



Lexical H*+L pitch accent in Ryukyuan: Diversities in phonological patterning and phonetic manifestation

Yasuko Nagano-Madsen

Department of Languages and Literatures, University of Gothenburg

yasuko.nagano-madsen@sprak.gu.se

Abstract

Lexical pitch accent languages such as Swedish and Japanese have been claimed to exhibit variation in phonological inventory and/or phonetic manifestation of pitch accents. This paper reports variations in the phonetic manifestation as well as phonological patterning of the lexical H*+L pitch accent in two Ryukyuan dialects – Shuri and Nakijin. The F0 manifestation of H*+L pitch accent in the two dialects was examined with reference to the phonetic evidence reported for Japanese in previous studies. The results showed that Shuri and Nakijin dialects have two entirely different types of F0 manifestation for their H*+L accent regarding the timing of F0 and accented mora, pitch range, and the behavior of post-accent Ls. Furthermore, both the occurrence and distribution of the H*+L accent in Nakijin are limited while it is not in Shuri dialect.

Index Terms: F0 manifestation, lexical pitch accent H*+L, Ryukyuan dialects, synchronization, pitch range, behavior of post-accent Ls

1. Introduction

This paper concerns diversity in the phonological patterning and phonetic manifestation found for the lexical H*+L pitch accent in two dialects of Ryukyuan. Ryukyuan is spoken in the Ryukyu Islands which situate at the southernmost part of the Japanese archipelago (cf. Figure 1). Once there was an independent kingdom that ruled most of the Ryukyu Islands from the 15th to the 19th century, but today it is a prefecture of Japan. Ryukyuan and Japanese are not mutually intelligible but there is a very good phonological correspondence between the two. Whether Ryukyuan and Japanese should be regarded as two separate languages or dialects of the same language is still controversial, but in this paper it is treated as separate language according to recent trend.

Most of the Ryukyuan dialects are endangered (UNESCO 2009) and it is becoming more and more difficult to find genuine native speakers of Ryukyuan dialects today. Within Ryukyuan linguistics, acoustic phonetic study of prosody is obviously the most understudied area. However, recent attempt based on fieldworks have recovered some interesting intonational phenomena that are unique to Ryukyuan [1][2]. Thus far, these studies have concentrated on intonation in Shuri dialect. In this paper, I will focus on the phonetics and phonology of the lexical H*+L pitch accent in Shuri and Nakijin dialects. Shuri is the most influential and well-studied dialect of Ryukyuan that can be regarded as standard Ryukyuan, though it has never been a lingua franca.

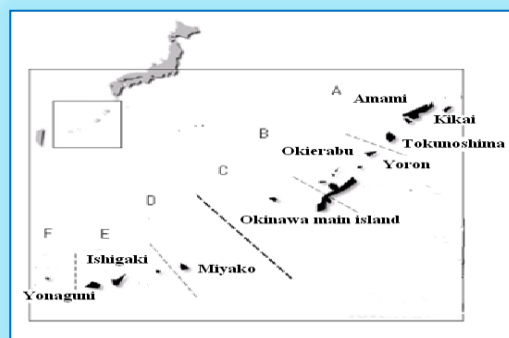


Figure 1: Map of the Ryukyu Islands.

2. Phonological patterning of lexical pitch accents in Ryukyuan

As for the prosodic typology based on the inventory of lexical pitch accents, most Ryukyuan dialects have a contrast of H*+L (accented) vs. unaccented words similar to Japanese. The difference between Japanese and Ryukyuan is that the location of H*+L accent is fixed to the second mora of a word in Ryukyuan while it is not fixed in most Japanese dialects. In both languages, however, the accent is ‘lexical’ in the sense that it is the lexicon that determines whether a given word is accented or not. This is in contrast to such a language like English where pitch accents are post-lexical. While the AM-theory based terms ‘accented’ vs ‘unaccented’ are used in the current paper, many use the traditional Japanese terms ‘falling type / lowering kernel’ vs ‘flat type’ instead [3]. Shuri dialect spoken in southern Okinawa Island represents this system.

