The Ikema Dialect of Miyako Ryukyuan Has a Three-, not Two-, Pattern Accent System

Yosuke Igarashi*, Tukinori Takubo**, Yuka Hayashi**, Thomas Pellard*** and Tomoyuki Kubo****

SUMMARY: In this paper we test the hypothesis that Ikema, a dialect of Miyako Ryukyuan, has a three-pattern accent system, where three accent classes, Types A, B, and C, are lexically distinguished, in contrast with previous studies which have claimed that it has a two-pattern accent system. The results of our analysis confirm the existence of three distinct accent classes. The three-way distinction can only be observed in quite restricted conditions, including when nouns followed by one or more bimoraic particles precede a predicate. The results also reveal that Type A words are few in number, indicating that Type A words are in the process of merging with Type B.

Key words: Ryukyuan, Miyako, Ikema dialect, three-pattern accent system, acoustic analysis

1. Introduction

The goal of this paper is to show that the accent system of the Ikema dialect of Miyako Ryukyuan (Ikema, below), which has been described as having a two-pattern accent system, is a three-pattern system.

Ryukyuan is the only language group proven to be genetically related to Japanese (Hattori 1979) and is composed of five mutually incomprehensible subgroups, namely: Amami and Okinawan (the Northern Ryukyuan group), and Miyako, Yaeyama and Yonaguni (the Southern Ryukyuan group) (Pellard 2009b, 2011, Shimoji 2010). Ikema, the target of analysis in this paper, is a dialect of Miyako, which is a member of the Southern Ryukyuan group. This dialect is spoken in three areas of Miyako City in Okinawa Prefecture: on Ikema Island, in Sarahama on Irabu Island, and in Nishihara on Miyako Island and is estimated to have approximately 2,000 fluent speakers. The findings reported in this paper are all based on data from speakers from Nishihara.

While a small number of dialects in the Northern Ryukyuan group have “multi-accent systems” in which the number of contrasting patterns does not vary with word length (Uwano 1984a). Excluding a small number of examples in which oppositions have increased due to various reformation, the maximum number of oppositions in an N-pattern system is 3 (a “3-pattern accent system”) (Uwano 1997). Dialects with the 3-pattern accent system are concentrated in the Northern Ryukyuan group and, with the exception of Yonaguni Ryukyuan (Hirayama and Nakamoto 1964, Uwano 2010) and the Iriomote-Sonai dialect of Yaeyama Ryukyuan (Hirayama et al. 1967)1, it has been generally accepted that 3-pattern accent systems do not exist in Miyako Ryukyuan (Hirayama et al. 1967, Hirayama 1983).

It was reported by HIRAYAMA Teruo et al. that the accent systems of Miyako Ryukyuan dialects are either so-called 1-pattern systems, which have no contrastive accent distinctions (Hirara, Irabu-Nakachi) or 2-pattern systems with two contrasting patterns (Yonaha, Uechi) (Hirayama et al. 1967, Hirayama 1983). HIRAYAMA Teruo et al. also indicated that the Ikema dialect that is the target of analysis in this paper had a 2-pattern system and that among “the younger generation” the phenomenon was observable of the distinction between the two accent patterns becoming obscured in adjectives (so-called “accent ambiguation”). Even comparatively

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In our earlier research (Hayashi et al. 2008), we reported the fact that Ikema dialect speakers born after the 1940s maintain a clear accent system and showed that the description of Hirayama et al. of the appearance of "accent ambiguation" did not apply, at the least to the variety spoken in Nishihara. However, we also shared the view of other researchers of this dialect having a 2-pattern accent system.

Based on the descriptions in such previous research, it might be thought initially that it would be more appropriate to posit a 2-pattern accent system for proto-Miyako Ryukyuan, the common parent language of the Miyako dialects, over a 3-pattern system. If this view were correct, there should be no Miyako Ryukyuan dialects with a 3-pattern system, retaining the oppositions that existed in proto-Ryukyuan. However, this proposal is incorrect. There are at least two pieces of evidence that show that proto-Miyako Ryukyuan had a three- (or more)-way opposition in accent patterns.

The first piece of evidence can be found in recent descriptions by MATSUMORI Akiko of the Tarama dialect of Miyako Ryukyuan. This dialect was formerly considered to have a 2-pattern system (Hirayama et al. 1967), but it has been shown that it has a 3-pattern system preserving the accent pattern distinctions proposed for the common parent of the Ryukyuan languages (proto-Ryukyuan) (Matsumori 2010). The Tarama dialect has been held to be more closely related to the dialects of Yaeyama Ryukyuan than to the Miyako dialects (Karimata 2000), but researchers using cladistics, based on shared innovations, have presented independent evidence that Tarama Ryukyuan is a dialect that split off from the Miyako dialects (Lawrence 2003, Pellard 2009). Based on the latter position, the fact that Tarama Ryukyuan has a 3-pattern system can only be explained by saying that proto-Miyako had a three-way distinction.

Another piece of evidence is to be found in the fact that, as recently pointed out by MATSUMORI Akiko, there is a dialectal difference in the convergence of accent patterns. Matsumori, developing a proposal due to Hattori 1958 based on comparative research into the accent patterns of the dialects of Ryukyuan, hypothesized that proto-Ryukyuan had at least two types of accent patterns distinguished for one-mora words and at least three patterns for two- and three-mora words and proposed to designate these as Class A, Class B, and Class C (Matsumori 2000a, b). The aggregate of words identified by which of the three classes they belong to is called a categorized word list, and, according to Matsumori, among the Miyako dialects with 2-pattern accent systems, there are those in which Classes A and B have converged (AB/C) (e.g., the Yonaguni dialect) and those in which Classes B and C have converged (A/BC) (e.g., the Uechi dialect) (Matsumori 2011). This fact can only be explained by saying that at the stage before the dialects diverged, that is, proto-Miyako, all three classes were distinguished (A/B/C).

