# The Role of Foot Structure in Teaching Vowel Length Distinctions in Japanese

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*Abstract*—The present study explores the possibility of using foot structure as a cue to teach vowel length distinctions in Japanese. While it has been said that the primary cue to such distinctions is duration (Fujisaki *et al*, 1975), Hirata (2004) has found that the duration of short vowels and that of long vowels overlap significantly across various speaking rates, implying that duration does not provide a reliable cue. The present study first demonstrates that different vowel lengths in minimal pairs correlate with different foot structures, and suggests that we use the difference in foot structure in order to correct learners' pronunciation errors. This approach is then applied to words that are not in minimal pairs.

# Index Terms—vowel lengths, foot structure, Japanese

#### I. INTRODUCTION

Distinguishing vowel lengths can be very challenging for learners of Japanese (Oguma, 2000; Toda, 2003). At the same time, this is a challenging task for those who teach Japanese as well. The main objective of this study is twofold: (i) to understand what makes it difficult for learners to distinguish vowel lengths in Japanese; (ii) to suggest a way to practice vowel length distinctions effectively based on theory. I will illustrate in this paper that qualitative distinctions, more specifically foot structure, give more reliable cues than quantitative distinctions (i.e., duration). I will therefore suggest that we turn our attention to foot structure, rather than focusing on duration when teaching vowel lengths in Japanese.

#### **II. PRELIMINARIES**

### A. Vowel Lengths in Japanese

There are five vowel phonemes in Tokyo Japanese: /a, i, u, e, o/, which have long vowel counterparts (Shibatani, 1990, p.160-162). In particular, it is important to note that the length distinctions among vowels are contrastive in Japanese, as the minimal pairs in (1) illustrate.

(1) Vowel lengths in Japanese

	Short Vowels	Long Vowels
a. /a/ vs. /a:/	obasan 'aunt'	obaasan 'grandmother'
b. /i/ vs. /i:/	ojisan 'uncle'	ojiisan 'grandfather'
c. /u/ vs. /u:/	tsuchi 'soil'	tsuuchi 'notification'
d. /e/ vs. /e:/	sekai 'world'	seekai 'correct answer'
e. /o/ vs. /o:/	hosoku 'supplement'	hoosoku 'law'

The only apparent difference in each pair is the length of one vowel. For example, *obasan* 'aunt' has short /a/ and *obaasan* 'grandmother' has long /a:/, but the rest of the words is identical. Phonologically, a long vowel is associated with two beats, technically called "moras" whereas a short vowel is associated with one mora. Therefore, *obaasan* 'grandmother' is longer than *obasan* 'aunt' by one whole mora: 5 mora long (o.ba.a.sa.n) vs. 4 mora long (o.ba.sa.n).<sup>1</sup>

Since vowel length distinctions are contrastive in Japanese, native speakers never have difficulty distinguishing them. However, learners, in particular those who do not have vowel length distinctions in their native language, tend to have significant difficulty discerning the difference (Tajima et al, 2008).

#### B. Moras

The mora is the smallest prosodic unit in Japanese. There are two major types of moras, as shown in (2): independent moras and special moras.

(2) Mora types in Japanese<sup>2</sup> Types Example Words a. Independent: V <u>*i*</u> 'stomach'

<sup>&</sup>lt;sup>1</sup> The mora boundaries are indicated by periods.

<sup>&</sup>lt;sup>2</sup> As a convention, 'R' is often used to indicate the lengthened part of a long vowel (Koizumi, 1978, p.121); alternatively, 'H' is used by others (Vance, 2008, p.58).

b. Independent: CV	<u>ki</u> 'tree'
c. Special: R	<i>i.<u>i</u> 'g</i> ood'
d. Special: N	ki. <u>n</u> 'gold'

An independent mora is made up of either a single short vowel (V) as in (2a), or a consonant followed by a short vowel (CV) as in (2b). The independent mora is so called because it can construct a foot independent of other moras (the foot is the next smallest prosodic unit as we will discuss more in detail in Section III). On the other hand, a special mora cannot make a foot on its own; it always leans on an independent mora to make a foot. Examples of special moras include the lengthened part of a long vowel (R), and the so-called moraic nasal (N) as illustrated in (2c) and (2d), respectively. A long vowel is thus made up of an independent mora (V) followed by a special mora (R).

