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Prosody of negation in Iu-Mien

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Abstract

This study investigates the prosody of negation in Iu-Mien. It focuses on the local prosodic structure of [ma:i^{31}] 'have' when it is negated by [mai^{45}] 'not'. It shows that the negated [ma:i^{31}] 'have' shows a new form, [m:a:i^{454}] 'not.have', characterized by a geminated word initial [m] and an F0 shape that, depending on the duration of the new form, is either 454 or 55. Beyond these local acoustic features of the new form, the F0 contour of the negative sentence is analyzed in order to see to what extent the negation influences the final F0 shape of the sentence.

Index Terms: Iu-Mien, tones, negation, F0 contours, gemination

1. Introduction

Lexical tones vary depending on factors such as the wider segmental environment and neighboring tones. Tone sandhi effects have been analyzed in, for example, Mandarin ([1]), Cantonese ([2]), Anong ([3]), Fuzhou Min ([4]), and Yongning Na ([5]) to name just a few studies. The phenomena discussed in these studies focused on F0 contour of bi-tonal sequences showing carry-over or anticipatory effects. A different type of tonal adjustment has been shown in the merger of two tones into one morphologically based tone, for example, diachronic processes analyzed by [6] in Shimen Hmong. For Cantonese, [7] shows that the morphologically-derived mid-rising tone has F0 distinct from that of the lexical mid-rising tone. Our study joins these investigations by looking at the less often examined language of Iu-Mien and analyzes the changes from the disyllabic construction [mai^{45} ma:i^{31}] 'not.have' to the monosyllabic form [m:a:i^{454}], having the same meaning.

It is generally agreed that intonation is also likely to modify the F0 patterns of tones, with the specific F0 patterns varying across languages ([8]). Thus, our study also investigates the prosody of negation in Iu-Mien in sentence-final position.

2. Iu-Mien tones, tone sandhi, and intonation

Iu-Mien (Hmong-Mien language family) is spoken in the northern areas of Thailand, Laos, Vietnam, and southern China ([9]). Iu-Mien has six tones ([10], [11], [12]). The description of these tones together with their markers and examples are given in Table 1. Tones are marked with tone numbers, on a five point scale with 1 denoting the lowest and 5 the highest point of a tone's F0. Tone 45 has two possible contours. The rising-falling shape is found in either open syllables or in syllables with a nasal in a coda. The rising-only shape is found in syllables with a final stop.

Table 1: *Iu-Mien tones*.

Description:		Examples:	
high rise (-fall)	45	tser^{45}	'paper'
mid level	33	tser^{33}	'to abstain, to fast'
mid fall	31	tser^{31}	'a paddle, flat ladle'
low rise	23	tser^{23}	'to create'
low rise-fall	232	tser^{232}	'to be correct, yes'
low level	21	tser^{21}	'a young female of certain mammals'

2.1. Tone sandhi

As discussed by [9], tone change is widespread in Iu-Mien. In disyllabic constructions, the anticipatory effect is large when the high-rising tone 45 of the first syllable is followed by either the mid tone 33, or the mid-falling tone 31, or the low falling tone 21 on the second syllable. There are two patterns depending on whether tone 45 occurs on a syllable that ends with a stop or whether it occurs on a syllable that is either open or ends with a nasal. Specifically, tone 45 becomes tone 21, when it occurs on a syllable that ends with stop. It becomes tone 31, when it occurs on an open syllable or on a syllable ending with a nasal. Table 2 presents these two patterns in a schematic way (based on [9]).

Table 2: *Tone sandhi in disyllabic sequences with tone 45 on the first syllable*.

1st syllable ends with a stop	1st syllable is open or ends with a nasal
/45 33/ -> [21 33]	/45 33/ -> [31 33]
/45 31/ -> [21 31]	/45 31/ -> [31 31]
/45 21/ -> [21 21]	/45 21/ -> [31 21]

2.2. Intonation

Two types of Iu-Mien intonation have been discussed in the literature: question intonation and focus intonation in declarative sentences. According to [9] and [10], the intonational patterns found in question sentences and in declarative sentences produced with focus-related intonation are reflected primarily in differences in tones on clause-final words. The tone on the final word is modified by a sentence intonation that raises its contour regardless of the original contour.

