of the tone over the duration of the vowel. Aligning the target vowels of the target words at the end allows steepness to be easily compared.

The words chosen for the figures for monosyllabic words were *pọ́t*, meaning “sweat,” and *pôt*, meaning path. There is a difference in vowel quality here, but that is a different issue, and it should not affect the tone.

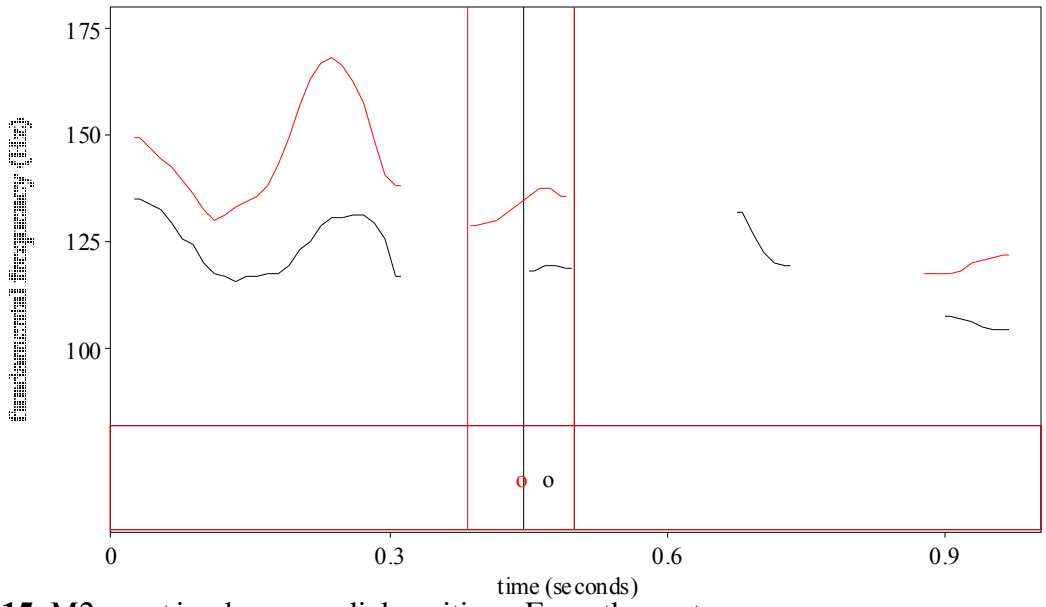


Figure 15: M2 – *pot* in phrase-medial position. From the sentences:
Black: Mislim, da je njena pôt prekrasna.
Red: Mislim, da je njen pót prekrasna.

Figure 15 shows that there is a clear length difference between the acute and circumflex, with the acute significantly longer than the circumflex. The acute tone has a sharper rise than the circumflex, with a peak late in the vowel. The circumflex tone is flat.

