Tonal Specification of Two Falling Pitch Patterns in Akita Japanese

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ABSTRACT

The present study examines the difference of phonetic realization of two types of falling pitch pattern in the Akita dialect of Japanese and seeks for the explanation of the difference in the tonal specifications of them. The analysis of acoustic measurements shows that the two types can be clearly discriminated by the steepness of the f0 fall. The gradual pitch fall is also observed in the longer words and phrases, extending beyond the constituent boundary. I argue that the different shape of the f0 contour results from the tonal specification of the two word classes; the words in unaccented class in the dialect lacks phrasal H tone, unlike the standard Tokyo Japanese. The result suggests that the tone specification in the dialect only consisted in sentential or phrasal terminal tones and tones of the lexical accent.

1. INTRODUCTION

Akita dialect of Japanese is said to have a system which is similar to the standard (Tokyo) Japanese [2, 5, 7]. However, the close examination is revealing that its tonal structure is different from that of the standard Japanese in some very important aspects [9-11]. In this report, I explore the tonal specification of the unaccented words. Akita Japanese has the accent system as in (1). This is a rough representation of the typical pitch pattern from 2 to 4 mora nouns. There are (n+1) accent types for the noun with n-mora length. They are discriminated with the accentedness and the location of the accent.

(1) Traditional pitch pattern of Akita Japanese

accent	2 mora	3 mora	4 mora
unaccented	ML	MML	MMLL
1st mora accented	HL	HLL	HLLL
2nd mora accented	LH	LHL	LHLL
3rd mora accented	-----	LLH	LLHL
4th mora accented	-----	-----	LLLH

The lexical accent is linked to high tone (H*) but the realization of pitch peak is frequently delayed. There is pretty great variation of pitch patterns, especially in the case of unaccented words. Also, several previous studies have reported different pitch patterns for the same classes [2, 5, 7]. However, my own data is rather similar to that of Yamagata Prefecture (the north of Akita) reported by Uwano [9].

The first issue here is the difference between the two falling pitch patterns, ML and HL, MML and HLL... HL pitch pattern also exists in the standard Japanese. What is unique about Akita Japanese is ML pitch pattern of unaccented words. The similar ML pattern is reported to exist widely in northern Japanese dialects. Figure 1 compares a typical pitch pattern of the unaccented word of Akita dialect with that of the standard Japanese taken from [1]. Unaccented word of the standard Japanese has a rising pitch pattern, while that of Akita Japanese has a falling pitch pattern.

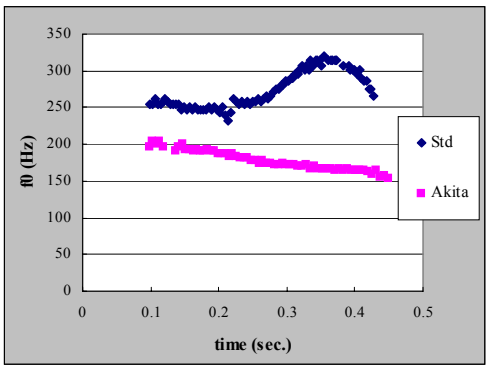

Figure 1 F0 tracking of an unaccented word /kani/ (crub) spoken by a speaker of standard Japanese and a speaker of Akita, SY.

The question is whether the two falling pitch patterns are really distinct and how they are differentiated. Uwano claims that the two falling pitch patterns are quite distinct with his impressionistic observation [9]. However, it should be substantiated in some objective way, given the several different descriptions. Another important issue is how the two different pitch falls are specified phonologically. This exploration is very important for revealing the intonation structure of the dialect. So the research questions of this paper are as below.

Q1) *How should the difference between the two falling pitch patterns be explained?*

Q2) *How are the tones specified, especially on the case of unaccented words?*

First I examine the difference of pitch fall with the data of 2 mora nouns and try to find the answer for Q1 (section 3.1, 3.2). Then I examine the data of longer words and phrases to find the answer for Q2 (section 3.3-3.5). In this study, I adopt the intonation model developed by Pierrehumbert [4, 7] for the description of intonation structure.

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2. PROCEDURE

2.1 Fieldworks

The sound materials of 2 mora nouns were collected on my fieldwork on the year 2001 at Nishisenboku Town. The town is located at the center of Akita Prefecture. The speech sample is made of 398 nouns of native Japanese vocabulary; see Appendix in [11] for details. Judging from the examination in previous reports [9-11], I chose four speakers who are the most conservative, i.e., least affected by the standardization in progress. They were born and raised in the town and have had no experience of living outside it. They will be noted here by their initial as IY (male, 67 years old), SI (male, 59), SY (female, 58), and KI (male, 57). I made a follow-up fieldwork on the year 2003 for collecting longer words and phrases from IT and SI. The data includes the speech sample of 3 and 4 mora nouns (98 words and 30 words).