As shown above, recent studies of the accent systems of Miyako Ryukyuan dialects strongly suggest that proto-Miyako had a three-(or more) way opposition. Considering this fact, it would not be unrewarding to pursue the possibility that dialects exist among present day Miyako Ryukyuan dialects that preserve a three-pattern accent system. We therefore set up the hypothesis that this dialect does in fact preserve a three-pattern system and initiated a systematic study aimed at proving this hypothesis. We discovered as a result that a three-way distinction is realized in a specific environment.

In the following, Section 2 describes the accent system of nouns in Ikema within the scope of what our research has made clear and show that this dialect does have a three-pattern system. Section 3 offers acoustic phonetic evidence for the claim that the noun accent system of Ikema has three patterns. Section 4 summarizes our argument and states our conclusions.

2. The Ikema Accent System

In this article we will refer to the three types of accent patterns found in Ikema as the A-pattern, the B-pattern, and the C-pattern; the names were chosen with correspondence with the classes in the categorized word list mind. Furthermore, we will limit our investigation to nouns of three or fewer mora. Since Ikema has no 1-mora nouns, we will be focusing on 2- and 3-mora nouns.

As in Section 1, it has been generally accepted that Ikema has a two-pattern accent system (Hirayama et al. 1967). According to HIRAYAMA Teruo et al., the accent patterns in Ikema surface as shown in Table 1. Following customary practice, in what follows a rise in pitch is shown by “↑” and a fall in pitch by “↓”. HIRAYAMA Teruo et al. named one pattern for 2-mora nouns odakagata ‘high final pattern’ and the other teihigata ‘low level pattern’ but judging from the form in which they are realized and the lexical items in each pattern, the former pattern corresponds to our A- and B-patterns...
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Table 1  Description of the realization of each accent pattern by HIRAYAMA Teruo et al. (Hirayama et al. 1967, Hirayama 1983).

<table>
<thead>
<tr>
<th>Accent Pattern</th>
<th>Isolated Utterance</th>
<th>With Particle -nu ‘Subject Marker’ (Nominal + Focus Marker)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-mora</td>
<td></td>
<td></td>
</tr>
<tr>
<td>teihe-gata (C-pattern)</td>
<td>usi ‘mortar’</td>
<td>[usi-nudu] ari ui ‘There is a mortar.’</td>
</tr>
<tr>
<td>3-mora</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nakadaka-gata (A- and B-patterns)</td>
<td>a[fu]zi ‘yawn’</td>
<td>a[fuzi]-nu idi yui ‘Make a yawn.’</td>
</tr>
<tr>
<td>teihe-gata (C-pattern)</td>
<td>garasa ‘crow’</td>
<td>[garasa-nudu] u[ri] ui ‘There is a crow.’</td>
</tr>
</tbody>
</table>

and the latter to our C-pattern. Similarly, with 3-mora nouns, Hirayama et al’s nakadaka-gata ‘middle high pattern’ corresponds to our A- and B-patterns and their teihe-gata ‘low level pattern’ to our C-pattern.

Our study found that when nouns are pronounced in isolation, they are exactly as shown in Table 1. Looking only at 2-mora nouns, HIRAYAMA Teruo et al’s description and ours coincide exactly. Regarding 3-mora nouns, our descriptions agree on A- and B-pattern nouns, but a discrepancy is found with the C-pattern nouns. It is unclear whether this discrepancy is due to generational or geographical differences or to some other factor.

(1) Realization patterns in isolation

a. 2 mora  A-pattern: [bu]tu ‘husband’
           B-pattern: [ma]yu ‘cat’
           C-pattern: na[bi ~ nabi ‘pan’

b. 3 mora  A-pattern: a[gai]i ‘east’
           B-pattern: mu[nui]i ‘word’
           C-pattern: u[mui ~ umui ‘thought’

It appears that when pronounced in isolation the opposition between the A-pattern and B-pattern is neutralized in both 2- and 3-mora nouns. Looking only at isolated utterances, we can make the generalization that a fall is found between the next-to-last and the last moras in the A- and B-patterns but there is no such fall in the C-pattern.

Other than the 2-mora A-pattern and B-pattern nouns in isolation, there in all patterns there are cases in which the first mora is realized with a low pitch and cases in which it is realized with a comparatively high pitch. As described below, when a 2-mora A- or B-pattern noun is followed by a particle or other word, the first mora in these cases also may be realized with a low pitch (A-pattern bu[stu]-nu ~ [butu]-nu ‘husband’s’; B-pattern ma[yu]-nu ~ [mayu]-nu ‘cat’s’). Whether this alternation is a matter of free variation or is determined by some other factor is a matter for further investigation. Below we will consider the pattern with the first mora low as the basic pattern and omit showing the alternation.

The realizations of nouns in an utterance-final environment with the 1-mora particle -nu ‘nominal or genitive case’ attached are shown in (2). (We have confirmed that of other 1-mora particles, at least -ya ‘topic marker’ and -u ‘accusative case’ show the same patterns.)

(2) Realization with utterance-final noun + 1-mora particle -nu

a. 2 mora  A-pattern: bu[stu]-nu ‘husband’s’
           B-pattern: ma[yu]-nu ‘cat’s’
           C-pattern: na[bi-nu]i ‘pan’s’

b. 3 mora  A-pattern: a[gai]-nu ‘east’s’
           B-pattern: mu[nui]-nu ‘word’s’
           C-pattern: u[mui]-nu ‘thought’s’

Considering only the 2-mora words, the generalization can be made that an immediate fall is observable in A-pattern and B-pattern nouns but that there is no such fall in C-pattern nouns. In this environment as well, the A-pattern and B-patterns are neutralized. On the other hand, in this environment, all patterns are neutralized with 3-mora nouns; that is, all patterns are realized with a fall between the second and third mora.