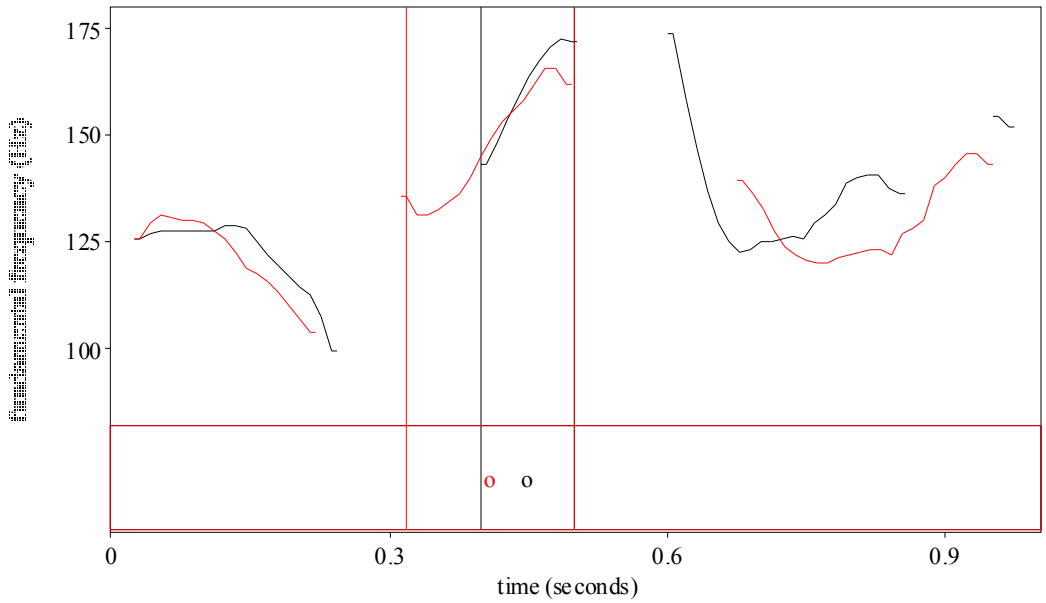


Figure 16: M2 – *pot* in phrase-initial position. From the sentences:
Black: Njen pôt ji veliko pomeni.
Red: Njena pót ji veliko pomeni.

Figure 16 shows, again, that the expected acute is longer than the expected circumflex. However, it looks like the expected circumflex has a sharper rise than the expected acute tone, which is unlike what is shown in figure 14. This suggests that, if a contrast is realized between the two, it is not based on the sharpness of the rise of the tones as it was for Srebot-Rejec's speaker.

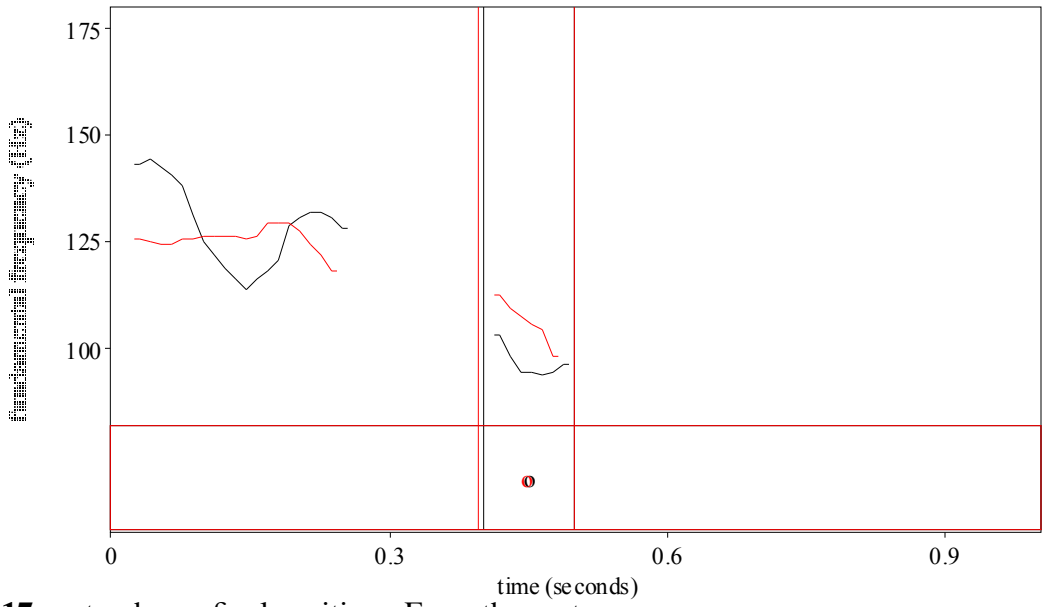


Figure 17: *pot* - phrase-final position. From the sentences:
Black: To je njena pôt.
Red: To je njen pót.

In figure 16, unlike in figures 15 and 16, there is no significant length difference between the acute and circumflex tone. Both tones are falling (as is to be expected phrase-finally), but the circumflex has a sharp fall initially with a slight rise towards the end of the vowel and the acute has a sharp fall through out the duration of the vowel.

It looks like M2 does not have the tone contrast word finally. The length difference between the expected tones in figures 15 and 16 may be significant, although it seems that he was speaking at a slightly slower rate when reading the first two acute sentences. One thing is certain, though – that M2 does not have the tone contrast as described by Srebot-Rejec it looks like he has no contrast at all. In fact, it appears that none of the speakers make a difference in tone shape in monosyllabic words (figures from the other speakers are in Appendix C).