2.2 The experimental words

In view of the purpose of this study, I chose 9 unaccented 2mora words as representative examples. Those are the words pronounced with the traditional pitch pattern (ML) by most of the elder speakers in my speech corpus. I also tried to select the words which are near the center of the distribution of pitch fall variation observed in [11], discarding the words in both ends of the distribution. For comparison, I chose 8 initially accented words (HL) which have comparable segmental structures. Those words are shown in (2) written in broad transcriptions. From the speech sample of the second fieldwork, I chose 14 words shown in (3), which are pronounced with the unaccented pitch patterns by both IT and SI. They were also fed to the acoustic measurements.

(2) Word list for acoustic measurements: 2 mora nouns

a) the unaccented words

kani 'crub'	kimi 'you'	sara 'plate'
sode 'sleeve'	tora 'tiger'	tori 'birds'
tana 'shelf'	himo 'cord'	fude 'brush'

b) the initially accented words

kare 'he'	kibi 'panic (plant)'	saru 'monkey'
sumi 'corner	tsubu 'grain'	hari 'needle'
fumi 'letter'	hebi 'snake'	

(3) Word list for acoustic measurements: 3 and 4 mora nouns

3 mora nouns

tonari 'the next'	hazime 'beginning'
tsukue 'desk'	koori 'ice'
sakana 'fish'	on'na 'woman'
sakura 'cherry tree'	kaori 'scent'

4 mora nouns

tomodachi 'friends'	nindzin 'carrot'
umeboshi 'salted plum'	niwatori 'chicken'
kanemochi 'the rich'	
mochitsuki 'pestling of rice cake'	

Sometimes voiceless consonants become voiced with the tendency of intervocalic consonant voicing of the dialect, so that we can see f0 at the consonant portion. For example, /futsu:/ 'ordinary' in Figure 3 was pronounced as [fuzu].

2.3 Acoustic measurements

The sound materials were digitized at 11.025KHz by Kay Elemetrics CSL4300B. The acoustic measurements were also made by the program. Fundamental frequency (f0) of the speech materials were calculated pitch synchronously with the autocorrelation method. I correct occasional miscalculations manually. The remaining clear measurement errors were discarded from the date for the statistical analyses. Figure 4 is an example of the f0 measurements.

3. RESULTS AND DISCUSSIONS

3.1 Two types of pitch falls

Figure 2 compares the two falling pitch patterns. Typically, initially accented words have a high beginning, followed by steep pitch fall. On the other hand, the slope of unaccented words is gradual, without abrupt turn of f0 contour (apart from consonantal perturbations). This gradual pitch fall is also seen in the spontaneous speech of the subjects. Figure 4 shows an example. It contains no lexical accent until /ba/, where a rise toward the accentual H* tone starts. The resulting f0 contour is a monotonous gradual pitch fall, with a few sags caused by consonantal perturbations.

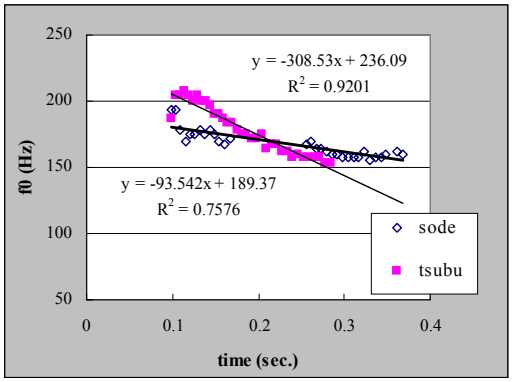

Figure 2 A comparison of f0 contour between HL (/sode/ 'sleeve') and ML (/tsubo/ 'pot') pitch fall. The regression lines are overlaid and its equation and coefficient of determinations are shown above (tsubo) and below (sode).