The realization of nouns followed by the 2-mora particle -mai ‘also’ in utterance-final position is shown in (3). (The same pattern has been confirmed with other 2-mora particles, at least for -kara ‘from’ and -nu ‘nominal + focus marker’.)

(3) Realization with utterance-final noun + 2-mora particle -mai

a. 2 mora  A-pattern: bu[stu]-mai ‘husband also’
           B-pattern: ma[yu]-mai ‘cat also’
           C-pattern: na[bi-mai] ‘pan also’

b. 3 mora  A-pattern: a[gai]-mai ‘east also’
           B-pattern: mu[nui]-mai ‘word also’
A three-way distinction is observable, as shown in (4). When a noun appears in an utterance-final environment, the distinction between the A- and B-patterns in both 2-mora and 3-mora words appears to be neutralized. The generalization can be made that with both A-pattern and B-pattern nouns, a fall is observable before the particle -mai but that no such fall is observed with C-pattern nouns (Hayashi et al. 2008). Hirayama et al. (1967) record the realization patterns they observed with the 2-mora particle -nudu ‘nominative + focus marker’ (Table 1) and our observations essentially agree with their observations for this environment.

In the environments examined so far, since at least some patterns are neutralized, at most two types of accent patterns have been observable. The examples in (4), however, showing the realizations with the 2-mora particle -mai ‘also’ followed by the predicate nyaan ‘not exist’ in the utterance-final environment, show three distinct accent patterns.

(4) Realization with utterance-final noun + 2-mora particle -mai + predicate nyaan

a. 2 mora A-pattern: bu[tu]-mai nyaan. ‘There’s no husband either.’
B-pattern: ma[yu]-mai [nyaan. ‘There’s no cat either.’
C-pattern: na[bi-mai] nyaan. ‘There’s no pan either.’

b. 3 mora A-pattern: a[gai]-mai nyaan. ‘There’s no east either.’
B-pattern: mu[nui]-mai [nyaan. ‘There’s no word either.’
C-pattern: [mu[i-mai] nyaan. ‘There’s no thought either.’

Both 2-mora and 3-mora words have the same realization in this environment. In that a fall is observable before the 2-mora particle -mai with the A- and B-patterns but not with the C-pattern, the realizations in (4) are the same as in the environment given in (3). The difference between the A-pattern and the B-pattern, which has been neutralized in all environments examined so far, shows up between the 2-mora particle -mai and the predicate nyaan. Concretely speaking, whereas a fall is observed between -mai and nyaan with the A-pattern, a rise is observed with the B-pattern. In the C-pattern, on the other hand, a fall is found.

When a noun appears in an utterance-final environment followed by a 2-mora particle and by a predicate, a three-way distinction is observable, as shown in (4). As shown in (3), the A-pattern and B-patterns are neutralized even when followed by a 2-mora particle if not then followed by a predicate. In addition, it appears that even when utterance-final and followed by a predicate, if there is not an intervening 2-mora particle (for example, saki-nu nyaan. ‘There’s no sake.’), the distinction between the A- and B-patterns is neutralized. From the observations above, it can be concluded that an environment that simultaneously satisfies both the condition that the noun be followed by a 2-mora particle and the condition that it be further followed by a predicate word in utterance-final position is one environment in which the three-way distinction is realized.

From the discussion so far it may appear that we can make the generalizations that the pitch movement showing the difference between the C-pattern and the other two (C-pattern = level, A- and B-patterns = fall) occurs between the noun and the following 2-mora particle and that the pitch movement distinguishing the A- and B-patterns (A-pattern = fall, B-pattern = rise) appears between a 2-mora particle immediately following the noun and a following predicate. However, although the first generalization is correct, the latter is not. The reason the latter is not is that, when a noun is followed by two 2-mora particles, the pitch movement in question is also found between the first and second 2-mora particles. The examples in (5) show the pitch realizations in an environment where the noun is followed by the 2-mora particle -kara ‘from’ which is then followed by the 2-mora particle -mai ‘also’ and the predicate kaki ‘write.imperative’ in utterance-final position.

(5) Realization with utterance-final noun + 2-mora particle -kara + 2-mora particle -mai + predicate kaki

a. 2 mora A-pattern: bu[tu]-kara-mai ka[ki. ‘Write from the husband also.’
B-pattern: ma[yu]-kara-[mai] ka[ki. ‘Write from the cat also.’
C-pattern: na[bi-kara]-mai ka[ki. ‘Write from the pan also.’

b. 3 mora A-pattern: a[gai]-kara-mai ka[ki. ‘Write from the east also.’
B-pattern: mu[nui]-kara-[mai] ka[ki. ‘Write from the word also.’
C-pattern: [mu[i-kara]-mai ka[ki. ‘Write from the thought also’
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between -kara and -mai. Accordingly, the appropriate generalization is that the pitch movement in question occurs between the 2-mora particle (the second word) and a word of two or more moras that follows (the third word)\(^9\).

Furthermore, the essential condition that, even should a noun be followed by two 2-mora particles, the utterance must end with a predicate in order for the three-way distinction to be realized, remains fixed. The distinction between the A- and B-patterns is not clearly observable in the environment “noun + 2-mora particle + 2-mora particle + end of utterance”.

From the above discussion, it is clear that, at any rate, the distinction among the three accent patterns can be realized in a string made up of three words, each of two or more mora. Accent in Ikema, which occurs (at least on the surface) over the large linguistic unit of a three word string may remind one of the tonal phenomenon of intonation (sentence tone) which similarly occurs over a large linguistic unit. However, at least in the framework we are applying, the characteristic sharply distinguishing accent and intonation lies not in the particular unit within which the tone is realized (the word for accent and the phrase or clause for intonation). The distinction between the two lies in whether or not the tone is specified for individual lexical items. Accordingly, as long as the tone feature is specified for each lexical item, it is considered to be accent, even though it may be realized over a domain larger than a word such as a phrase or clause.