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3. Negation in Iu-Mien

Negation in Iu-Mien is expressed by the particle [mai^{45}] 'not' which is followed by the verb it negates ([9]). However, as this study shows, when [mai^{45}] 'not' is followed by the verb [ma:i^{31}] 'have', the disyllabic construction [mai^{45} ma:i^{31}] becomes a monosyllabic form [m:a:i^{454}] that is characterized by a different F0 contour and a word-initial morphological geminate [m:]. Figure 1 illustrates the new word in [jiə^{33} m:a:i^{454} tæ^{33}] 'I don't have a father', and it shows a hat-like F0 contour for [m:a:i^{454}]. The morphological geminate in the word-initial [m] is studied by comparing the durational values of the geminate [m:] with the durational values of the singleton [m]. The F0 contours of the new form are correlated with the duration of [m:a:i^{454}]. Additionally, F0 contours for words occurring in final position are also studied.

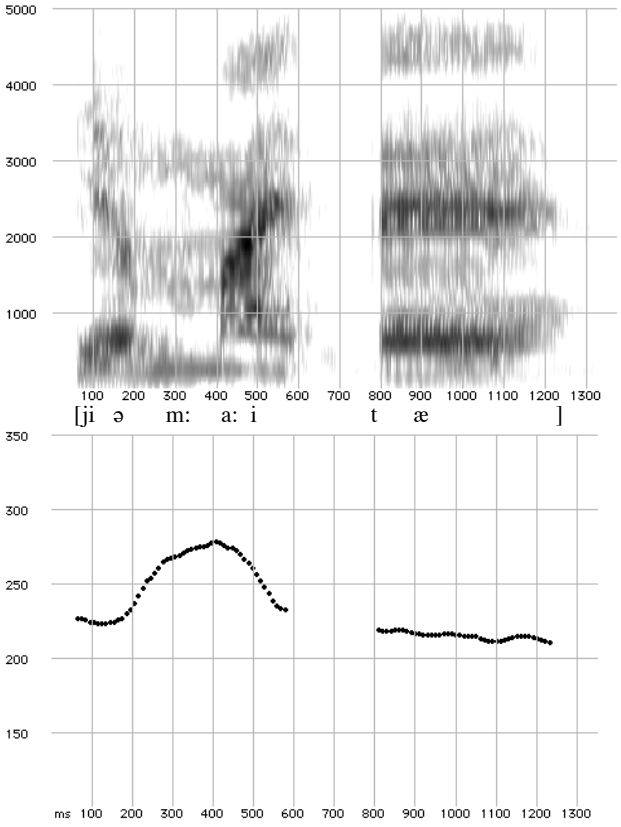

Figure 1: *Sample spectrogram and F0 track of [jiə^{33} m:a:i^{454} tæ^{33}].*

4. Method

4.1. Subjects

Six Iu-Mien speakers, four females and two males, were recorded. Two of them, a female (F1) and a male (M1), were in their 50s, and came to the US from Laos via Thailand when they were 18 and 20, respectively. The remaining four speakers were between 23 and 29 years old. They did not know each other. Two of them (speakers F2 and F3) were born in Thailand, and two (speakers F4 and M2) were born in Sacramento. They all speak Iu-Mien at home.

4.2. Speech material

A corpus of 34 utterances was prepared. It was divided into two lists of 17 sentences each. The first list included the declarative sentence frame [jiə^{33} ma:i^{31} ___] 'I have __' . The second list was the negative sentence frame [jiə^{33} m:a:i^{454} ___] 'I don't have __'. Table 3 gives the words used in the final position in both sentence types. There were three words for each tone, except for tone 232 where an accidental gap occurred, and only two words were available. The speakers were given each of the sentences in English. They were asked to translate them into Iu-Mien and repeat them twice at normal speed. Each of the speakers produced a total of 68 stimuli (17 target words repeated twice in the two intonation frames by six subjects).

Table 3: *Words used in the sentence final position*.

