



## JFL Learners and Big Numbers: Pitch-Accent and Phrasing

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### Abstract

Japanese numbers display a bewildering variety of pitch-accent behavior, and textbooks that address this problem at all provide pitch patterns only for small numbers and for large round numbers. Most large numbers in actual conversation, of course, have to be assembled on the fly rather than retrieved from memory. Nonetheless, the pitch patterns that occur on large numbers are quite systematic. Native speakers of Japanese generally produce the same number with the same pitch pattern.

Most large numbers are treated like prosodically non-unified compounds in Japanese, that is, as a single major phrase consisting of more than one accent phrase. The pitch patterns that result are strikingly different from the intonation patterns that large numbers carry in English. Not surprisingly, JFL learners who are native speakers of English typically do not produce big numbers in Japanese with anything like the native pitch patterns, which are probably beyond the threshold of what most students can learn without explicit instruction. The question that arises for teachers is whether such instruction is worth the effort.

**Keywords:** Japanese, number, pitch-accent, intonation.

### 1. Introduction

The Japanese number system presents many challenges for JFL learners. Not surprisingly, the magnitude of these challenges differs depending on a learner's native language. This paper is a preliminary report on a project being carried out jointly with Seiji Watanabe of Akita International University. The focus here is on native speakers of English; JFL learners with other native languages will be mentioned only in passing.

A prototypical Japanese number consists of a numeral followed by a counter [1], as in /sa<sup>1</sup>N+sai/ '3' + 'years of age' and /haçi<sup>1</sup>+mai/ '8' + 'flat things'. A downward-pointing arrow in a phonemic transcription marks the location of a steep fall in pitch. The distinctive aspects of the Tokyo pitch

accent system are (1) the presence or absence of such a fall and (2) its location if present [2, 3].

Some counters, including /sai/ 'years of age', denote the entity being counted. Others are used to count something outside themselves. Counters like /mai/ 'flat things' are sometimes called shape classifiers, because they are ordinarily used when counting entities that are close to some prototypical shape. The example /haçi<sup>1</sup>+mai/ cited above would be appropriate for 8 sheets of paper, 8 pancakes, etc. For an English speaker, choosing a counter can be difficult, especially when no counter-like element would occur in an equivalent expression in English.

Another complication is that native Japanese numerals occur in some numbers, while Sino-Japanese numerals occur in others. For example, the numeral in /futa+keta/ '2' + 'digits' is native Japanese, while the synonymous numeral in /ni+keN/ '2' + 'buildings' is Sino-Japanese.

In addition, some numerals and some counters exhibit morphophonemic alternations that are only partially regular. For example, the numeral varies in /yo<sup>1</sup>+ji/ '4' + 'o'clock', /yo<sup>1</sup>N+kai/ '4' + 'times', and /yoQ+cu<sup>1</sup>/ '4' + 'things'. The counter varies in /i<sup>1</sup>Q+pai/ '1' + 'cupful', /ni<sup>1</sup>+hai/ '2' + 'cupfuls', and /sa<sup>1</sup>N+bai/ '3' + 'cupfuls'.

### 2. Numbers and pitch-accent

Numbers display a bewildering variety of pitch-accent behavior, and most textbooks written for English speakers pay little or no attention to this aspect of pronunciation. The accent patterns on the numbers from 1 to 10 have to be memorized for each counter. So do the patterns on larger round numerals (100, 200, 300, . . . ; 1,000, 2,000, 3,000 . . . ; etc.), which occur as parts of big numbers. The examples in Table 1 illustrate.

**Table 1:** Unpredictable accent patterns on some small numbers and some large round numerals.

	'flat things'	'yen'	'hundreds'
1	/içi <sup>1</sup> +mai/	/içi+eN/	/hyaku <sup>1</sup> /
2	/ni <sup>1</sup> +mai/	/ni+eN/	/ni+hyaku <sup>1</sup> /
3	/sa <sup>1</sup> N+mai/	/saN+eN/	/sa <sup>1</sup> N+byaku/
4	/yo <sup>1</sup> N+mai/	/yo <sup>1</sup> +eN/	/yo <sup>1</sup> N+hyaku/
5	/go+mai/	/go <sup>1</sup> +eN/	/go+hyaku <sup>1</sup> /

### 3. Big numbers and phrasing

Needless to say, native speakers and JFL learners alike have to assemble most large numbers on the fly rather than retrieving them from memory. Nonetheless, native speakers of Tokyo Japanese produce such numbers with largely predictable pitch-accent and phrasing patterns. Most large numbers are treated like prosodically non-unified compounds [4], that is, they are pronounced as a single major phrase consisting of more than one accent phrase.