A very different inventory of pitch accents is found in Nakijin dialect which is spoken in northern Okinawa islands. Presumably, the Nakijin dialect has one of the most controversial pitch accent systems among all the Japanese and Ryukyuan dialects, which can be demonstrated by the fact that two PhD theses have been advocated for the phonological interpretation of Nakijin pitch accents [4][5]. Although Nakijin is an endangered dialect, the existence of the dictionary and speech database has enabled such works.

Today, most researchers agree that this dialect has three kinds of lexical pitch accent. Uniqueness of the Nakijin accent is partly because of the three kinds of pitch accents instead of two kinds as most other Japanese and Ryukyuan dialects have, and partly because of the rising accent rather than falling accent (H*+L) that is important in distribution. It has also been

noted for a long time that phonetic realization of the H*+L accent in Nakijin dialect is unstable and difficult to capture, but it has never been subject to any phonetic analyses. Most researchers recognize three types of lexical pitch accents in this dialect. The specific feature for this dialect is the main pitch accent is the rising (L- H*) type and the other two types, i.e. falling (H*+L) and flat (H) are limited in their occurrence. A feature of Nakijin dialect to be noted is this dialect is spoken very monotonous at a low pitch range without much pitch variation.

Table 1. *Phonological inventories of lexical pitch accents in Shuri and Nakijin dialects.*

Dialect	Phrasal tone	Lexical pitch accent	Distribution
Shuri	H-	H*+L	unmarked
	H-	-	unmarked
Nakijin	L-	H*	unmarked
	-	H*+L	marked
	-	H	marked

3. Phonetic manifestation of H*+L pitch accent in Japanese

3.1. Synchronization

It has been known for some time that the most critical criterion for pitch accent manifestation is the synchronization of F0 with accented mora/syllable. Many studies of tone, pitch accent, and intonation have used the minima and maxima of F0 as acoustic reference points. These F0 minima and maxima are known to be the acoustic correlates of cricothyroid (CT) activity. Activation of CT correlates with F0 rise while a decrease in CT activity correlates with F0 fall [6]. The F0 minimum (the onset of F0 rise) corresponds to the point at which CT activation begins and the F0 maximum corresponds to the point at which the activation of CT is relaxed. In other words, the F0 minima and maxima are the acoustic reference points that correlate with significant motor commands.

Such phonatory controls at the larynx relative to supraglottal articulation has been identified as a key element in the phonetic analysis of word accent in Norwegian, Swedish, and Japanese [7] [8] [9]. Pitch range and rate of pitch change vary across speakers while the timing of the onset and offset of phonatory command relative to articulatory command is claimed to be constant across speakers for a given accent pattern.

This point can be demonstrated by the F0 manifestation for the HLL and LLH words in Japanese shown in Figure 2 below. The synchronizing point is indicated by a vertical stroke, which usually coincides at the CV-CV boundary between H and L. It is important to note that for Japanese word accent, the F0 rise/fall movements itself is not significant but rather, it is the perceptual change between H and L. In Swedish, on the other hand, the F0 fall is timed with a vowel so that the pitch fall is perceived. Similarly, in a language like English where pitch accents are post-lexical, it is the F0 movement which is timed with a vowel to convey pragmatic meanings.

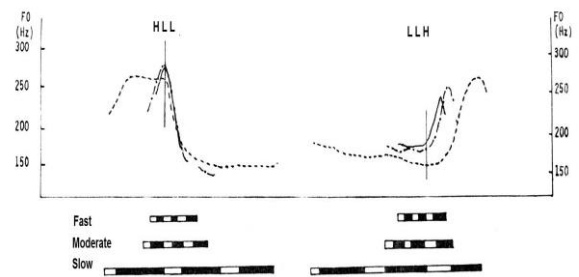


Figure 2: *The F0 contour of HLL and LLH words in Japanese produced at three speaking rates, fast, moderate, and slow. A female speaker. Adopted from [10]. The bars below show consonant (blank) and vowel (black). L.*

3.2. Post-accent Ls

Another F0 characteristics reported for the manifestation of the H*+L pitch accent in Japanese is the case with longer post-accent stretches. When more and more Ls are added to the preceding H as HL, HLL, HLLL, the F0 values of the first and second Ls move upwards (see Figure 3 below). In some cases, the F0 value of the first L can be as high as that of the preceding H. It implies that pitch command is not executed on mora to mora (or syllable to syllable) bases as we perceive but on a larger unit such as word or utterance. It also indicates a gap between human perception and production since such contour shown in Figure 3 are still perceived as LHLLL perceptually despite the very high pitch value for the first post-accented L.