Discussion:

These findings suggest that speakers from Ljubljana are indeed undergoing a process of tone loss, as was suggested in Greenberg 2000. It appears that the four speakers discussed are in different states of tone loss. On disyllabic words, M2 appears to have a robust tone contrast. His tone shapes are consistent with those described by Srebo-Rejec. M1 appears to be producing words with the expected tone shapes, but may not constantly produce words with the expected tone. M4 and F2 appear to have lost the contrast completely. This is consistent with what was described by Lehiste and Ivić about tone change in Slavonian. Speakers of Slavonian were in different stages of the transition between the older accent system to the newer one, with some speakers preserving the old pattern, some with transitional forms between the two, and some with the new system. Having speakers in different stages of the change suggests that this is a process that is happening slowly, and that, for now at least, the innovation is winning. With the speakers described in this paper, M2 is preserving the old pattern, M2 is in a state of transition, making a tone contrast but not consistently, and F2 and M4, appear to have made the transition to non-

tonemic Slovene. The fact that two speakers appear to have completely lost the contrast suggests that the younger generation is one step farther than the speakers described by Srebot-Rejec. In her study, all speakers made some sort of tone contrast, just with varying degrees of consistency; In this study, some speakers did not make a contrast at all.

The situation on monosyllabic words appears to be consistent with the trend of tone loss as well. In Srebot-Rejec's study, all but one speaker had lost the tone contrast word finally completely. In this study, no speakers appear to make a tone contrast word finally. This suggests that, during the time of Srebot-Rejec's study, speakers were in the process of losing tone word finally, with some speakers having the contrast and others not. The results of this study suggest that that process has gone one step further, and that possibly all speakers (even those like M2 with a consistent contrast on disyllabic words) have lost the contrast on monosyllabic words.

The reasons for tone loss are not completely understood, and it is likely a multitude of factors have an influence on tone loss and language change in general. Marc Greenberg attributes tone loss to "a low functional load of pitch," and contact with non-pitch distinguishing dialects. It is true that the pitch distinction is very subtle, and there are very few minimal pairs making it unlikely that meaning could be misunderstood solely because of tone. However, it is difficult to rationalize these factors causing tone loss, as the distinction still persists in such a subtle state, and there is a similar low functional load of pitch in other south Slavic dialects that do not appear to be losing tone. Language contact (or, more specifically, dialect contact) could indeed be accelerating tone loss, as Ljubljana is the capital city of Slovenia and is home to Slovenes from both tonemic and non-tonemic regions of the country. It is also likely that social factors have something to do with tone loss. To understand what these factors may be, though, would require a detailed analysis of the situation from a socio-linguistic point of view.

Further Research

There is still much to be understood on this topic. One logical next step is to perform listening tests to see if tonemic and non-tonemic speakers can hear the pitch difference. If non-tonemic speakers can hear the pitch difference, this could contribute to the idea that social factors accelerate tone loss, as it would mean that non-tonemic speakers can recognize the difference in the speech of tonemic speakers, and perhaps then they could associate certain attributes with that style of speech. Also, it is important to perform listening tests on the tonemic speakers to determine for sure what the salient features in the tone contrast are, and how far those features can be manipulated in order to still be interpreted correctly.

It would also be important to record a variety of speakers, and to control more tightly for background. Perhaps social data should be gathered to help determine if social factors are indeed a factor in tone loss. Also more tokens of more words should be recorded in different carrier phrases to get a better idea of the nature of the contrast. Then the project could be extended to include the vowel length distinction in Slovene as well as sentence prosody. This is only a pilot study, and more of the specifics will be worked out in future work.

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Appendix A -Word List provided by Peter Jurgec

kila-c
In kakšna **kila** domače ajdove ali koruzne moke se vedno najde za zdraviliške goste.

kila-a
V kolikor **kila** ne izgine sama, jo je potrebno operirati.

kura-c
Učinkovita shujševalna **kura** mora biti taka, da se je lahko v glavnem držiš vse življenje, ne pa da nihaš med stradanjem in prenajedanjem.

kura-a
Vzrok in posledica sta tu kot **kura** in jajce.

mula-c
Ko se je muslimanski **mula** zlagal mimoidočim, češ da tam, od koder prihaja on, delijo brezplačno jagnjetino in riž, so prvi takoj stekli v to smer in **mula** je kmalu ostal sam.

mula-a
Bil sem tako vznemirjen, da je bila **mula** osedlana že čez nekaj minut.

pot-c
Na vročini, bilo je okoli 30 stopinj Celzija, je **pot kar tekel** z nas in vsi trije smo se že tedaj spraševali, ali je naše početje pametno. Na vročini je **pot kar tekel** z nas.

pot-a
Označena sprehajalna **pot** se začne pri prehodu za pešce.