In order to confirm that the tonal phenomenon in question is specified for lexical items, minimal pairs contrasting only in accent are shown in (6). The corresponding speech waveforms and fundamental formant frequency curves (F0) are shown in Figure 1. If, in a pair in which all vocal characteristics other than tonal ones are the same, the intellectual meaning of the single words occupying the same location are different, then the observed tonal differences between the two utterances must be ascribed to lexically specified differences in the words in question, namely accent.

![Minimal pairs contrasting in accent showing vocal waveform (above) and F0 graph (below).](image-url)

Figure 1. Minimal pairs contrasting in accent showing vocal waveform (above) and F0 graph (below).
(6) Minimal pairs distinguished solely by accent

a. A-pattern versus B-pattern
   A-pattern: [i][i]-mai nyaan.
   ‘There’s no west either.’
   B-pattern: [i][i]-mai [nyaan.
   ‘There’s no drill either.’

b. B-pattern versus C-pattern
   B-pattern: [n][n]-mai [nyaan.
   ‘There’s no dog either.’
   C-pattern: [n][n-mai] nyaan.
   ‘There’s no ocean either.’

c. A-pattern versus C-pattern
   A-pattern: yu[i]-mai nyaan
   ‘There’s no labor cooperation either.’
   C-pattern: yu[i-mai] nyaan.
   ‘There’s no supper either.’

The above observations are summarized below in (7).

(7) The Ikema accent system

a. There are three accent patterns.

b. Environments in which the three types can be distinguished are extremely limited and one such environment is one that satisfied the two conditions that a 2-mora particle follow a noun and that it be a predicate ending the utterance.

c. The three-way distinction is realized in a string of three words of two or more moras each.
   - In the environment of “noun + 2-mora particle + predicate + utterance final”, the distinction is realized in the domain from the noun through the predicate.
   - In the environment of “noun + 2-mora particle + predicate + utterance final”, the distinction is realized in the domain between the noun and the second 2-mora particle.

d. The three patterns realized under the condition of a noun followed by a 2-mora particle in a utterance-final predicate are realized on the surface as:
   A-pattern: There is a fall between the noun and the following 2-mora particle and another fall between the 2-mora particle and the following word.
   B-pattern: There is a fall between the noun and the following 2-mora particle and a rise between the 2-mora particle and the following word.
   C-pattern: The noun and the following 2-mora particle are at the same level and there is a fall between the 2-mora particle and the following word.

Although there are many areas that are still unclear about the accent realization rules for Ikema, there is little doubt that accent realization in this dialect has unusual characteristics when viewed typologically.

The environment of “noun + 2-mora particle + predicate + utterance final” is one environment in which the three types of accent patterns are completely realized, but it is not thought to be the only such environment. What other environments there may be is a matter for future research, but environments in which the three-way distinction is fully realized are undoubtedly highly limited. One of the reasons Ikema has been mistakenly described as having two accent patterns in previous descriptions can be thought to be the fact that environments realizing the distinctions in patterns are quite limited.

We have described above the noun accent system of Ikema and have demonstrated that this dialect has a three-pattern system. The next section will prove that Ikema has a three-pattern system using acoustic phonetic methods.

3. Acoustic Analysis

3.1 Methodology

3.1.1 Speakers
   The speakers are the three male native speakers of Ikema (Nishihara variety) described in (8).

   (8) Speakers
   a. MT born 1943 male
   b. MK born 1935 male
   c. MH born 1947 male

3.1.2 Phonetic Materials
   Potential words were chosen from words in the Miyako Ikema (Nishihara variety) dialect that were cognate to words in Miyako Tarama found in Matsumori (2010). The potential test words were presented to the speakers in the following sentence frames.

   (9) Frame sentences (X shows the test word.)
   a. X-mai nyaan ‘There’s no X either.’
      (Speakers MT and MK)
   b. X-mai arii duu.11) ‘There is X also’
      (Speaker MH)

   From the spoken potential test words, words were chosen that met the following criteria: 1) they were composed of two or three mora, and 2) no variation in accent pattern was observed among the speakers. As a result, the 121 words in Table 2 were selected as test
word.

3.1.3 Recording

Recording was done between January 8 and January 10, 2011 in either the speakers’ homes or the community center in the village of Nishihara, Miyakojima City, Okinawa Prefecture using a C420 condenser microphone made by AKG and a PMD660 recorder made by Marantz.

The test sentences were presented to the speakers with the Ikema pronunciation of the words spelled in *hiragana* and the approximate meaning of the word in Japanese given together (example: かじゃ kaja “J. 匂い nioi ‘odor’”). The speakers read each test sentence once. The first and second authors monitored the speakers’ reading and had the speaker redo a sentence on the spot when he made a mistake in reading a test sentence.

The recorded speech was passed through an appropriate low-frequency pass filter and saved in a 16-bit format on a memory card at a sampling rate of 44.1 kHz.

3.1.4 Methods of Analysis

The following methodology was adopted as the primary method of analysis. First all test words were categorized by accent pattern based on auditory impression. Next, the F0 of the test words belonging to the various accent patterns was measured. Finally, in order to determine whether the average values for the F0 of each of the various accent patterns were different from each other, a test for differences (ANOVA) was conducted and the validity of the initial division into accent patterns was verified. The tests on the differences in the F0 values were done both viewing the F0 levels of the three words in the test frame and also viewing the F0 movement between words.

Another analytic method adopted was cluster analysis. Since cluster analysis is a method that does not rely on externally imposed values but automatically analyzes the data, it can be said to be a method more suited to examining how many accent contrasts there are than the method described above which starts off by measuring the differences among three predetermined categories. This analysis was conducted only looking at F0 movement between words.