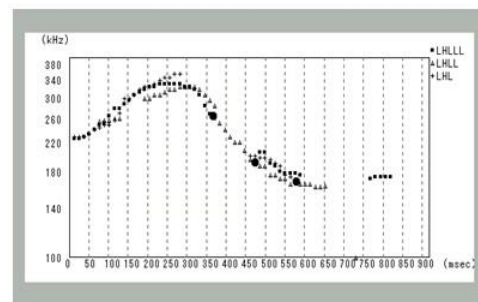


Figure 3: *The F0 contours of LHL, LHLL and LHLLL in Tokyo dialect of Japanese. The end point of the first L is shown by a dot in the same word order. Female speaker. Adopted from [11]*

4. Phonetic manifestation of H*+L accent in Ryukyuan

Nakijin speech sounds monotonous with very narrow pitch range, which can be exemplified below. Figure 4 shows the F0 contours of the pitch accent contrast in Shuri and Nakijin dialect respectively.

The first observation is that all the pitch accents in Nakijin dialect are produced within a very narrow pitch range and that the F0 change is considerably small compared to those in Shuri dialect. The H*+L accent and H accent both have word initial F0 rise and its magnitude is larger for the H*+L accent. These F0 characteristics are exactly the same for the F0

manifestations of pitch accents in Tokyo Japanese. In contrast, none of the three accent types accompany a clear F0 rise word initially.

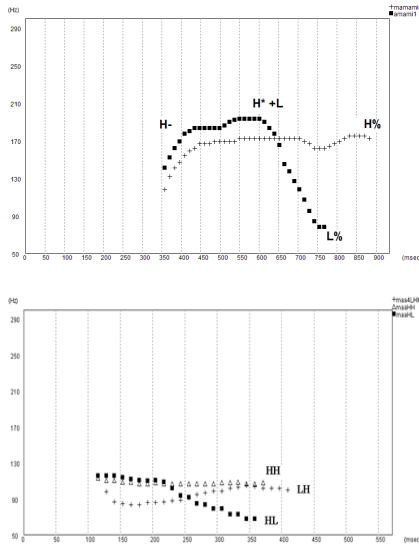


Figure 4: F0 contours for pitch accents in Shuri (above) and Nakijin (below) dialect. Female speakers.

The F0 manifestation of H*+L pitch accent were examined by using words in isolation form extracted from the speech database of Shuri dialect and Nakijin dialect respectively [12][13]. These speech data consist of recordings of word and phrases by a male and female speaker. One hundred words varying in segmental composition for syllable and mora structure were chosen are analyzed by using PRAAT. However, not all the word had recordings from both speakers, and pitch extraction was difficult for some tokens.

4.1. Synchronization for Shuri H*+L

The synchronization of F0 and accented mora was examined visually on the PRAAT screen.

The results showed that F0 maximum was rigidly synchronized with the boundary between an accented mora and post-accented mora regardless of the segmental structure of the morae, i.e. CV, N(mora nasal) or VV, or Q (first half of the double consonant). Figure 5 below shows an example of Shuri word with H*+L accent *maguraa* (surface tone HHLL) in which the onset of F0 fall is synchronized with the H-L boundary.

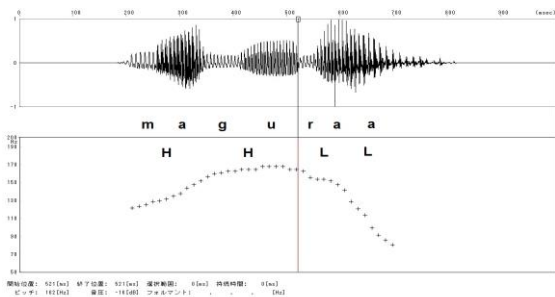


Figure 5: F0 contour for the word with H*+L accent in Shuri dialect. Male speaker.

4.2. Synchronization for Nakijin H*+L

The H*+L accent in Nakijin dialect has long been described as ‘uncertain’ in previous literature [5]. Figures 6 shows three examples to demonstrate variations in F0 patterns for three bi-moraic words having HL pattern perceptually.