Japanese is said to be a "mora-timed" language, where each mora is pronounced with approximately the same duration (Ladefoged and Johnson, 2011, p.251-252). This generalization holds whether it is an independent mora or a special mora. For example, since the lengthened part of a long vowel counts as one mora, a long vowel has two moras in total (i.e., VR) while a short vowel has only one (i.e., V); therefore, the former is pronounced approximately twice as long as the latter. In fact, phonetic experiments have shown that the difference in duration is even greater; long vowels are pronounced 2.4-3.2 times as long as short vowels in Japanese (Han, 1962; Ueyama, 2000).

#### C. Sources of Difficulty

Despite the seemingly significant difference in duration (i.e., 1:2.4-3.2), studies have shown that learners have difficulty distinguishing vowel lengths in both perception and production (Oguma, 2000; Toda, 2003). One source of the difficulty stems from the fact that the difference in duration is affected by factors, such as speaking rate (Hirata, 2004; Tajima *et al*, 2008). In fact, Hirata (2004) observes that the duration of short vowels and that of long vowels overlap each other considerably across various speaking rates. Hirata's observation thus implies that it is virtually impossible to distinguish vowel lengths based on absolute duration alone. Given her observation, I suggest that we turn our attention to "qualitative" cues, rather than "quantitative" cues.

In languages, such as Arabic, long vowels are distinguished from their short vowel counterparts not only in terms of quantity (i.e., duration) but also in terms of quality.<sup>3</sup> In the present study, I argue and illustrate that foot structure gives us more reliable cues than duration to distinguish vowel lengths in Japanese.

### III. QUALITATIVE DIFFERENCE BETWEEN LONG AND SHORT VOWELS

#### A. Foot Structure

As mentioned above, the mora is the smallest prosodic unit, and the foot is the prosodic level immediately above it. In other words, moras are grouped together into feet. The ways in which moras are combined into feet are constrained by several principles. First, there are no more than two moras in each foot in Japanese (i.e., either one mora or two moras in each foot). More specifically, since an independent mora can stand alone as discussed earlier, a mono-moraic foot consisting of a single independent mora (IM) as in (3a) is well formed; in contrast, a foot consisting of a single special mora (SM) as in (4a) is not well formed. Instead, a special mora always leans on an independent mora, as the contrast between (3b) and (4b) shows. Finally, a bi-moraic foot consisting of two independent moras as in (3c) is well formed; however, one consisting of two special moras as in (4c) is ill formed.

(3) Well-formed feet<sup>4</sup>

Examples
V, CV
VR, VN, etc
CVCV, VCV, etc

Keeping in mind the way in which feet are constructed in Japanese, let us now see how foot structure allows us to help distinguish vowel lengths in Japanese.

#### B. Proposal: Foot Structure as a Cue to Distinguish Vowel Lengths in Japanese

Let us examine the minimal pairs in (1) again. This time, we pay attention to foot structure, which is indicated in (5). (5) Vowel lengths in Japanese with foot structure indicated

	Short Vowels	Long Vowels
a. /a/ vs. /a:/	(o.b <u>a</u> )(sa.n) 'aunt'	(o)(b <u>a.a</u> )(sa.n) 'grandmother'

<sup>&</sup>lt;sup>3</sup> For example, Thelwall and Sa'adeddin (1999, p.53) observe that /u/ and its long counterpart /uw/ are realized as [v] and [x] respectively before a pharyngeal consonant. In other words, before a pharyngeal consonant, the difference in duration neutralizes, but the difference in quality remains. Given this, /u/ and /uw/ are different from each other not only in duration but also in quality.

<sup>&</sup>lt;sup>4</sup> Parentheses indicate foot boundaries; periods indicate mora boundaries.

b. /i/ vs. /i:/	(o.ji)(sa.n) 'uncle'	(o)(j <u>i.i</u> )(sa.n) 'grandfather'
c. /u/ vs. /u:/	(tsu.chi) 'soil'	(tsu.u)(chi) 'notification'
d. /e/ vs. /e:/	(se.ka)(i) 'world'	(se.e)(ka.i) 'correct answer'
e. /o/ vs. /o:/	(ho.so)(ku) 'supplement'	(h <u>o.o</u> )(so.ku) 'law'

One will immediately notice that the number of feet is different in most of the minimal pairs: (5a) through (5c). For example, *obasan* 'aunt' has two feet whereas *obaasan* 'grandmother' has three feet, as illustrated in (5a). More importantly, different moras are grouped in different feet between the members of each minimal pair. Observe that the first two (independent) moras are put in the same foot in the words with short vowels whereas they are put in different feet in the words with long vowels. For example, in the word *ojisan* 'uncle,' the first two moras (i.e., *o* and *ji*) are footed together. On the other hand, in the word *ojisan* 'grandfather,' *o* and *ji* are in separate feet; *o* constructs its own foot (i.e., first foot), and *ji* is in another foot (i.e., second foot). Furthermore, even in pairs like (5d) and (5c), where there is no difference in the number of feet, there is an asymmetry in foot structure. For example, as shown in (5d) *se* and *ka* are footed together in *sekai* 'world' whereas *se* is footed as part of the first foot and *ka* is footed as part of the second foot in *seekai* 'correct answer.'