Tones	Words	Tones	Words
45	[piau^{45}] 'house'	21	[pai^{21}] 'comb'
45	[piou^{45}] 'fruit'	21	[ʤuʔ^{21}] 'knife'
45	[dzæŋ^{45}] 'boat'	21	[dei^{21}] 'field'
33	[tæ^{33}] 'dad'	23	[fa:n^{23}] 'umbrella'
33	[ʧɛ^{33}] 'chicken'	23	[həu^{23}] 'pants'
33	[lai^{33}] 'vegetable'	23	[tsau^{23}] 'leg'
31	[he^{31}] 'shoe'	232	[ma:^{232}] 'horse'
31	[ʤɛ^{31}] 'deer'	232	[tuŋ^{232}] 'pig'
31	[ɲan^{31}] 'money'	232	---

Recordings were made using the Sound Studio software program on a Mac with a head mounted Telex H-831 mic. The acoustic measurements were made using the Scicon's Macquirer software program at a sampling rate of 11,025 Hz and a quantization rate of 14 bits.

4.3. Data analysis

Average time-normalized F0 contours were obtained by extracting a 7-point (equally spaced) sequence of F0 values for each of the words given in Table 3 and repeated twice in the statement frame [jiə^{33} ma:i^{31} ___] 'I have __', and in the negation frame [jiə^{33} m:a:i^{454} ___] 'I don't have __'. The F0 values were averaged for each of the tones as produced by the six subjects in the two sentence frames. The same procedure for averaging the time-normalized F0 contours was used for the forms [ma:i^{31}] 'have' and [m:a:i^{454}] 'not.have'. Additionally, the duration of [m:a:i^{454}] 'not.have' and the duration of its geminate [m:] as well as the duration of [ma:i^{31}] 'have' and its singleton [m] were measured and averaged across the six speakers. The data were analyzed using a one-way repeated measures ANOVA.

5. Results

5.1. F0 contours of [m:a:i^{454}] 'not.have'

Figure 2 presents time-normalized F0 contours of [m:a:i^{454}] 'not.have' given in Hz for the four female speakers. Two F0 shapes can be observed: one characterized by a hat-like shape, and one characterized by

a high level F0. The two male speakers show a similar distribution of F0 shapes. Speaker M1 produced a hat-like shaped F0; Speaker M2 produced a level F0.

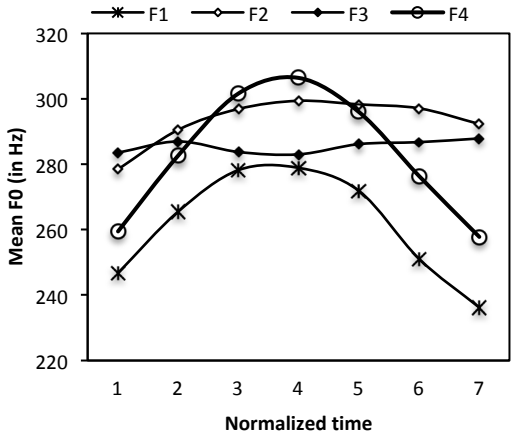

Figure 2: *Averaged F0 contours in Hz.*

The six Iu-Mien speakers divided themselves into two groups. Group 1 speakers (subjects F1, F4, M1) produced an F0 with a hat-like contour; Group 2 speakers (subjects F2, F3, M2) produced a high F0 with a level shape. Figure 3 gives the F0 values extracted in semitones with Praat ([13]). It includes all the speakers, but separates them into two groups according to the F0 shape produced.

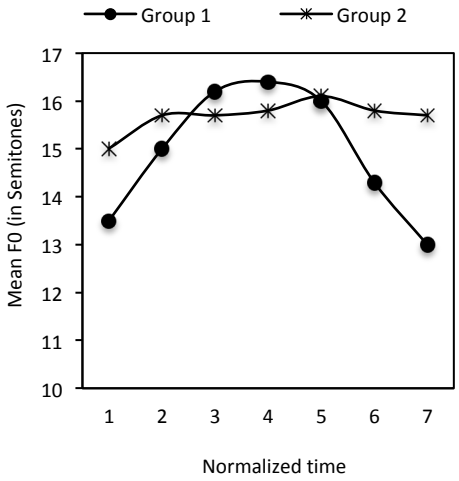

Figure 3: *Average F0 contours in semitones.*

5.2. Geminate [m:]

Besides a new F0 height and contour, the form [m:a:i^{454}] 'not.have' also has a word-initial morphological geminate [m:]. The averaged durational contrasts between the geminate [m:] in [m:a:i^{454}] 'not.have' and the singleton [m] in [ma:i^{31}] 'have', and their standard deviations are presented in Figure 4. Table 4 gives the durational ratios for each speaker. The ratios make it clear that for one of the subjects, speaker F1, the geminate [m:] is particularly long.