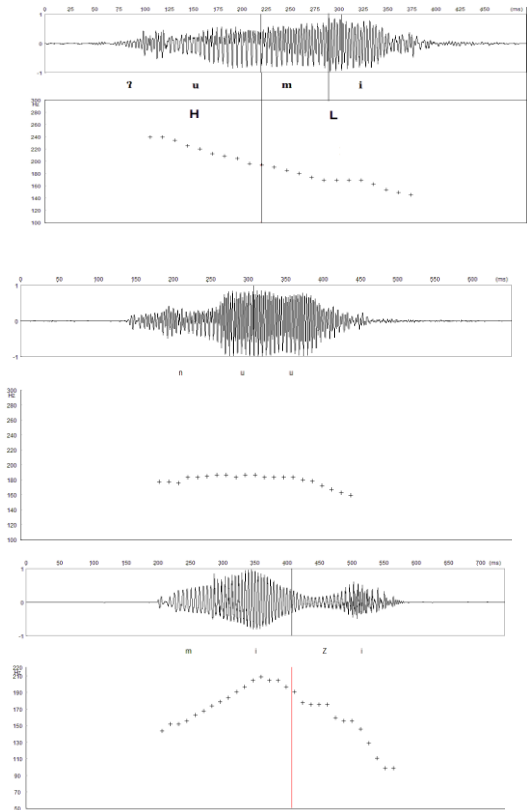


Figure 6: F0 contours for bi-moraic words with H*+L accent in Nakijin dialect. Top and bottom (female speaker), middle (male speaker).

Total of hundred (100) bi-moraic words varying in moraic structure were chosen for examination for male and female speakers. Since pitch extraction was difficult for some words, total of 176 tokens were examined. Table 2 below shows the summary. Out of the 176 tokens examined, only 36% shows clear synchronization between onset of F0 fall and H-L mora boundary while 64% lacks clear F0 boundary between the two moras. Those words with clear F0 boundary tend to have a moraic nasal as second mora. Note, however, regular synchronization was observed regardless of the mora structure.

Table 2. Presence or absence of synchronization in words with H*+L accent in Nakijin dialect.

synchronization	Nr of tokens	%
absent	112	64%
present	64	36%

4.3. Pitch range

In order to examine the production correlates of the perceived narrow pitch range in Nakijin speech, the degree of F0 fall for the lexical H*+L pitch accent in Shuri dialect and Nakijin dialect was measured. For comparison, even the gradual F0 fall (declination) for the unaccented word in Shuri dialect was measured. Total of 100 words differing in mora structure were chosen for analysis for two speakers (male and female) from the database for each dialect. Some words were eliminated because of the difficulty in eliciting the F0. For Nakijin dialect, all the 100 words were two-mora words while those in Shuri dialect varied in word length from two to four morae. This is because two-mora words are not many in Shuri dialect. The degree of F0 fall was measured by subtracting the minimum F0 value from the maximum F0 value for each word. In order to enable the comparison across speakers, the measurement was done in semitones.

The results of the F0 fall for the H*+L accents are presented in the Table 3 below. The mean value of F0 fall for the H*+L accent in Nakijin and Shuri differed significantly. It is only 5.84 semitones for Nakijin while that of Shuri is 15.09 semitones. The F0 fall of the H*+L accent in Nakijin dialect is closer to that of declination rather than the H*+L accent in Shuri dialect. These figures support an auditory impression of the narrow pitch range (monotonous) in Nakijin dialect.

Table 3. Degree of F0 falls for Shuri and Nakijin dialects.

Dialect	Accent type	Mean F0 fall (in semitone)	Nr of tokens	S.D.
Nakijin	H*+L	5.84	187	3.08
Shuri	H*+L	16.02	185	3.82
	H	3.40	179	3.21

4.4. Post accent Ls

The behavior of post accent Ls was examined only for Shuri dialect because Nakijin dialect has limited patterning of words with H*+L accent, i.e. most of them are bi-moraic. Figure 7 shows the F0 contour for three words that has surface tone structure LHL, LHLL, and LHLLL in Shuri dialect. In principle, the pitch of the post-accent L behaves exactly the same as that for Tokyo dialect of Japanese shown in Figure 3 in that it gradually raises as more and more Ls are added.