3.1.5 Measurement

Measurement was performed using the phonetic analysis software Praat. First, while viewing the screen showing simultaneously both the wave form and the broadband spectrogram, word boundaries were identified manually, thus identifying the word region, the particle region, and the predicate region. Next, using the “To Pitch ...” command, the frequency of the F0 in Hz was extracted at 10 msec intervals. Using the Praat script function, three points (Pt1, Pt2, Pt3) on the F0 curve were then identified and the F0 values at each point were measured automatically. Pt1 is defined as the point at which the highest F0 is found within the test word region, Pt2 as a point at 80% of the particle region, and Pt3 as a point at 50% of the predicate region.

3.2 Results

3.2.1 Division into Accent Patterns by Qualitative Analysis

The division of the test words into accent patterns by auditory impression is given in Table 2. There is a regular correspondence such that cognates of words in the B-pattern in Tarama are nearly all also B-pattern in Ikema and cognates of words in the C-pattern in Tarama are nearly all in the C-pattern in Ikema. On the other hand most of the A-pattern words in Tarama correspond to the Ikema B-pattern, but over half of those that do not instead correspond to the A-pattern. Only a few words in Ikema belong to the A-pattern (7 out of 121 words).

3.2.2 Analysis of the F0 Level

Figure 2 shows the mean values of F0 at Pt1, Pt2, and Pt3. With the accent pattern (A, B, or C) as the independent variable, we conducted a multivariate analysis of variance (MANOVA) using the Pillai trace and found that accent pattern had a significant effect for all speakers [MT, F(6, 234) = 81.70, P < 0.001; MK, F(6, 234) = 90.02, P < 0.001; MH, F(6, 234) = 46.45, P < 0.001]. Multiple comparisons were conducted using the Bonferroni adjustment to see whether the effect of accent pattern was significant at each point of measurement (the P values are shown in Figure 2). The differences between the A-pattern and the B-pattern, between the B-pattern and the C-pattern, and between the C-pattern and the A-pattern were all significant at Pt2 for all speakers (C > A > B; from here on, X > Y indicated that X is significantly higher than Y). At Pt3, for all speakers the differences between the A-pattern and the B-pattern and between the B-pattern and the C-pattern were significant (B > A, C). Individual differences were observed at Pt1. For speakers MT and MK, differences between each of A, B, and C were significant (A > B > C), but for speaker MH, only the difference between A and C was significant (A > C).

The results of acoustic analysis of the F0 level showed that the F0 curves of the three accent patterns differed from each other significantly. Differences in the F0 level of the noun (C-pattern highest, A next, and B lowest) and of the predicate (the B-pattern higher than the others) were consistently observed. In addition,
Table 2 Test words.

<table>
<thead>
<tr>
<th>test words</th>
<th>meaning</th>
<th>accent pattern</th>
<th>test words</th>
<th>meaning</th>
<th>accent pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. agai</td>
<td>higasi (east)</td>
<td>A A</td>
<td>61. nyadi</td>
<td>mukade (centipede)</td>
<td>B C</td>
</tr>
<tr>
<td>2. butu</td>
<td>atto (husband)</td>
<td>A A</td>
<td>62. nuuma</td>
<td>uma (horse)</td>
<td>B C</td>
</tr>
<tr>
<td>3. tibi</td>
<td>ato (after)</td>
<td>A A</td>
<td>63. asa</td>
<td>asosu (sea lettuce)</td>
<td>C C</td>
</tr>
<tr>
<td>4. nsi</td>
<td>migi, kita (right, north)</td>
<td>A A</td>
<td>64. adan</td>
<td>adan no mi (screw pine fruit)</td>
<td>C C</td>
</tr>
<tr>
<td>5. syaaka</td>
<td>akekata (dawn)</td>
<td>A A</td>
<td>65. agu</td>
<td>tomo, dohoh (friend, comrade)</td>
<td>C C</td>
</tr>
<tr>
<td>6. tuzi</td>
<td>tuma (wife)</td>
<td>A A</td>
<td>66. aka</td>
<td>kami (hair)</td>
<td>C C</td>
</tr>
<tr>
<td>7. akaci</td>
<td>ti (blood)</td>
<td>B A</td>
<td>67. ara</td>
<td>soto (outside)</td>
<td>C C</td>
</tr>
<tr>
<td>8. akai</td>
<td>art (ant)</td>
<td>B A</td>
<td>68. aecya</td>
<td>getu (wooden clogs)</td>
<td>C C</td>
</tr>
<tr>
<td>9. avin</td>
<td>akena (heat rash)</td>
<td>B A</td>
<td>69. mokko</td>
<td>mokko (implement for carrying heavy loads)</td>
<td>C C</td>
</tr>
<tr>
<td>10. fla</td>
<td>kodomo (children)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. flaci</td>
<td>kuwa (hoe)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. fudami</td>
<td>warazi (straw sandals)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. in</td>
<td>inu (dog)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. zuu</td>
<td>uo (fish)</td>
<td>B A</td>
<td></td>
<td></td>
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<tr>
<td>15. yudai</td>
<td>yodare (drool)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. yuu</td>
<td>ono (hatchet)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. kaa</td>
<td>ido (well)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>18. kazya</td>
<td>nioi (odor)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. kyuusi</td>
<td>kemari (smoke)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. kuusu</td>
<td>toogarasi (chili pepper)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. kuba</td>
<td>kuba (palm, Livistona chinensis)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. mai</td>
<td>kome (rice)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. uru</td>
<td>tontoma (red algae)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. nai</td>
<td>zis (earthquake)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. nanu</td>
<td>sana (sand)</td>
<td>B A</td>
<td></td>
<td></td>
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<tr>
<td>26. sanin</td>
<td>gettou (shell ginger)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>27. saba</td>
<td>same (shark)</td>
<td>B A</td>
<td></td>
<td></td>
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<tr>
<td>28. sousa</td>
<td>yasai (vegetables)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>29. sudj</td>
<td>sode (sleeve)</td>
<td>B A</td>
<td></td>
<td></td>
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<tr>
<td>30. ttueci</td>
<td>sotou (sago palm)</td>
<td>B A</td>
<td></td>
<td></td>
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<tr>
<td>31. urui</td>
<td>motsi (rice cake)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. zyyu</td>
<td>sippou (tail)</td>
<td>B A</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>33. dussi</td>
<td>tomo (friend)</td>
<td>C A</td>
<td></td>
<td></td>
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<tr>
<td>34. nzi</td>
<td>toge (thorn)</td>
<td>C A</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>35. sabani</td>
<td>sabanibune (sabi boat)</td>
<td>C A</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>36. sura</td>
<td>sateoki nado (tip of sugar cane)</td>
<td>C A</td>
<td></td>
<td></td>
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<tr>
<td>37. kutusi</td>
<td>kotosi (this year)</td>
<td>A B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38. azya</td>
<td>hokuro (mole)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>39. acya</td>
<td>asita (tomorrow)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>40. bata</td>
<td>hara (stomach)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>41. cizi</td>
<td>taba (spit)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>42. cyaa</td>
<td>tyu (tea)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43. i</td>
<td>kiri (drill)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>44. iiki</td>
<td>uroko (fish scale)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>45. yadu</td>
<td>to (door)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>46. yunaka</td>
<td>yonaka (middle of night)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47. cin</td>
<td>kimono (clothes)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>48. kyuu</td>
<td>kyoo (today)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>49. miduN</td>
<td>tuma, onna (wife, woman)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>50. nna</td>
<td>makigai (spiral shell)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51. nagani</td>
<td>senaka (back)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52. nai</td>
<td>ni (fruit)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>53. taku</td>
<td>tako (octopus)</td>
<td>B B</td>
<td></td>
<td></td>
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<tr>
<td>54. uzzya</td>
<td>uzuura (quail)</td>
<td>B B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55. icyufa</td>
<td>itoko (cousin)</td>
<td>C B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56. nnama</td>
<td>ima (now)</td>
<td>C B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>57. hai</td>
<td>hateke (dry field)</td>
<td>C B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>58. akiki</td>
<td>tonbo (dragonfly)</td>
<td>B C</td>
<td></td>
<td></td>
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<tr>
<td>59. zaxu</td>
<td>kai (root)</td>
<td>B C</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>60. kangi</td>
<td>tategami (mane)</td>
<td>B C</td>
<td></td>
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</tbody>
</table>