3.2 Distinction of two falls

This section confirms the distinctiveness of the two pitch falls statistically. Only the speech data of words pronounced in isolation are used here. It is because there are many tokens which are pronounced with the standard pitch pattern (LH) in sentence condition. This is because even the most conservative speakers are never free from the influence of the standardization. A plain hypothesis posited here is that there is a difference in the slope of pitch fall between the two. First, the slope of the pitch fall was calculated with the regression analysis. Figure 2 shows an example of the fitting of the regression lines. F0 measurement was not possible for some of the tokens spoken by KI, because of his creaky voice. Therefore the

statistical analysis was not performed for his data. Table 1 shows the summary of the results. The difference of the slope of the regression line was tested by 1 way repeated measure of ANOVA. The main effect of the accent type was significant for all three speakers (IY df=1, 15 F=75.6 p<.000; SI df=1, 15 F=18.7 p<.000; SY df=1, 15 F=32.0 p<.000). The result confirms that the two falling pitch patterns constitute the different categories.

Speakers	ML mean (SD)	HL mean (SD)
IY	-134.0 (42.1)	-338.9 (54.9)
SI	-270.3 (107.4)	-489.9 (101.0)
SY	-156.0 (50.8)	-291.5 (47.5)

Table1 Result of the regression analysis of 2 mora nouns.

3.3 Duration and slope

The next question is the tonal specification of the less steep pitch fall. My conclusion is that there is no tonal specification for the unaccented class, neither the tone by the lexical accent nor phrasal H tone. I am going to report the supporting evidences below. A crucial evidence for tonal underspecification is the relationship between the slopes of pitch fall and the duration of it; the longer the duration, the less steep the slope. This is in the same fashion as Pierrehumbert and Beckman argues about Tokyo Japanese [7: 35-51]. They examined the slope from the phrasal H to the phrasal L tone. In present case, however, this is an interpolation of L tone on both ends, with no intervening phrasal tones.

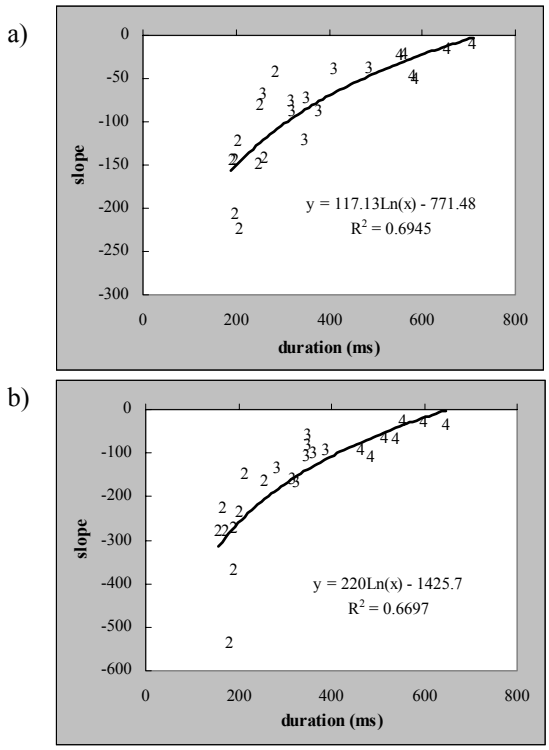

Figure 3 The slopes of the pitch fall plotted against the segmental duration. Panel (a) is the result of IY and panel (b) is that of SI. The plotting figures represent the mora of each word. A logarithmic regression line is fitted to the data and its equation and coefficient of determination are shown below.

This hypothesis was tested with the data of IY and SI (2-4 mora unaccented words spoken in isolation). The slopes of the pitch fall were calculated by regression analysis as in the section 3.2. As the duration measures, the time between the first and the last phonation of the word were used. There are two reasons why I discarded the consonant portions before and after it. One is that it is difficult to decide the onset and offset of consonants, therefore including them would make the measurement less reliable. The other, more important reason is that what really matters for pitch perception is trajectory of f0 in vowel portion [3]. There are several tokens pronounced with standard pitch pattern, i.e. with initial pitch rise. I discarded these tokens with the following statistical analyses.

Two panels in Figure 3 plot the results. They confirm the hypothesis above; the longer the duration, the less steep the slope. Because of the paucity of the data, the approximation by the logarithmic regression is not very good; the upper end of regression lines almost cross zero. However, the relationship can be clearly seen. This suggests that the degree of pitch fall is not actively controlled. Rather it should be regarded as an interpolation of terminal tones at the beginning and the end of each phrase. Therefore it is not necessary to posit Mid tone, besides H and L, for explaining the less steep pitch fall.