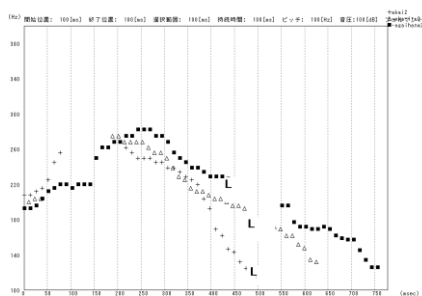


Figure 7: F0 contours for LHL, LHLL, and LHLLL words in Shuri dialect. L indicates the endo point of the first post-accent. Female speaker.

5. Discussion

Phonetic manifestation of the lexical H*+L accent in Shuri and Nakijin dialects of Ryukyuan was examined with reference to synchronization, pitch range, and the behavior of post-accent Ls. In all the aspects, the two dialects showed significant differences in F0 manifestation (or in phonological patterning for post-accented Ls in Nakijin since it lacks such words). The H*+L pitch accent in Shuri dialect shares the basic characteristics of phonetic manifestation reported for Japanese while the H*+L accent in Nakijin doesn't. In phonetic literature, it has long been claimed that the critical phonetic manifestation of pitch accent such as found in Swedish and Japanese is synchronization of F0 and accented mora/syllable. The present data from Nakijin dialect has added a new insight in the phonetic manifestation of HL shows counter evidence to such a well-established claim.

At this point, it is also important to note that the phonological patterning of the H*+L accent also differs between Shuri dialect and Nakijin dialect. While the distribution of H*+L accent is unmarked in Shuri, it is limited to the word initial position in Nakijin [5]. In Nakijin, it is the rising type accent L- H* that is unmarked and free in distribution. Most of the phrases are the succession of the L- H* words and to find a succession of H*+L words is difficult in Nakijin dialect.

The current paper has shown a great diversity both in the phonetic manifestation and phonological patterning for the lexical H*+L pitch accent in Ryukyuan dialects.

6. References

- [1] Y. Nagano-Madsen, "Intonation in Ryukyuan - with reference to modality, syntax, and focus," *Language Documentation and Description*, vol 10, pp.178-207, London:SOAS, 2011.
- [2] Y. Nagano-Madsen, "Intonation in Okinawan (chapter)," *Handbook of the Ryukyuan Languages*, pp. 199-225, Berlin/New York: De Gruyter Mouton, 2015.
- [3] Pierrehumbert, Janet and Mary E. Beckman (1988) Japanese tone structure. Cambridge, MA: MIT Press.
- [4] W.P. Lawrence, 1990. Nakijin Phonology: Feet and extrametricality in a Japanese dialect. Unpublished PhD thesis, University of Tsukuba. 1990.
- [5] H. Ogawa, Structure of Nakijin accent (=in Japanese), Unpublished PhD thesis, Kobe University, 2009.
- [6] H. Hirose, "Comments in the discussion after Fujisaki et al.'s paper. In Stevens, K. & Hirano, M. (eds.) *Vocal Fold Physiology*, pp.361. Tokyo: University of Tokyo Press, 1981.
- [7] E. Haugen, "Phoneme or prosodeme?," *Language* 25, 278-282
- [8] Öhman, Sven. Word and sentence intonation: A quantitative model. *Quarterly Progress and Status Report* 2-3: 20-54. Royal Institute of Technology: Stockholm.1967.
- [9] H. Fujikaki and H. Sudo, "A model for the generation of fundamental frequency contours of Japanese word accent," *Journal of the Acoustical Society of Japan* 27, pp.445-453, 1971.
- [10] Y. Nagano-Madsen, "Effects of tempo and tonal context on fundamental frequency contours in Japanese," *Working Papers* 31, pp. 103-115. Department of Linguistics and Phonetics, Lund University, 1987.
- [11] Y. Nagano-Madsen, "Phonetic realization of the HL and LH accents in Japanese," *Proceedings of the Symposium Cross-Linguistic Tonal Phenomena*, pp.243-264, Tokyo, 2003.
- [12] Speech Database for Shuri Ryukyuan: <http://ryukyulang.lib.u-ryukyu.ac.jp/srnh/index.html>
- [13] Speech Database for Nakijin Ryukyuan: <http://ryukyulang.lib.u-ryukyu.ac.jp/nkjin/index.html>