Slava-c
Medtem ko mu Mojca in **Slava** Partljič pišeta program, jima on kuha kavo.

slava-a

Nepričakovana **slava** in bogastvo sta pomenila breme, ki ga ni mogel in ni hotel nositi.

stikati-c
Hitro so začeli **stikati** glave in obnavljati dogodke iz predstave.

stikati-a
Prikazala se je izza mize in začela **stikati** po prostoru.

šalica-c
Zgoraj je šalica čaja.

šalica-a
Ta tvoja mala **šalica** ni nič več smešna.

šibica-c
Vi pa se bodete tresli kakor **šibica** na vodi, volk vas bo zvijal okrog svojih krempljev.

šibica-a
Vlažja **šibica** je končno zagorela.

Ruta-c
Svetopisemska **Ruta** je bila poganka.

ruta-a
Zraven spada še **ruta** enake modre barve.

ročka-c
Če bi bila kavna **ročka** na mizi, bi ga polila z vročo kavo.

ročka-a
Telovadna **ročka** se je odlomila.

mačka-c
Tudi moja sijamska **mačka** ima takšne oči.

mačka-a
V imenu naroda torej poslanci kupujejo **mačka** v žaklju.

vrana-c
Živalsko podobje zavzema v avtorjevi poeziji osrednje mesto, tako da poleg **vrana** naletimo še na jastreba, lisico, sove, celo skušo ...

vrana-a
Črna **vrana** je doma v Evropi, siva podvrsta pa je razš irjena tudi po obsežnem delu Azije.

valček-c
Neizkušenega deskarja lahko že najmanjši **valček** prevrne v vodo.

valček-a
Zaječal je od bolečega besa in odplesal **valček** po cesti.

žarek-c
Običajni **žarek** svetlobe pa je sestavljen iz množice valovnih potez.

žarek-a
Belo meso ima **žarek vonj.**

lisa-c
Naša **lisa** je spet na paši.

lisa-a
Mi smo zato ostali popolna bela **lisa** na kulturnem zemljevidu Evrope.

turna-c
Pozimi je možna lepa **turna** smuka z Meje in s prevala Globoko.

turna-a
Vzpenjamo se po dnu, naravnost proti vitki skalni ostrici **Turna** pod Razorjem.

Appendix B – Word List Controlling Lexical and Prosodic Environment

Mula - C
Moja prijateljica Nataša živi v muslimanski skupnosti.
Tô je njén Mûla.

Nataši vera velkio pomeni, zato je čvrsto sledi.
Njén Mûla ji velíko poméni.

Nekega dne sem srečal njenego Mulo.
Mislim, dà je Mûla zelô prijázen.

Spoznal sem, da izhaja iz njene vasi.
Àli je tô njén Mûla?
...

My friend Natasha lives in a muslim community.
That is her *Mula* (Muslim leader).
Natasha's religion is dear to her, and she follows the faith closely.
Her *Mula* (Muslim leader) is important to her.
One day I met Natasha's mula.
I think that her *Mula* (Muslim leader) is friendly.
I recognize that person from Natasha's village. ú
Is that her *Mula* (Muslim leader)?

mula - A

Moja teta ima veliko kmetijo in veliko različnih živali.
Tô je njéna múla.
Moja teta ne bi zmogla vsega dela brez njenih živali.
Njéna múla ji velíko poméni.
Ko sem bil otrok, sem videl njeno mulo.
Mislim, dà je njéna múla zelô prijázna.
Prejšnjo noč je bila poplava in vse živali v njeni vasi so ušle.
Àli je tô njéna múla?
...

My aunt owns a large farm with many different animals.
That is her *mula* (mule).
My aunt couldn't do all her work without her animals.
Her *mula* (mule) is important to her.
As a child, I used to see my aunt's mula.
I think that her *mula* (mule) is friendly.
There was a flood last night, and all of the animals in my aunt's village escaped.
Is that her *mula* (mule)?

pot - C

Moja prijateljica Saša je pravkar petekla maraton in zelo se je trudila.
Tô je njén pôt.