An accent phrase is the domain of the rise-fall intonation pattern that short phrases carry in Tokyo Japanese, as shown in the schematic diagrams in Figure 1 [5]. Provided there are enough syllables to accommodate the entire pattern, the pitch contour on an accented accent phrase consists of an initial rise (IR), an accentual boost (AB), an accentual fall (AF), and a final declination (FD). (Some researchers reject the idea of an accentual boost and instead have a level or slightly declining pitch between IR and AF.) The pitch contour on an unaccented accent phrase consists of just IR and FD, since there is no lexical accent to trigger AB and AF.

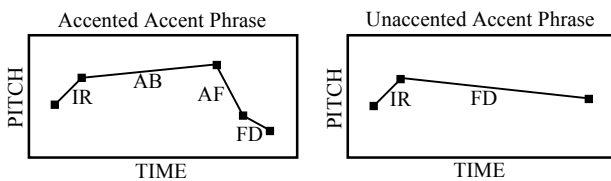


Figure 1: Schematic pitch contours on accent phrases.

A major phrase is the domain of downstep, that is, a gradual decline in peak pitch from one accent phrase to the next.

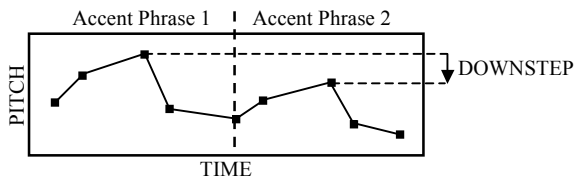


Figure 2: Schematic pitch contour showing downstep in a major phrase.

To illustrate with a concrete example, using a broken bar (|) to mark the boundary between accent phrases, /sa<sup>1</sup>N+byaku | ni<sup>1</sup>+juH | go+ka<sup>1</sup>i/ '325 times' ('3' + 'hundred' | '2' + 'ten' | '5' + 'times') is normally pronounced as a single major phrase consisting of three accent phrases. Semantically, of course, the primary division is between the numeral (i.e., the portion corresponding to '325') and the counter /kai/ 'times'.

In the example just given, each of the three accent phrases has the same accent pattern that it would have as an independent word, but not all big numbers have such straightforward phrasing patterns. If a potential accent phrase (digit plus X) is accented

on its final syllable as a word on its own and is followed by another potential accent phrase, the two are typically (but not always) combined into a single accent phrase. For example, the numeral /go+ju<sup>1</sup>H/ '50' ('5' + 'ten') and the number /sa<sup>1</sup>N+sai/ '3' + 'years of age' combine into /go+juH+sa<sup>1</sup>N+sai/ '53 years of age', that is, a major phrase containing a single accent phrase.

No thorough description of the phrasing patterns of big numbers is available in print, and such an undertaking is far beyond the scope of this short paper. The situation is complicated by the fact that there is some variability; more than one phrasing pattern is possible for some big numbers.

### 4. JFL learners

This section will cite a few selected examples from recordings of 33 JFL learners reading a list of 34 different numbers, including some short numbers and some long numbers. The participants were in study-abroad programs in Akita (at Akita International University) or in Kōbe (at Kōnan University), and most were still in the early stages of their JFL learning careers. The recordings were made in February and March of 2011.

The Japanese phrase meaning '365 days' will serve to illustrate some of the salient differences between the productions of native speakers and those of JFL learners. This particular item may well be frequent enough to be stored in memory, but it has the phrasing pattern that would result from on-the-fly assembly, and the JFL-learner pronunciations are quite representative. Native speakers pronounce this number as a major phrase consisting of two accent phrases: /sa<sup>1</sup>N+byaku | roku+juH+go<sup>1</sup>+niči/ '3' + 'hundred' + '6' + 'ten' + '5' + 'days'. Figure 3 shows a token produced by a female native speaker, and the downstep is clearly visible in the pitch track. (All the spectrograms in this paper were produced using Praat [6]. Pitch-track perturbations due to consonants are ignored.)