The examples in (5) thus illustrate that minimal pairs contrasting vowel length can be distinguished in terms of foot structure. What does this mean for teaching vowel length distinctions in the classroom? I suggest that instructors first make their students be aware of the boundaries within words (i.e., foot boundaries) in practicing vowel lengths. For example, since o and ba are footed together in obasan 'aunt,' they are pronounced together as a unit in the same way as the remaining moras (i.e., sa and n) are pronounced; in contrast, since o and ba are in separate feet in obaasan 'grandmother,' they are pronounced separately; in particular, o is pronounced alone, and ba and a are pronounced as a unit in the same way as sa and n are pronounced.

Furthermore, with the foot structure indicated, words, such as (o)(ba.a)(sa.n) 'grandmother' and (se.e)(ka.i) 'correct answer' are particularly easier to practice since there are two bi-moraic feet in them. For example, in *obaasan* 'grandmother,' the last two feet (i.e., *ba.a* and *sa.n*) are both bi-moraic. What this means is that both of them are pronounced with the same rhythm. Since most learners have much less difficulty pronouncing a foot like *san* than *baa*, instructors can use *san* as the reference point, and have their students practice pronouncing *baa* in the same rhythm as *san* since they are both bi-moraic.

# C. Extension: Vowel Lengths in Words without Minimal Pairs

While the examples that we have examined so far are all in minimal pairs, the above proposal can be extended to vowel lengths in words without minimal pairs. Given the fact that there are not many minimal pairs contrasting vowel lengths in Japanese (Vance, 2008, p.56-57), this extension adds significantly to the proposal.<sup>5</sup>

Let us start with a brief discussion of why different vowel lengths result in different foot structures. The answer lies in the idea that a short vowel involves an independent mora whereas a long vowel involves a special mora as well as an independent mora. Recall that a special mora cannot construct a foot on its own so that it leans on the independent mora before it. With this restriction in mind, let us look at the word *ojiisan* 'grandfather' in (5b) one more time. Suppose we try to foot the word *ojiisan* 'grandfather' in the same way as we foot the word *ojisan* 'uncle.' It would result in \*(o.ji)(i.sa)(n). There are two problems with this foot structure. First, a special mora is preceding an independent mora in the second foot, which has the ill-formed structure illustrated in (4b). Second, the third foot is made up of a special mora alone, which has the ill-formed structure in (4a). To avoid these ill-formed structures, *ji* and *i* are footed together before *o* is footed, as is shown in the steps in (6).

(6) Footing of Words Containing a Special Mora

- a. o.ji.i.sa.n
- b. o(ji.i)sa.n
- c. (o)(ji.i)(sa.n)

Because a special mora (e.g., i) is always footed with the independent mora that precedes it (e.g., ji), an independent mora that would otherwise be footed with that independent mora (e.g., o) is "bumped" to a separate foot. In other words, since special moras only fit in a specific position in the foot, independent moras "move" to different positions in order to accommodate the need of special moras, which in turn results in a difference in foot structure.

Let us now discuss how foot structure can help us correct learners' mistakes on vowel length distinctions even in the absence of minimal pairs. The examples in (7) and (8) represent words on which learners often make length mistakes, in particular, in production; the left column shows the correct pronunciations and the right column shows the incorrect pronunciations.<sup>6</sup> More specifically, the examples in (7) are words that learners often mistakenly pronounce with a long vowel; those in (8) are words that contain long vowels, which learners often pronounce them with a short vowel by mistake.

(7) Common mistakes in words with short vowels

<sup>&</sup>lt;sup>5</sup> Using minimal pairs to teach vowel length distinctions is understandably common in textbooks (e.g., Tanaka and Kubozono, 1999). However, due to the number of available minimal pairs, minimal pairs used in textbooks often involve "obscure" words, such as *yookan* 'western style building' (as opposed to *yokan* 'anticipation'). This is not a desirable situation at least for beginning learners.

