

A corpus-based analysis of Japanese rhythm and mora duration

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A widely held belief, dating back to [1], which was originally published nearly a century ago, is that the duration of moras is held constant in Japanese. This postulated isochrony has given rise to the idea that Japanese is mora-timed [1] and has led to positing a rhythm class of mora-timed languages with Japanese as the prime example. However, acoustic evidence has provided mixed results on this point [2], and has failed to show clear evidence of either isochrony in mora duration or some consistent and generally agreed upon pattern of temporal compensation [see 2 for a review]. A possible reason for these discrepancies could be the reliance of early studies on relatively small samples. The aim of the current study was to examine mora duration using the Corpus of Spontaneous Japanese (CSJ, [3]) in order to uncover possible durational patterns in a large and varied sample of Japanese speech. The CSJ has been compiled by the National Institute for Japanese Language and Linguistics (NINJAL) and includes 50,337 words tagged for accent, mora duration, and mora position in the word.

Mora durations for words of up to 10 moras long were used for analysis. Durations were examined in terms of mora accentuation (accented or unaccented), position in the word (1st to 10th), and segmental composition. In terms of composition a distinction was made between four types, CV moras on the one hand, and single-segment moras, i.e. those consisting of a (coda) nasal (syllable structure CVN), a vowel (syllable structure CVV), and the coda element of a geminate consonant (syllable structure CVG). Durations were analysed using linear mixed models with the lme4 package in R [4, 5]. In all models the dependent variable was duration; mora type, mora position, and accentuation were fixed factors; word was a random factor.

The results showed that mora duration depends on segmental composition, with CV moras being significantly longer than single-segment moras, on average twice as long (see Figure 1a). Accented moras are also significantly longer than unaccented ones (see Figure 1b). Further, mora duration decreases with position in the word, though the effect is small (see Figure 2). Accent and position interact, in that the data show a clear tendency for accent to fall on odd numbered moras: 14.7% of odd-numbered vs. 9.9% of even-numbered moras were accented. This result is related to the fact that even-numbered moras tend to be the second mora of heavy syllables: only 6.6% of odd-numbered moras were single-segment moras, while 30.6% of even-numbered moras were single-segment. A combination of these patterns results in odd-numbered moras being more likely to be longer and accented relative to even-numbered ones.

The results of this large corpus study support the conclusion of [2] and [6] that mora duration is not held constant in Japanese but depends on segmental composition, with CV moras being longer and showing greater variability in duration (see Figure 1a). Further, there is a small but statistically significant effect of accent on mora duration, even though Japanese pitch accent is said not to have durational correlates [6]. Finally, the interaction between accentuation and mora position indicates that the two are connected and that Japanese shows a tendency for odd-numbered moras to be accented. This finding supports accounts like those of [7] and [8] who have argued that Japanese has a tendency for trochaic structure. This tendency is also supported by perceptual evidence, with Japanese listeners showing a preference for the trochaic grouping of auditory stimuli [9].

In conclusion, this extensive corpus does not support the view that Japanese is mora-timed, and indicates that trochees may be the basis of rhythmic structure in Japanese, a tendency that emerges from regularities in the Japanese lexicon and its usage in spontaneous speech. These results add to many studies, such as [10], showing little evidence in favour of isochrony and timing as the basis of rhythm.

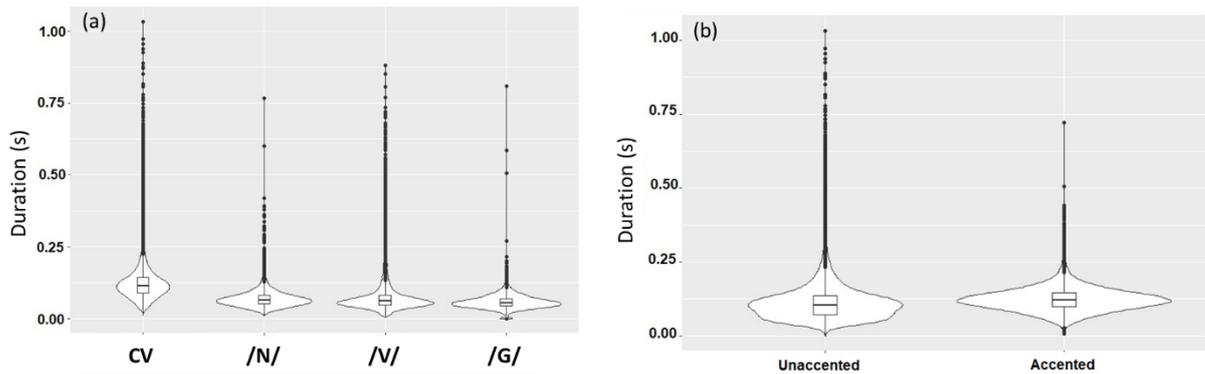


Figure 1. Duration of moras by segmental composition (a) and accentuation (b).

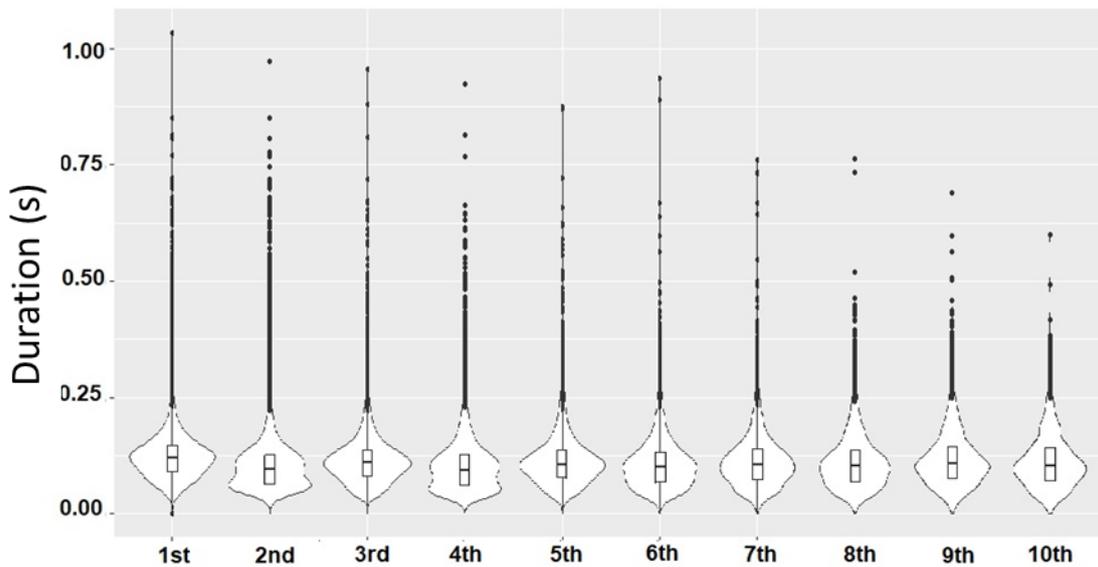


Figure 2. Duration of moras by position in the word.

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