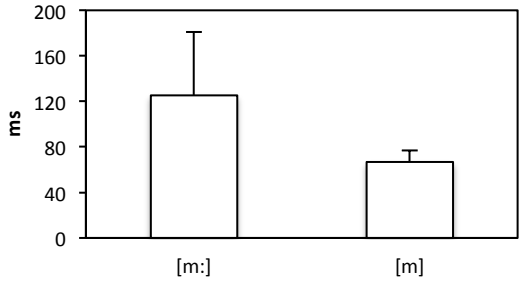

Figure 4: *Averaged duration of [m:] and [m].*

Table 4: *Duration ratios for each speaker and average duration ratio of [m:] to [m].*

Speaker	Ratio
F1	1:2.9
F2	1:1.8
F3	1:1.6
F4	1:1.5
M1	1:1.7
M2	1:1.6
Average	1:1.85

There are significant differences in the duration of the whole word [m:a:i^{454}] 'not.have' and, consequently, in the duration of the geminate [m:] among the speakers. As Figure 5 illustrates it, these durational differences correlate with the two groups into which the speakers were divided earlier. The Group 1 speakers, who produce a hat-like shape of F0, also produce the word [m:a:i^{454}] 'not.have' significantly longer than the Group 2 speakers, who produce a level high tone ($F(1,78) = 53.624$, $p < .0001$). Similarly, Group 1 produce significantly longer geminates than Group 2 ($F(1,76) = 33.790$, $p < .0001$).

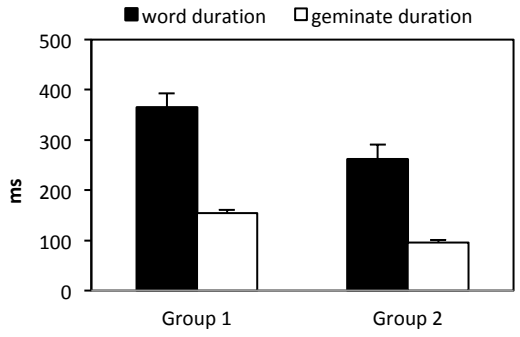

Figure 5: *Duration of [m:a:i^{454}] 'not.have' and [m:] as produced by Group 1 and Group 2.*

5.3. Tonal intonation

Except for tones 45 and 33, the remaining four tones when produced in the final position of the negation frame [jiə^{33} m:a:i^{454}___] 'I don't have __' have lower F0s than the same tones produced in the final position of the statement frame [jiə^{33} ma:i^{31} ___] 'I have __' . The differences in F0 values of the same words given earlier in Table 3 and produced in the two sentence types are significant (at 0.05 significance level) for tones 31, 21, 23, 232 for both female and male subjects. Table 5 presents the ANOVA results.

Table 5: *ANOVA results for the effects of intonation on the F0 levels across the six tones in final position. An asterisk indicates statistical significance at p < 0.05*

Tone	Gender	df	F	*p*
45	Females	1,55	0.809	0.372
	Males	1,27	1.751	0.197
33	Females	1,55	0.161	0.69
	Males	1,27	0.244	0.625
31	Females	1,55	42.341	0.001*
	Males	1,27	27.937	0.001*
21	Females	1,55	12.212	0.001*
	Males	1,27	12.4	0.002*
23	Females	1,55	15.307	0.001*
	Males	1,27	167.242	0.001*
232	Females	1,55	8.947	0.004*
	Males	1,27	26.108	0.001*

The mean contour shapes and heights of the four tones (tones 31, 23, 21, and 232), for which the F0 values are significantly different in the two sentence frames, are given in Figure 6 (the top part is for the female subjects, the bottom part is for the male subjects). In the production of all the subjects, the four tones show lower F0 values in the final position of a negative frame than in the final position of a statement frame. There is clearly some variability in the F0 contour shapes, particularly for tone 232.