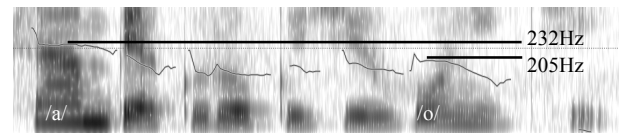
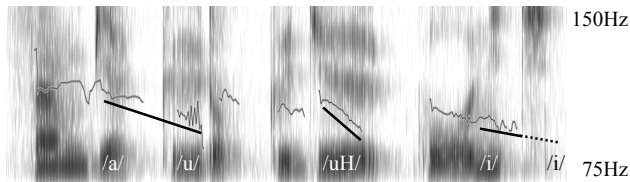


Figure 3: Native production of /sa<sup>1</sup>N+byaku | roku+juH+go<sup>1</sup>+niči/ '365 days'

In English, a big number is typically pronounced as a single phrase with a rise-fall on the last stressed syllable. Using a circumflex (ˆ) to represent this rise-fall, the English translation of the number in Figure 3 is pronounced /θri.hʌn.drəd.sɪk.sti.fɑɪv.dēz/ (cf. /θri.hʌn.drəd/, /sɪk.sti.fɑɪv/). Many of the JFL students recorded for this study produced most Japanese numbers with this kind of intonation

contour. Such tokens were typical not only of native speakers of English but also of native speakers of French and Spanish.

The intonation pattern shown in Figure 4 is quite different. This token of the number in Figure 3 was produced by a JFL student who is a native speaker of British English.



**Figure 4:** Production of /sa<sup>1</sup>N+byaku | roku+ju<sup>1</sup>H+go<sup>1</sup>+ni<sup>1</sup>çi/ ‘365 days’ by a native speaker of British English.

There are pauses in the token in Figure 4, each pause preceded by a pitch fall that sounds like a Japanese accentual fall on the penultimate mora, as if the number were /sa<sup>1</sup>N+bya<sup>1</sup>ku | roku+ju<sup>1</sup>H | go+ni<sup>1</sup>çi/, using an unbroken bar (|) to mark the boundary between major phrases. The last vowel (the second /i/ in /niçi/ ‘day’) is actually devoiced (a very native-like feature), which gives the listener the impression that the pitch continues to fall, although there is no actual F<sub>0</sub>. For this learner and for a few other English-speaking JFL learners in the sample, the default seemed to be to put an English-like stress on the location corresponding to the Japanese penultimate mora preceding each pause, and to put a falling pitch (or a rise-fall) on that stressed syllable.

Although the intonation contour in Figure 4 does not sound native-like, it is arguably a better approximation than a single phrase with a rise-fall on the last stressed syllable. The token in Figure 4 has three phrases rather than the two in native tokens like the one in Figure 3, but the division into more than a single accent phrase seems like a step in the right direction.

It is not difficult to describe the modifications that would be necessary to convert a token like the one in Figure 4 into a native-like production. First, the pitch fall in each digit+counter or digit+decimal-place combination would have to be in the correct location rather than always on the penultimate mora. As noted above in §2, these accent locations are largely unpredictable and thus a matter of memorization. The three combinations included in the number under consideration are /sa<sup>1</sup>N+byaku/ ‘3’+‘hundred’, /roku+ju<sup>1</sup>H/ ‘6’+‘ten’, and /go<sup>1</sup>+niçi/ ‘5’+ ‘days’. Needless to say, it is not realistic to expect a JFL learner to approach native norms until late in his or her learning career, if ever.

Second, the pauses separating the three combinations in Figure 4 would have to be eliminated to approximate native fluency. This is presumably just

a matter of practice and happens automatically as overall fluency improves.

Third, the second and third combinations need to be merged into a single accent phrase, as typically happens when the first of two combinations is accented on its final syllable (see §3). In the number under consideration, /roku+ju<sup>1</sup>H/ ‘60’ loses the accent on its long (two-mora) final syllable and combines with /go<sup>1</sup>+niçi/ ‘5 days’ into a single accent phrase: /roku+ju<sup>1</sup>H+go<sup>1</sup>+niçi/ ‘65 days’.

Finally, the two remaining accent phrases need to be combined into a single major phrase with downstep (as described above in §3). Downstep itself does not seem to cause any real difficulty for native speakers of English [7].

## 5. Dialect input

Since Akita International University and Kōnan University are in regions of Japan where the traditional dialects are very different from Tokyo Japanese, one might wonder whether input differences are part of the explanation for the difficulties that JFL learners have.

The traditional Akita dialect is highly stigmatized and seldom used in speaking to outsiders. Furthermore, the JFL teachers at AIU are not local natives. Thus, Akita dialect input cannot be an important factor.

In contrast, the traditional dialects of the Kinki region, which includes Kōbe, are a source of pride for many residents, and some JFL teachers at Kōnan are local natives. Consequently, Kinki dialect input cannot simply be excluded from consideration. Nonetheless, the Kinki natives who work in the Kōnan International Exchange Center all speak near-standard Japanese in their daily interactions with the JFL students. Some of these study abroad professionals recorded the same list of numbers as the student participants, and they produced exactly the same phrasing and accent patterns as Tokyo natives. Although the pitch-accent systems of Kinki dialects differ significantly from the Tokyo system, the phrasing patterns are essentially the same. Thus, Kinki-dialect input cannot explain the phrasing patterns of JFL students at Kōnan.