Ve, da ji pot pomaga hladiti telo, brez tega bi se lahko pregrela.
Njén pôt ji velíko poméni.
Nočem, da bi umrla zaradi vročice, zato sem vesel, da se poti.
Mislim, dà je njén pôt prekrâsen.
Mislim, da se je polila z vodo med tekom, ampak nisem siguren.
Àli je tô njén pôt?
...

My friend Sasha just ran a marathon, and she was working very hard.
This is her *pot* (sweat).
She knows that sweat helps cool her body, and without it, she would overheat.
Her *pot* (sweat) is important to her.
I don't want her to die from overheating, so I am glad she sweats too.
I think her *pot* (sweat) is vital.
I suspect she splashed herself with water during the race, but I am not sure.
Is that her *pot* (sweat)?

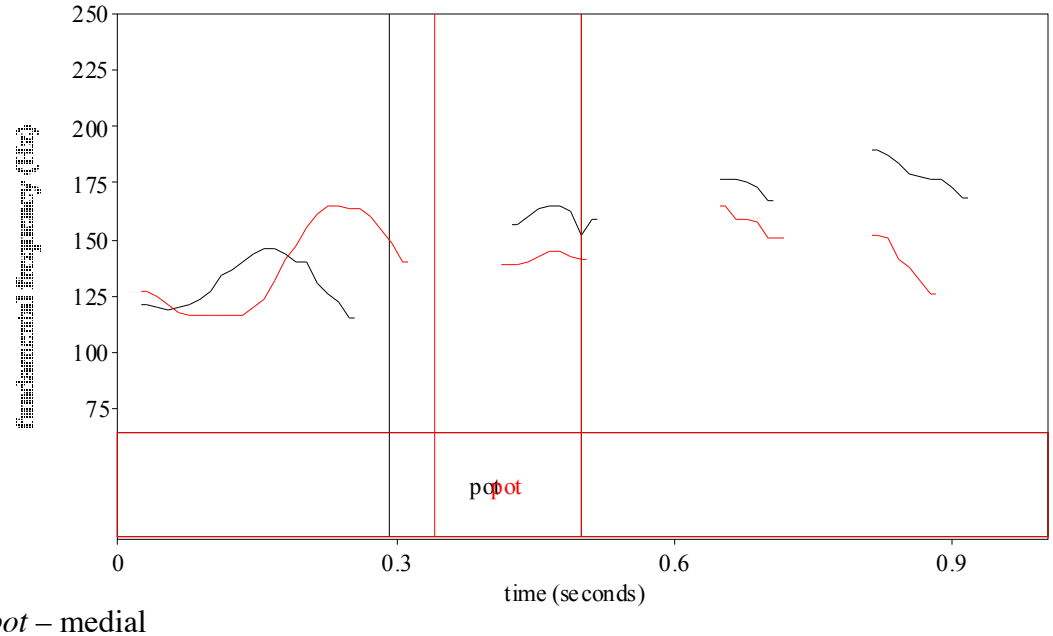
pot - A

Moja prijateljica Maša živi v gozdu in naredila je sled do njene hiše.
Tô je njéna pót.
Brez njene sledi se ne bi znala vmiti domov.
Njéna pót ji velíko poméni.
Zelo rad jo obiskujem.
Mislim, dà je njéna pót prekrâsna.
Zgubljen sem v gozdu zraven njene hiše.
Àli je tô njéna pót?