3.4 Lack of phrase medial tone

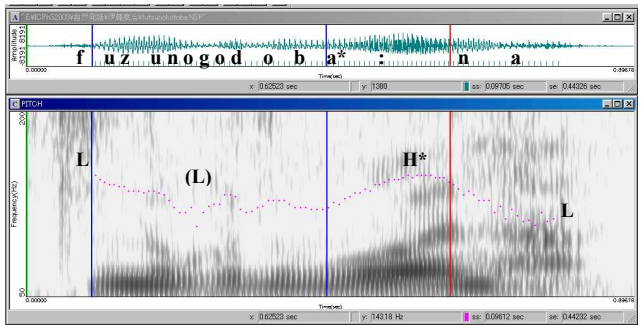

Figure 4 An example of acoustic measurements. The lower panel shows the wide-band spectrogram with the f0 value superposed against it. This is a spontaneous speech by IY /Fuzu no godoba: na/ 'The ordinary speech is like that'. A long stretch of low pitch (with a few sags by consonantal perturbation) can be seen from the beginning of utterance up to the 5th mora, where the F0 rise begins (at around /b/ marked by the second line). The f0 peak by the lexical accent H* on /ba/ is delayed and realized at following /a/ (topic particle).

Next let us see whether there is phrase medial tone. As Pierrehumbert and Beckman argue, there is phrasal H which normally links to the second mora in Tokyo Japanese, realized as the initial rise of the pitch [7]. Figure 4 shows the f0 contour of the words with the accent on the final mora (/kotoba/ 'speech'). The f0 constantly falls from the beginning of the utterance. Pitch rise does not appear until the lexical accent comes. It starts from the final mora /ba/, where the accent H* tone is linked. The f0 peak is delayed and realized at the topicalization particle /a/ next to the accented mora. This very late realization of pitch rise is rather like the f0 contour in Osaka Japanese [7:226]. This suggests the lack of phrasal H tone, i.e., there are not any tones before the H* tone of the lexical accent. It is also

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obvious from the present observation that the terminal tone at the beginning of the sentence is a low tone.

3.5 Cases of longer phrases and sentences

The smooth pitch fall can also be observed in longer stretch of segments. Figure 4 in the previous section is an example of the long stretch of pitch fall. I add one more example here. Figure 5 shows the case where the whole sentence assumes a gradual pitch fall. There is no lexical tone throughout the utterance; therefore the resulting f0 contour is just an interpolation of terminal L tones.

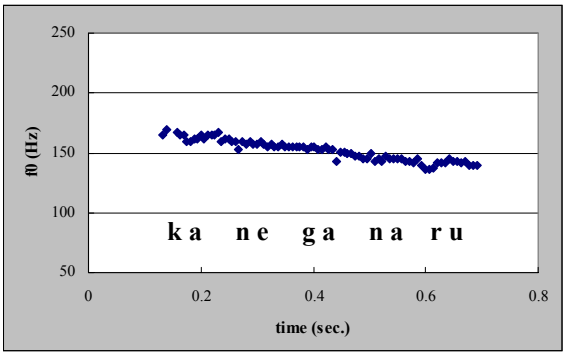

Figure 5 F0 contour of longer unaccented words and phrases: /kane ga naru/ (the bell rings) by IY.

4. DISCUSSION AND CONCLUSION

The answers for the question in section 1 are as below.

A1) *Two types of pitch fall in Akita Japanese differ with their steepness of pitch fall. The regression slopes of the two pitch falls clearly discriminate them.*

A2) *The difference results from their different tonal specifications. The unaccented word in Akita Japanese is unique in that there is no phrasal tone, with the outcome of smooth interpolation from and to the terminal L tones.*

The two types of pitch fall are distinctive as the statistical analysis in section 3.2 confirms. The difference is due to their different tonal specifications. Unaccented words have neither lexical tonal specification (because they are unaccented) nor any phrasal tone. The result is just an interpolation of the terminal L tones, i.e., the gradual pitch fall yielding to natural F0 declination. This pitch fall can continue across the boundary of constituents, until the H* of lexical accent appears. On the other hand, Initial accented words have H* tone of lexical accent. It designates fairly high f0, with the outcome of the steep pitch fall after it. Therefore, it is not necessary to posit M tone for explaining the pitch pattern of this dialect.

The result obtained in the present investigation clarifies the uniqueness of the unaccented word class in Akita Japanese and its tonal specification. The tone in Akita dialect includes only sentential and phrasal terminal tones and H* tones of lexical accent. Therefore, tonal specification of the dialect is sparser than those of Tokyo and Osaka Japanese. The full formulation of the structure of tone specification must await further study, including the prosodic structure hierarchy and other types of terminal tone marking question or some other grammatical and paralinguistic information. I will pursue these questions in the future study.

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