I = Ikema, T = Tarama

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The Ikema Dialect of Miyako Rykyuan Has a Three-, not Two- Pattern Accent System

a tendency for the F0 level of the noun to be lower in the C-pattern than in the other patterns was also observed.

3.2.3 Analysis of F0 Movement

Figure 3 shows scatter graphs plotting the difference in the values of F0 at Pt1 and Pt2 (Pt2-Pt1) on the horizontal axis and between Pt2 and Pt3 (Pt3-Pt2) on the vertical axis. A negative value shows a fall in F0 between two adjacent points. The test words are clearly

Figure 2  Mean F0 at Pt1, Pt2, and Pt3 (*P < 0.05, **P < 0.01, ***P < 0.001).

Figure 3  Scatter graphs plotting the difference in the values of F0 at Pt1 and Pt2 (Pt2-Pt1) on the horizontal axis and between Pt2 and Pt3 (Pt3-Pt2) on the vertical axis.
distributed into three groups on these axes. Speaker MH’s B-pattern has a smaller Pt3-Pt2 than the other speakers (meaning that either his rise from the particle to the predicate is smaller or that there is a slight fall), but this may be related to the fact that speaker MH had a different frame sentence from the other two speakers.

When we conducted a MANOVA (Pillai trace) with accent pattern (A, B, or C) as the independent variable and Pt2-Pt1 and Pt3-Pt2 as dependent variables, significant effects for accent pattern were found for all speakers [MT, F(4, 236) = 116.43, P < 0.001; MK, F(4, 236) = 104.51, P < 0.001; MH, F(4, 236), P < 0.001]. Multiple comparisons were conducted using the Bonferroni adjustment. For speakers MK and MH the difference between the A-pattern and the B-pattern for Pt2-Pt1 was not significant but the difference between the C-pattern and the others was (C > A, B) [P < 0.001] and for speaker MT all the differences among the three patterns were significant (C > A > B) [P < 0.001]. For Pt3-Pt2, on the other hand, all the differences among the three patterns were significant for all speakers (B > A > C) [P < 0.001].

These results confirm that the F0 curves of the three accent patterns differ significantly from each other based on an acoustic analysis of F0 movement. It was confirmed that in moving from the noun to the particle, the F0 falls in accent patterns A and B but that there is practically no fall in pattern C. In moving from the particle to the predicate, in contrast, it was confirmed that there is a rise in F0 in the B-pattern and a fall in the A- and C-patterns, but the fall is much larger in the C-pattern than in the A.

3.2.4 Cluster Analysis

Finally, we conducted a hierarchical cluster analysis for each speaker using Pt2-Pt1 and Pt3-Pt2. The squared Euclidean distance was used as a measure of the distance between the test words using Ward’s method to define the distance between clusters. For all speakers three clusters were formed as a result. The members of each cluster thus formed, except for two words from speaker MH, coincided completely with the members of the accent pattern categories established through auditory impressions. Cluster dendrograms (omitted for reasons of space) showed that the words in the C-pattern are located far from those of the other patterns but that the distance between the A-pattern and the B-pattern is much closer. This suggests that the A-pattern and the B-pattern are, at least in terms of the two variables used here, acoustically close to each other.

These results, besides suggesting that division into accent patterns based on auditory impressions is appropriate, also support the existence of three accent patterns in Ikema.