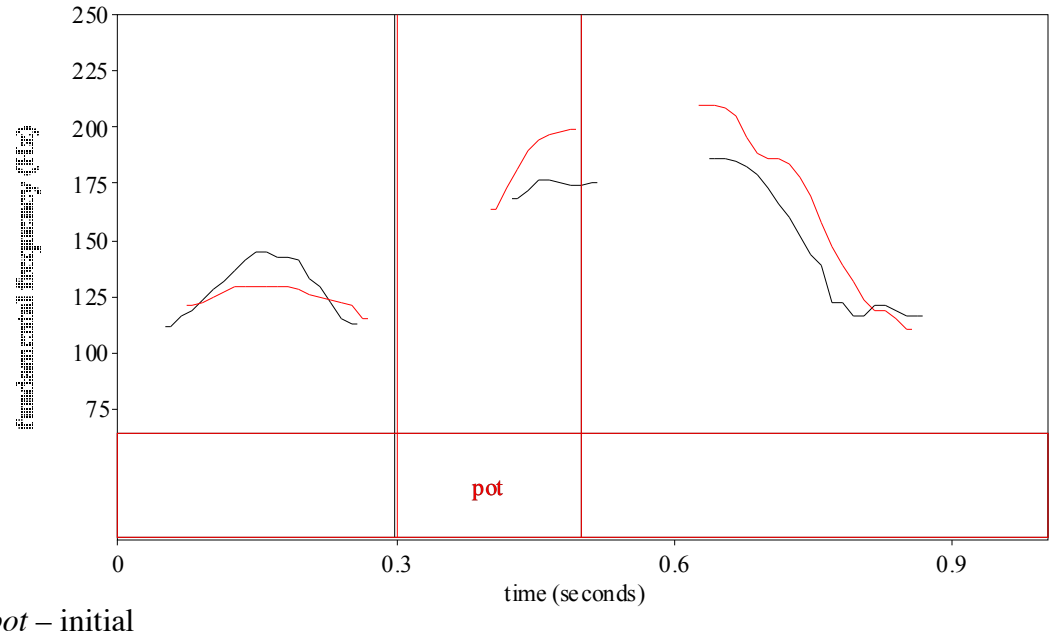
...

My friend Masha lives in the forest, and she made a trail to her house.
This is her *pot* (path).
Without her trail, she could not get home.
Her *pot* (path) is important to her.
I like to visit her a lot.
I think her *pot* (path) is vital.
I am lost in the forest near her house.
Is this her *pot* (path)?

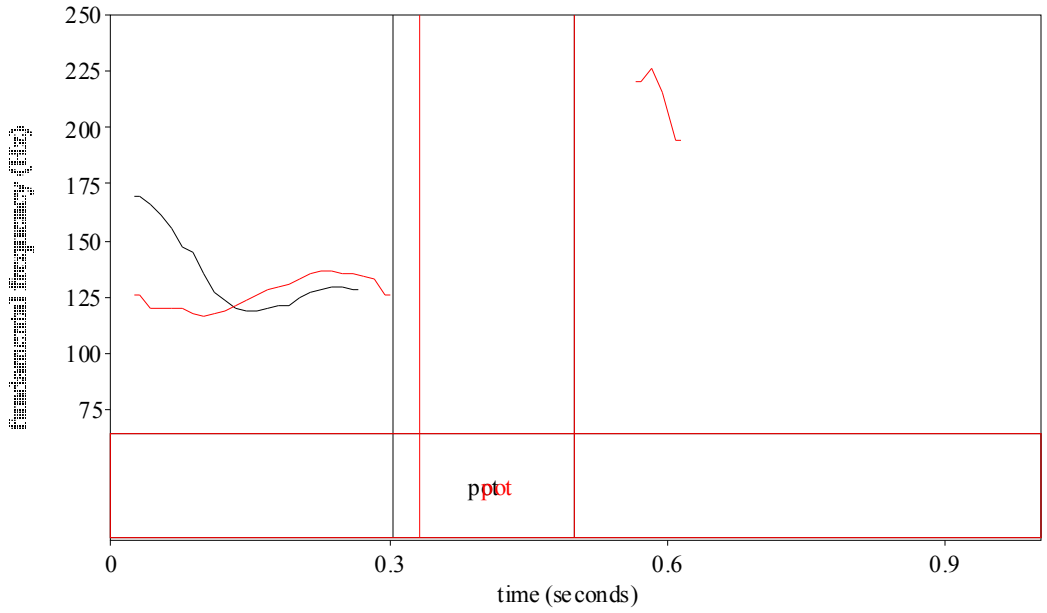
Appendix C – Additional *pot* Figures from the list given in Appendix B. For all figures, black is used for circumflex and red for acute.