<sup>&</sup>lt;sup>6</sup> The author thanks Madoka Kusakabe for sharing examples of errors that she observed in her own classrooms.

a. (su.k <u>o</u> )(shi) 'a little'	*(su)(k <u>oo</u> )(shi)
b. (shu.k <u>u</u> )(da.i) 'homework'	*(shu)(k <u>u.u</u> )(da.i)
c. (to.sh <u>o</u> )(ka.n) 'library'	*(to)(sh <u>o.o</u> )(ka.n)
d. (o.k <u>i</u> )(ru) 'to get up'	*(o)(k <u>i.i</u> )(ru)
(8) Common mistakes in words	with long vowels
a. (i)(m <u>o.o</u> )(to) 'little sister'	*(i.m <u>o</u> )(to)
b. (o)(n <u>i.i</u> )(sa.n) 'big brother'	*(o.n <u>i</u> )(sa.n)
c. (ky <u>o.o</u> )(ka.sho) 'textbook'	*(ky <u>o</u> .ka)(sho)
d. (ch <u>i.i</u> )(sa.i) 'small'	*(ch <u>i</u> .sa)(i)
<b>F</b> 1 1 1 1 1 1	(1)(1), $(7)$

For example, the word *sukoshi* 'a little' in (7a) has a short vowel in the second mora (i.e., *ko*); however, a common error is to pronounce it as long (i.e., *ko.o*). On the other hand, the word *imooto* 'little sister' in (7a) has a long vowel (i.e., *o.o*); a common mistake is to pronounce it as short (i.e., *o*).

We saw with the minimal pairs in (5) that the number of feet is different whether the word contains a short vowel or a long vowel. Something parallel is observed here with words without minimal pairs: the number of feet is different between the correct pronunciation and the incorrect pronunciation in most of the cases above: (7a) through (7d), and (8a) and (8b). For example, in the word *shukudai* 'homework' in (7b), there are two feet with the correct pronunciation whereas there are three feet in the incorrect pronunciation. More importantly, the correct pronunciation and the incorrect pronunciation and the instances. For example, in the word *toshokan* 'library' in (7c), the first two moras (i.e., *to* and *sho*) are separated in different feet in the incorrect pronunciation whereas they are in the same foot in the correct pronunciation.

The difference in foot structure in (7) and (8) can be also utilized to help correct learners' mispronunciations. For example, when a learner mistakenly lengthens the second mora of *okiru* 'get up' as in (7d), instructors can help them correct the mistake by having them practice pronouncing the first two moras (i.e., o and ki) together as a unit to the exclusion of the third mora (i.e., ru). In a parallel way, when a learner fails to lengthen the first mora of *chiisai* 'small' in (8d) for example, instructors can have their students practice pronouncing the final two moras (i.e., *sa* and *i*) as a foot to the exclusion of the initial two moras (i.e., *chi* and *i*).

# IV. SUMMARY AND CONCLUSION

Vowel length distinctions trouble both learners and instructors of Japanese. While there is a significant difference in duration between long and short vowels at least at a fixed speaking rate, studies have demonstrated the duration of short vowels and that of long vowels across various speaking rates overlap each other significantly. Since learners cannot use duration as a reliable cue, I suggested that we pay attention to a qualitative cue associated with vowel lengths, more specifically, the foot structure. I first demonstrated that minimal pairs contrasting vowel lengths could be clearly distinguished in terms of the number of feet and asymmetries in foot structure. I then illustrated how foot structure would allow us to help learners practice vowel length distinctions in minimal pairs as well as in words without minimal pairs.

While I do not claim that foot structure provides cues to solve all the difficulty that learners have with vowel length distinctions, I would like to emphasize the following three points. First, the difference in vowel lengths results in different foot structures in a systematic way due to the properties of independent and special moras. In addition, the differences in foot structure associated with vowel lengths are very clear. Second, since studies have shown that duration is not a reliable cue, the role of non-durational cues become more important. In particular, given the robustness of differences, the role of foot structure becomes even more significant. Last but not least, I would like to point out the fact that, while moras are discussed in a number of Japanese language textbooks (e.g., Banno, Ohno, Sakane, and Shinagawa, 1999; Tohsaku, 2006), feet are rarely, if at all, mentioned.<sup>7</sup> Furthermore, feet are in fact discussed to a great degree in some Japanese phonetics/phonology textbooks (e.g., Tanaka and Kubozono, 1999; Vance, 2008); however, they are not discussed as they relate to vowel lengths.

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<sup>&</sup>lt;sup>7</sup> While it is not accurate, the term "syllables" are used in place of "feet" in most Japanese language textbooks.

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