3.3 Summary

That the test words variously assigned to three accent patterns classified through auditory impressions also differ significantly from each other acoustically has been confirmed from the results of analysis of variance. Also, a cluster analysis categorizing the test words solely by their acoustic characteristics without any predetermined categories not only produced three groups of clusters, but the members of the three clusters completely coincided with the accent pattern types established through auditory impressions. From these results we can conclude that it is indisputable that Ikema has three, not two, accent patterns.

Through the analysis in this section, it has been shown that there are regular correspondences between the accent patterns that words respectively belong to in Tarama and Ikema, but it has also been made clear that only an extremely small number of lexical items belong to the A-pattern in Ikema. The extreme paucity of lexical items in the A-pattern may be one reason the accent system of Ikema has been described as having only two patterns. We will touch upon the correspondences between dialects in the next section.

4. Conclusion

It has generally been accepted that the Ikema dialect of Miyako Ryukyuan has a two-pattern accent system; however, the results of our study have clearly demonstrated that the system has three patterns. It is also clear that, of the three accent patterns (A-pattern, B-pattern, and C-pattern), the number of lexical items in the A-pattern is extremely small. Although distinctions between the accent patterns are neutralized in a great many environments, it was found that one environment in which the three-way distinction is realized is “noun + 2-mora particle + predicate + utterance final”. Among the likely reasons that Ikema has been wrongly described as having a two-pattern system are: 1) the fact that the number of lexical items in the A-pattern is extremely small, and 2) the fact that environments in which distinctions among all three patterns are realized are severely limited.

It is not possible to consider, because the number of lexical items in the A-pattern is extremely small, Ikema’s three-pattern accent system to have arisen from a process in which the original Class A and Class B
accent categories collapsed in to one (AB/C) and then a new pattern (with a very small number of member lexical items) split off. This is because, although their number is small, nearly all of the lexical items in the A-pattern in Ikema correspond to original Class A lexical items. For reasons of space, it is not possible to provide a detailed description here, but Ikema shows regular correspondences in accent not only with Tarama Miyako but also with the several other Ryukyuan languages. However, in Ikema the majority of words belonging to Class A in proto-Ryukyuan belong to the same accent class as those originally Class B. Regarding correspondences from a categorized vocabulary list (Kindaichi 1974), the characteristic correspondences between Ryukyuan and Japanese proposed by early on by HATTORI Shiro (1958) and more recently by MATSUMORI Akiko (2000a, b) are also observed in Ikema. The most compelling hypothesis to explain the correspondences with the other Ryukyuan languages and with Japanese is probably that Ikema in in the final stage of moving from a three-pattern system, which preserves the proto-Ryukyuan system most faithfully, to a two-pattern system. This is a topic for a future article.

This article is important descriptively for presenting the discovery of a language in the Southern Ryukyuan group with a three-pattern accent system. We have also showed that the realization of the Ikema accent system has unusual characteristics when viewed typologically and thus this article may contribute to acoustic research on the world’s languages in general.

This article has also shown that, when describing the accent system of a given language or dialect, an analysis that considers only a lexical item or a lexical item followed by a grammatical particle pronounced in isolation may lead to incorrect conclusions. Ikema is certainly not the only language or dialect in which certain accent distinctions are neutralized in isolation or with a particle; consider, for example, Yonaguni (Uwano 2010). At the very least, we have shown that there are languages and dialects to which a framework that holds that the accent patterns found in isolation or with a particle are the basic patterns and that other realizations may be obtained through various weakenings of these basic patterns in sentential contexts (Kori 2003) is inapplicable. It is necessary, rather, to use a variety of framing contexts and to analyze the realizations of the accents of words in context in as much detail as possible. Without doing so, it is impossible to to decide a priori what is or is not an accent pattern; further, it is impossible to even determine the number of accent contrasts based solely on analysis of isolated forms or isolated forms with following particles. Ikema Miyakoan, being a language in which some accent distinctions are neutralized in many environments, is a good example that clearly illustrates this.

Other examples, can be found; for example, Uwano (1984a)’s study of the Japanese Murakami dialect (Niigata Prefecture), like this article, corrects previous mistaken descriptions based on analysis of the realization of accent patterns in sentential contexts. In Uwano’s study, an accent system that had previously been described as an “ambiguous accent” system in which accent classes were indistinct, was shown to have a multi-pattern system with clearly distinguished accent patterns. Re-examination of the realization of accent patterns in accent systems of Ryukyuan languages that have hitherto been analyzed looking solely at isolated forms or forms with particles taking into account the various realizations found in sentential contexts may prove to be a promising approach in future studies of the accentual systems Ryukyuan languages. Such re-examination may lead to the new discovery of three-pattern accent systems in languages that have previously been described as having two-pattern or single-pattern systems.

Finally, we present topics for future research. The first topic is the study of accent in verbs and adjectives. In our study so far, we have found a two-way accent distinction in verbs (e.g., nii ‘boil’ versus mii ‘see’). Adjectives, on the other hand, show a three-way distinction, like nouns (e.g., aka ‘red’ versus naga ‘long’ versus taya ‘strong’). As with nouns, one specific accent pattern (the pattern to which taya ‘strong’ belongs) has only a very small number of members. Furthermore, adjectives are similar to nouns in that the three-way contrast is fully realized in an environment in which the adjective stem is followed by two 2-mora elements (e.g., aka-munu-hazi ‘It’s probably red.’). Analysis of the phenomenon of similar behaviors shown in Ikema by nouns and adjectives with respect to accent will probably need to be linked to morphosyntactic similarities between nouns and adjectives in Ikema.

Another topic, the most important topic, is clarification of the regularities in accent realization. In this article, we have shown that Ikema has a three-pattern accent system, but the rules and principles under which accent is realized in this dialect are still very much unclear. In order to pursue this topic, it will be necessary to expand our scope to nouns of four or more moras and examine the realization of accent in a variety of environments. As mentioned at the end of Section 2, there
ought to be environments other than “noun + 2-mora particle + predicate + utterance final” in which the three-way distinction in accent patterns is fully realized, and finding and generalizing such environments should contribute to the clarification of the rules for accent realization. It is quite possible that, as a result of future research, the realization of accent patterns in Ikema will be shown to be governed by much simpler principles.