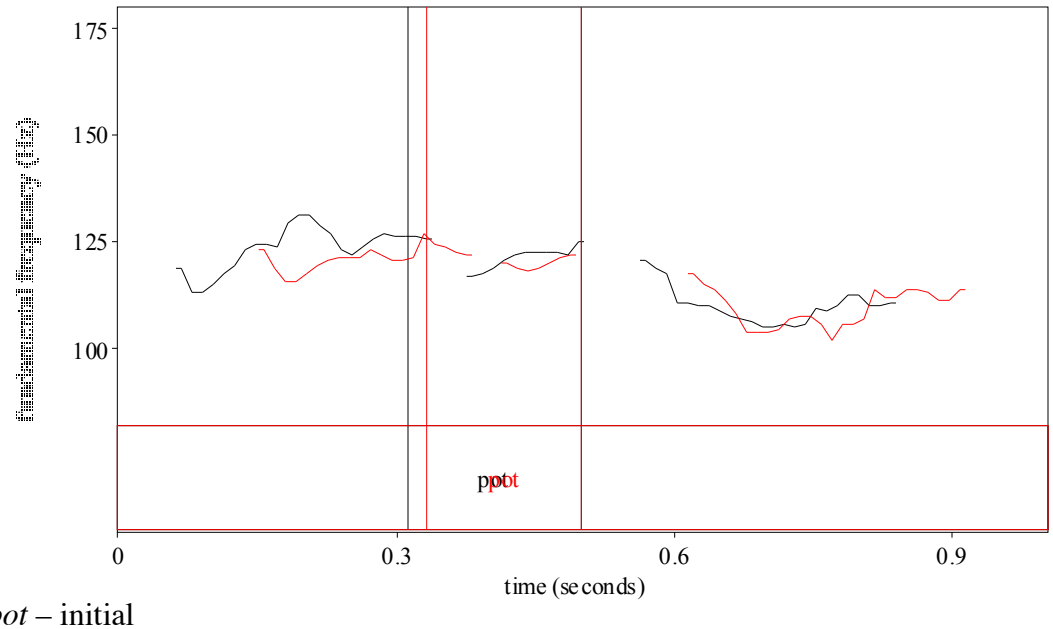
M1 – *pot* – medial



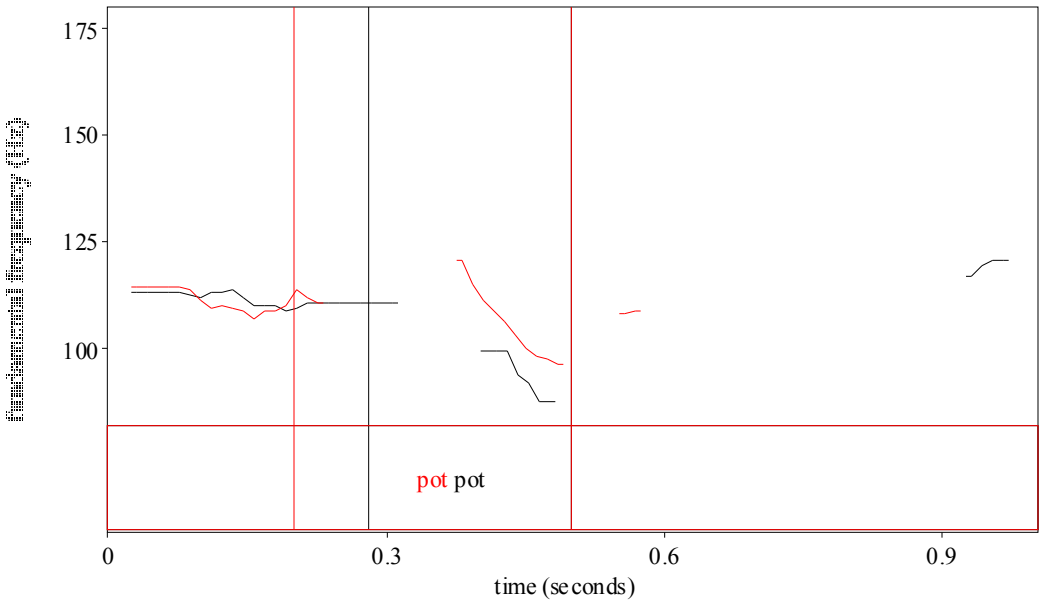
M1 – *pot* – initial



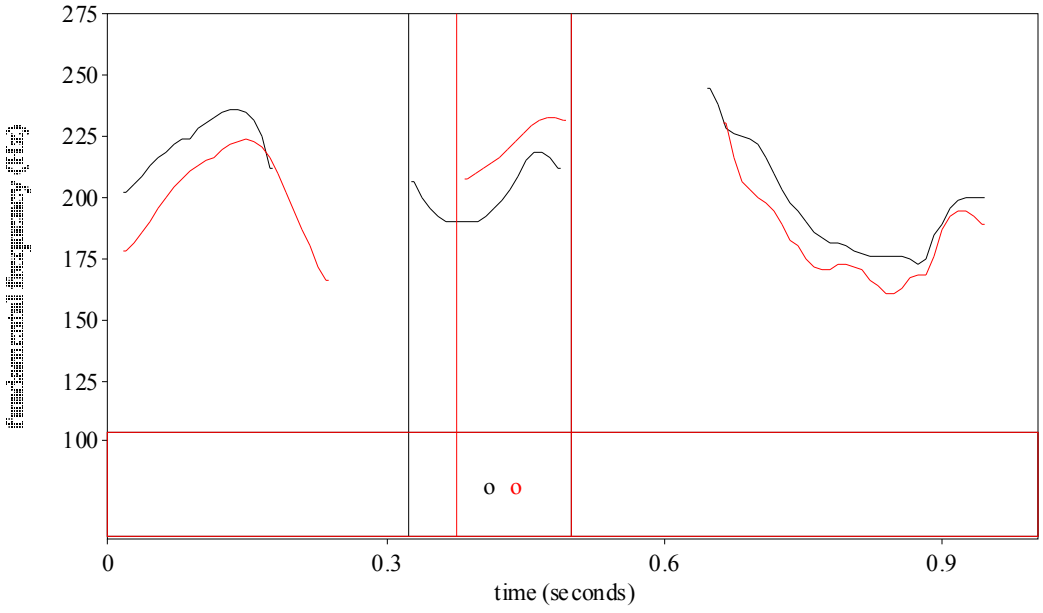
M1 – *pot* – final