## 6. Pedagogical possibilities

JFL learners who produce English-like contours on big numbers clearly have a long way to go on the road to native-like pronunciation, and so does the learner who produced the token in Fig 3. The question of primary interest for JFL teachers is whether any sort of pedagogical effort could foster progress.

It could well be that the native phrasing patterns are beyond the threshold of what can be learned without explicit instruction for most native speakers

of English and other Western European languages. The recordings made for this study, however, cannot be used to test this hypothesis because, as noted in §4, almost all the participants were still beginners. Without comparing more advanced learners, it is impossible to rule out the possibility that at least some learners simply “pick up” native-like phrasing as their proficiency improves.

Assuming, for the sake of argument, that most JFL learners with these native languages do not just develop native-like phrasing patterns spontaneously, the question that arises is whether explicit instruction would be worth the time and effort required. As explained above in the introduction (§1), it is a non-trivial task just to choose an appropriate counter and to put it and the rest of a number into the correct segmental form. Furthermore, it is highly unlikely that non-native phrasing will result in communication failures in real-life situations. It therefore seems unreasonable to expect most students to be very concerned about native-like phrasing when the only payoff is sounding a little more native-like. On the other hand, it could well be that a little effort would go a long way. It is not very difficult to explain the basics of the phrasing system, and such explanation might have a significant impact, at least on some students.

It is, of course, important to keep in mind that most JFL learners are not native speakers of Western European languages but of Asian languages, especially Mandarin, Korean, and Indonesian/Malay [8]. In Korean, big numbers behave almost exactly as they do in Japanese, and it is almost certainly unnecessary to draw attention to the Japanese phrasing patterns in the case of learners with this L1.

A native speaker of South Gyeongsang (SG) Korean who is a highly-proficient JFL speaker recorded the same list of Japanese numbers as the student participants in this study, and most of her productions, including the number in Figure 3, are indistinguishable from those of native speakers. Unlike Seoul Korean, SG Korean has a pitch-accent system very similar to the Tokyo Japanese pitch-accent system. Thus, the only real challenge that Japanese big numbers present for such a speaker is the unpredictable accentuation of individual digit+counter and digit+decimal-place combinations. The SG Korean number meaning ‘365 days’ consists entirely of Sino-Korean morphemes that correspond one-for-one to the Sino-Japanese morphemes in the Japanese number, as shown in Figure 5.

T Japanese: /sa<sup>↓</sup>N + byaku | roku + juH + go<sup>↓</sup> + niči/  
 SG Korean: /sa<sup>↓</sup>m + pek | juk + si<sup>(↓)</sup>p + o + i<sup>↓</sup>l/  
                   ‘3’ ‘hundred’ ‘6’ ‘ten’ ‘5’ ‘days’

**Figure 5:** The number for ‘365 days’ in Tokyo Japanese and South Gyeongsang Korean.

## 7. Future directions

As noted in the introduction (§1), this paper is just a preliminary report. The work that remains to be done can be divided into three major tasks. First, a comprehensive description of the pitch-accent and phrasing patterns of Japanese big numbers needs to be completed and made available. Second, a thorough analysis of the 2011 recordings remains to be done. In particular, beginning JFL students whose L1 is a tone language (Mandarin or Cantonese) have been neglected. Finally, learners with Western European L1s should be studied at different stages in their JFL careers to see whether native-like phrasing emerges spontaneously or requires explicit instruction.

## 8. Acknowledgements

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## 9. References

- [1] Martin, S. E. 1975. *A reference grammar of Japanese*. New Haven: Yale University Press.
- [2] Kubozono, H. 2006. *Akusento no hōsoku*. Tokyo: Iwanami Shoten.
- [3] Vance, T. J. 2008. *The sounds of Japanese*. Cambridge: Cambridge University Press.
- [4] Kubozono, H. 1993. *The organization of Japanese prosody*. Tokyo: Kurosio.
- [5] Pierrehumbert, J., Beckman, M. 1988. *Japanese tone structure*. Cambridge: MIT Press.
- [6] Boersma, P., Weenink, D. 2011. Praat: Doing phonetics by computer, ver. 5.3. <http://www.praat.org>
- [7] Yazawa, K., Kondō, M. 2016. Eigo bogo-washa ni yoru Nihongo no daunsuteppu no jitsugen. *Dai-30-kai Nihon Onsei Gakkai zenkoku taikai yokō-shū*, 120–125.
- [8] Kokusai Koryū Kikin (ed.). 2013. *Kaigai no Nihongo-kyōiku no genjō*. Tokyo: Kurosio.