The Effect of Foot Structure on Segment Duration in Syllable-Timed Languages:
The Cases of Buginese and Toba Batak

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This study investigates timing in Buginese and Toba Batak, both Western Austronesian languages of Indonesia, and shows that moraic structure, syllable structure, and foot structure each influence segment duration. I argue that the timing strategy employed in these languages refers to not one but all levels of prosodic representation and that the languages differ in the relative importance granted to specific levels.

Most researchers agree that timing, or the translation of phonological representations into physical outputs, is influenced by segmental factors (e.g., schwas are shorter than full vowels). However, the role of different constituents in the prosodic hierarchy (1) is less clear. Although it has been found that across languages segment duration can be influenced by moraic structure (Hubbard 1994, Broselow et al. 1997), syllable structure (Maddieson 1985), and foot structure (Beckman 1995), it is generally assumed that within a language one prosodic constituent takes precedence, such that its timing strategy can be characterized by a single prosodic unit. For example, Japanese is a mora-timed language, Tagalog syllable-timed, and English foot-timed.

Buginese and Toba Batak are considered syllable-timed languages, due to both phonological and phonetic factors. Both languages are quantity-insensitive, as syllable weight and moraicity do not affect the assignment of stress. As illustrated in (2), the canonical foot type in both Buginese and Toba Batak is the syllabic trochee, with stress appearing penultimately regardless of whether the penult bears two morae or one. The syllable also has priority at the phonetic level, as vowels shorten in closed syllables to preserve constant syllable lengths (Cohn et al. 1999) and geminates lengthen after inherently short schwas (Podesva 1998).

Based on acoustic analyses of recordings of two Buginese and two Toba Batak speakers, I illustrate that despite robust patterns of syllable-timing, both moraic and foot structure influence the implemenation of duration. In Buginese, geminates (assumed to be doubly linked to coda moras of one syllable and onsets of the next) are shorter than ʔC sequences in the same environment (with ʔ linked to the coda mora of one syllable and C independently linked to the onset of the next), as summarized in (3). This suggests that moraic affiliation does in fact play a role in duration assignment. Furthermore, even though syllable-timing motivates closed syllable vowel shortening in Buginese, the pattern is suppressed in unfooted syllables, as shown in (4), revealing a foot structure effect on timing. Preliminary Toba Batak data reveal the same effect, but to a smaller degree.

I account for these facts by outlining a timing model in which prosodic constituents (segments, morae, syllables, feet) are represented by both durational targets and weights indicating their relative importance. Under this analysis, the Buginese weight for the foot target is greater than the corresponding weight in Toba Batak, accounting for the stronger foot structure effect in Buginese. The proposed model can thus account for subtle differences between closely related languages (e.g., Buginese and Toba Batak) as well as qualitative differences between languages (e.g., syllable-timed languages vs. mora-timed languages).

References

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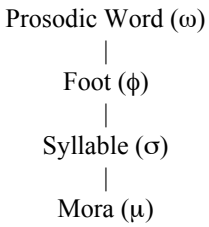
Data

(1) Prosodic Hierarchy (Selkirk 1980)

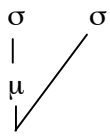
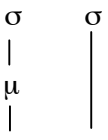


(2) Quantity insensitivity in stress assignment

	Buginese		Toba Batak	
$(CV_{\mu})(CV_{\mu})$	tápa	'to smoke'	tába	'to hack'
$(CV_{\mu})(CV_{\mu}C_{\mu})$	kápaʔ	'ax'	tábas	'magical spell'
$(CV_{\mu}C_{\mu})(CV_{\mu})$	tábba	'to fry'	tábba	'to multiply'
$(CV_{\mu}C_{\mu})(CV_{\mu}C_{\mu})$	páppaʔ	'piece'	tábbak	'grave'
$(CV_{\mu})(CV_{\mu})(CV_{\mu})$	matápa	'smoked'	dadápi	'to feel repeatedly'
$(CV_{\mu}C_{\mu})(CV_{\mu})(CV_{\mu})$	mattápa	'to smoke'	dadáppu	'act of feeling'

(Syllable boundaries marked by ( ), moraic segments marked by subscripted μ.)

(3) Duration of geminates and ʔC sequences in Buginese

	Geminates	ʔC Sequences
prosodic structure		
example	pəttakkku	pəttaʔku
gloss	'my stupidity'	'my shot'
mean duration (speaker Y)	138 ms	164 ms
mean duration (speaker I)	157 ms	191 ms

(Underscores indicate target segments.)

(4) Closed syllable vowel shortening in Buginese

	in footed syllables		in unfooted syllables	
	open sylls.	closed sylls.	open sylls.	closed sylls.
example	(pət)[(ta)(ku)]	(pət)[(tak)(ku)]	(ma)[(ta)(pa)]	(mat)[(ta)(pa)]
gloss	'my royal father'	'my stupidity'	'smoked'	'to smoke'
mean V duration (speaker Y)	140 ms	101 ms	78 ms	81 ms
mean V duration (speaker I)	173 ms	136 ms	107 ms	106 ms

(Foot boundaries marked by [ ], syllable boundaries marked by ( ), underscores indicate target vowels.)