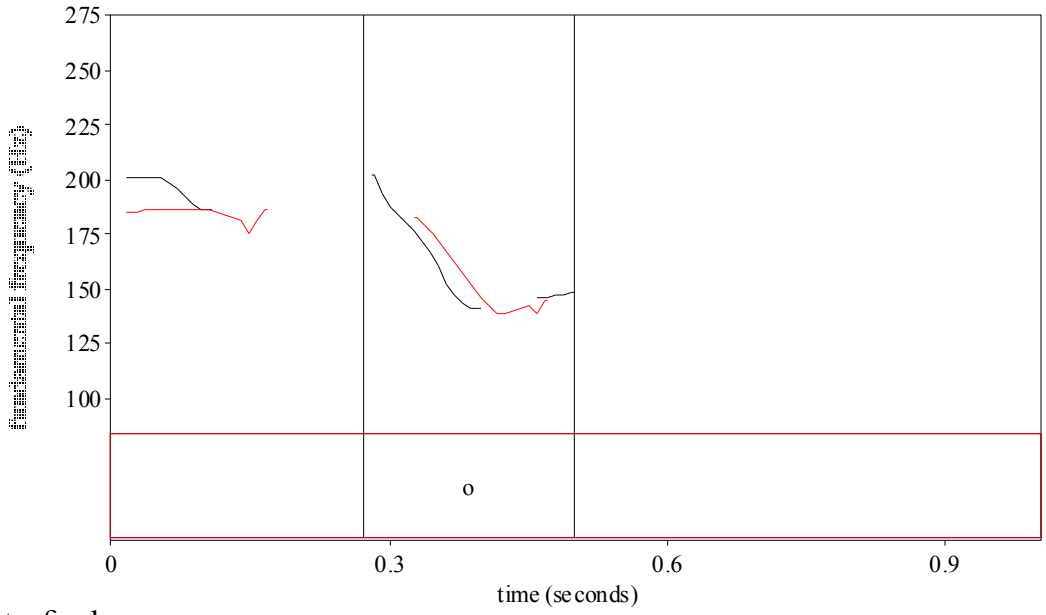
M4 – *pot* – initial



M4 – *pot* – final



F2 – *pot* – initial


fundamental frequency
275
250
225
200
175
150
125
100
o
0
0.3
0.6
0.9
time (seconds)

F2 – *pot* – final