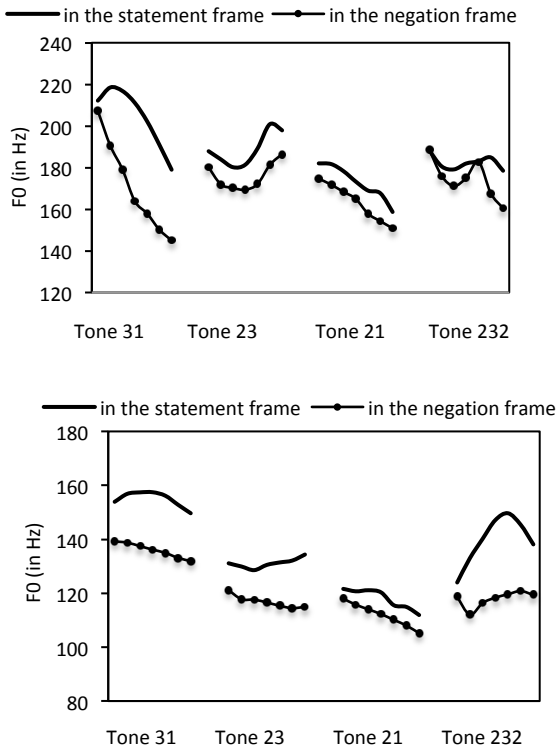

Figure 6: *Effects of a sentence frame on mean F0 values of the four Iu-Mien tones at seven time-normalized F0 contours produced by female subjects and by male subjects.*

6. Discussion

Our analysis of the intonation of the negative sentence [jiə^{33} m:a:i^{454} ___] 'I don't have __', with the 17 words in the final position, focused first on the local prosody of [m:a:i^{454}] 'not.have'. The hat-like shape of [m:a:i^{454}] 'not.have' is based on a merger of two tones, tone 45 and tone 31, into one morphologically based tone 454. We suggest that tone 454 is not a new tone but rather it constitutes an allophonic variation of the high-rising tone 45. There is also another allotone with a high level F0 shape. It co-occurs with a shorter duration of the form [m:a:i^{454}] 'not.have'. Figure 7 presents the graph of the mean F0s for the three allophonic variations of the high-rising 45 tone, i.e., the hat-like contour produced by Group 1, the high level shape produced by Group 2 (both shown earlier in Figure 3), and the high-falling contour of tone 45 when produced in isolation (based on [12]).

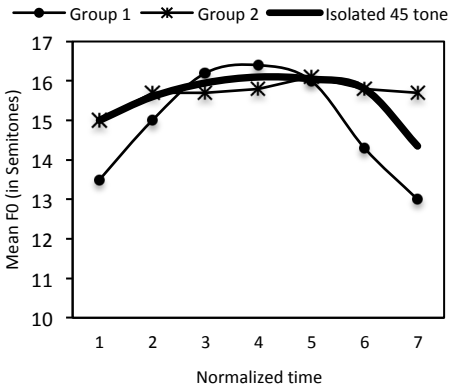

Figure 7: *Averaged F0 contours of the three allotones of the high-rising tone.*

The concatenation of two forms [mai^{45}] 'not' and [ma:i^{31}] 'have' not only resulted in a new F0 contour of the high-rising tone 45, but also in the gemination of the word initial [m]. The word initial morphological geminate [m:] is the only geminate in Iu-Mien.

The study also analyzed the F0 contours of the final words in the negation sentence and compared them with the F0 contours of the same words in the statement sentence. In both sentence frames, these words reported new information and thus were in focus. The analysis showed an intonation-induced lower F0 for tones 31, 23, 21, and 232. Only the falling and/or low tones correlated with a lowered F0 in the negation frame.

7. Final remarks

The study has shown that the prosody of negation in Iu-Mien relies primarily on the local prosody when the verb [ma:i^{31}] 'have' is negated. It has also shown that a more global shape of the negation sentence with [m:a:i^{454}] 'not.have' relies on a lowered F0 for the falling and/or low tones on the words in the sentence final position.

8. Acknowledgements

I would like to thank my Iu-Mien participants for their generous help.

9. References

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