We still do not have clear answers to the questions of what the domain for accent realization is and what the tone-bearing unit is. There is no doubt, in any case, that the bimoraic foot that SHIMOJI Michinori proposed for the single-pattern accent system of the Ibaru Nagahama dialect of Miyako Ryukyuan (Shimoji 2009) also plays an important role in Ikema. In the Ibaru Nagahama dialect, a phenomenon is observed in which high pitch and low pitch alternate with each foot (termed HL alternation by Shimoji) and there may be a similar alternation phenomenon in Ikema as well. Also, the phenomenon that the realization of noun accent patterns in Ikema changes when followed by a number of words brings to mind the phenomenon of tone sandhi observed in several dialects of Chinese (Chen 2000). In fact, a phenomenon of accent pattern alternation that might well be called tone sandhi is observed in the Nagahama dialect of Miyako Ryukyuan (Shimoji 2009). On this point alone can a discrepancy be found between our description and that of Hirayama et al. (1967). This discrepancy arises because in Hirayama et al. (1967), a 2-mora particle is followed by another lexical item, and the focus marker -nudu in Ikema behaves the same as other 2-mora particles.

The results of this study and the topics for future research can only be approached through the application of a methodology that examines the different realizations of an item in a larger context. This approach, which has been little used in studies of accent in Ryukyuan and Japanese languages and dialects, has been the mainstream approach leading to significant breakthroughs in the study of intonation in the West since the 1980s (Ladd 1996) and, in fact, has been used for some time by a few researchers in the study of variations in Standard Japanese (Kawakami 1957) and various dialects (Uwano 1984b).

Notes

1) According to Hirayama et al. (1967) this dialect has an accent system with a three-way distinction (tentatively: Type-α, Type-β, and Type-γ). However, from a diachronic point of view, the split into Type-β and Type-γ has arisen through a series of divisions and mergers under specific phonological conditions of the Class B and Class C lexical categories (Classes A, B, and C (Matsumori 2000b)) reconstructed for the proto-Ryukyuan accent system. Accordingly, the three-pattern system in this dialect does not preserve the divisions of the accent system hypothesized for proto-Ryukyuan.

2) This restriction was imposed because of the methodological problem that some longer words may arise through compounding. It is known that, unlike simple lexical items, productive accent rules apply to compound words; however, not only are the accent rules for compounds in this dialect almost completely unknown, we also have no methodological basis for deciding whether a given word is simple or compound. Accordingly, it would be impossible to determine whether the observed tonal pattern is a simple word accent or the result of the application of compound accent rules. This problem may appear avoidable by choosing as our target for analysis only nouns clearly composed of a single morpheme, but, since the number of words in the A-pattern in Ikema is overwhelmingly small compared to the other patterns (see Section 3), it is currently impossible to find enough such nouns in each pattern to be able to generalize. In any case, greater than a three-way contrast was not found in words of four or more mora.

3) Lexical items in Ikema cognate with single mora Japanese words are all 2-mora, having long vowels (e.g., haa, J. ha ‘leaf’, naa, J. na ‘name’, and tii, J. te ‘hand’). These are included in the analyses for this article.

4) The orthography used for Ikema items follows Hayashi (2010). ty [ɪ], sy [ɕ] c [ʦ], cy [ʨ], zy [ʑ] ~ [dz], hn [n̥n])

5) The particle -nudu is reported to behave differently from other 2-mora particles in some Miyako dialects (Hirayama et al. 1967, Matsumori 2010). Matsumori (2010) points out the possibility that the special behavior of -nudu in Tarama may stem from the composition of this particle (composed of a fusion of the nominative -nu and the focus marker -du). However, -nudu in Ikema behaves the same as other 2-mora particles.

6) In (3), a fall is observed immediately before the second mora of a 2-mora particle following a C-pattern noun, but such a fall is not observed in the description of Hirayama et al. (1967). On this point alone can a discrepancy be found between our description and that of Hirayama et al. This discrepancy arises because in Hirayama et al. (1967), a 2-mora particle is further followed by other lexical items. In our observations, as shown in (4), when a 2-mora particle is followed by another lexical item, the fall in the 2-mora particle following a noun in the C-pattern is extinguished.

7) The predicate nyaan ‘not exist [inanimate]’ does not by nature take an animate subject. With an animate subject, miin ‘not exist [animate]’ is used instead. Accordingly, special contexts are necessary for speakers to judge butu-mai nyaan ‘There’s no husband either.’ and mayu-mai nyaan ‘There’s no cat either’ semantically.
acceptable.

8) In this article we interpret -mai in an utterance in which it accompanies an A-pattern noun as being immediately followed by a fall. However, it is possible that there is no fall at this point and that the pitch simply remains low from the fall following the noun to the end of the utterance. Further research is needed.

9) Whether or not it is a necessary condition that the second word be a particle cannot be determined without further research.

10) The content of this section is greatly revised and expanded from Igarashi et al. (2011).

11) Duu is a contracted form composed of the focus marker -du and the aspectual auxiliary verb ui.

12) The two words in question are kutsu and cyuuka, which were assigned to the A-pattern by the qualitative analysis but were placed respectively into the B-pattern and C-pattern clusters based on auditory impression.

13) HAYATA Teruhiro terms the N-pattern system such as that of Ikema “word tone” and suggests a commonality between Japanese and Ryukyuan languages and dialects that have word tones and so-called tone languages like Chinese (Hayata 1999). If tone sandhi is found in Ikema, that could be interpreted as another commonality between Ikema (with word tones) and tone languages.

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