The Metrical Structure of Thai in a Non-Linear Perspective

Apiluck Tumtavitikul

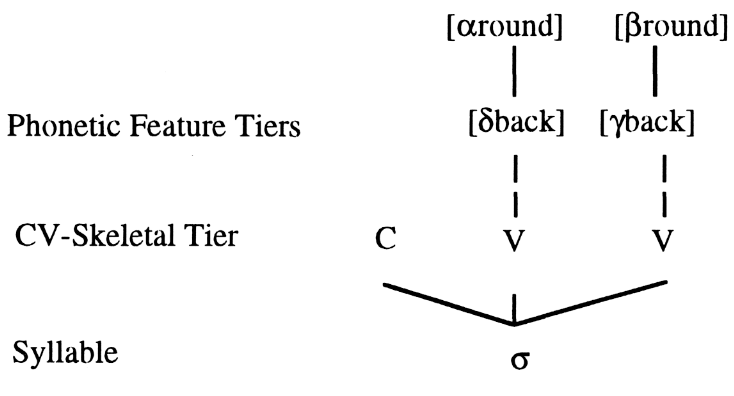
Kasetsart University

1. SYLLABLES IN AUTOSEGMENTAL AND METRICAL PHONOLOGY

Syllables and stress patterns have been considered suprasegments, external to segmental features of consonants and vowels. In a more recent approach to phonological analysis, the autosegmental approach (Goldsmith, 1976, 1990), the distinction between segments and suprasegments is, more or less, neutralized to autosegments. That is, consonants and vowels, phonetic features, and tones are all viewed as autosegments on their own separate tiers. Although autosegments are independent of one another, they are geometrically linked to one another by association lines which express simultaneity in time: Linked elements jointly represent a sound.

While Clements and Keyser (1985) see syllables as elements on their own syllable tier in a multi-linear representation, Goldsmith (1990) takes a syllable to be a "hierarchical structure organized on the skeletal tier." Syllables themselves constitute a phonological plane of metrical structure, upon which stress assignment is based. For example, see (1).

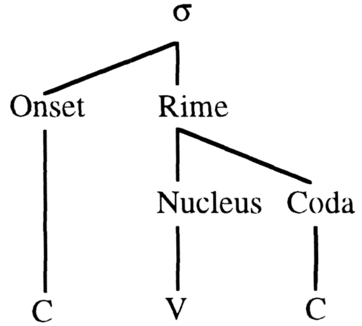
(1)



2. SYLLABLE ORGANIZATION

The "hierarchical" internal structure of a syllable according to Goldsmith, consists of two major constituents, onset and rime, with nucleus and coda as the subconstituents of the rime. The internal structure of the syllable on the syllable plane can be charted as in (2).

(2)



σ = syllable
C = consonant
V = vowel

For a complex nucleus, the nucleus node is branching as in (3).

(3)

```
Nucleus
  / \
 V   V
```

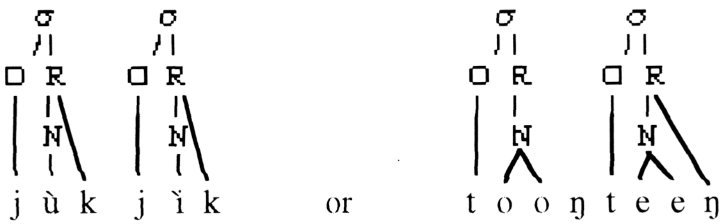
This internal structure of the syllable is psychologically real and is well attested cross-linguistically in such phenomena as language games, speech errors, etc. These constituents and subconstituents of the syllables are evidenced in the Thai language game Kham Phùán (Surintramont, 1973) in which rimes are permuted, and in a form of reduplication in Thai (Luksaneeyanawin, 1986) in which the syllable nucleus behaves differently than the syllable coda in reduplication as in (4).

(4)a. Kham Phùán (Surintramont, 1973): rimes permutation

```
 σ       σ             σ       σ
/ |     / |           / |     / |
O  R    O  R          O R     O R
|  /\   |  |\         | |\    | /\
d  u u  n  a ŋ        d a ŋ   n u u
'see movie'
```

Here tones as autosegments may or may not move with the "melodic" segments of the rime. Thus, [duu nǎŋ] > [daŋ nùú] or [dǎŋ nuu].

(4)b. Special Reduplication (Luksaneeyanawin, 1986): vowel ablaut



'not still' 'untidy'

Whereas Kham Phùán takes a larger unit of rime permutation regardless of the internal structure of the rime itself, the special reduplication in (4)b looks at the subconstituent of the rime, the syllable nucleus. Both phenomena are good evidence of the reality of the internal structure of the syllable for Thai speakers.

A notion that has been given much weight in Goldsmith (1990) is "extrasyllabicity," which is an extra element of the internal structure of the syllable. Such an element is a consonant in either initial or final position of a syllable which, if it is not syllabified during the word-formation process, will be deleted in the phonetic form. In word-final position such a segment has been called an "appendix" or a "termination" (1990, p. 107). Extrasyllabic segments are evidenced in Thai and may be said to be comparable to [tua kàʔran] in Thai (to be discussed in section 4.2).

3. SYLLABLE WEIGHT, STRESS, AND METRICAL STRUCTURE

Metrical Phonology (tree theory) analyzes stress patterns as hierarchical representations of relative prominence of syllables and higher constituents in the metrical structure (metrical tree). In general, stress assignment is based on rhythm and/or syllable weight, which looks at the rime structure. While rhythm alternates stress at regular intervals, syllable weight distinction, which is in general binary, i.e., light and heavy, counts moras in the rimes. Heavy syllables are those with branching rimes, while light syllables are single-moraic with non-branching rimes (cf. (5) & (6)). In a quantity-sensitive language, heavy syllables are the ones that attract stresses.

(5) Light syllables are of this form:

```
Rime
 |
 V
```

(6) Heavy syllables may take one of the following internal structures of the rime:

```
a. Rime         b. Rime         c. Rime
    |               | \             | \
    N               N  \            N  \
   / \              |   \          / \  \
  V   V             V    C        V   V  C
```

Syllable weight is crucial to stress assignment in Thai (to be discussed in sections 4 and 5).

Metrical Theory, developed from Liberman and Prince (1977) and Prince (1980) (cf. Goldsmith, 1990), sees three main hierarchical constituents in the metrical tree:

a. *The syllable, which is the lowest level constituent, with internal structure of the rime being crucial to stress attraction.*

b. *The metrical foot, which is a higher-level constituent, consisting of a strong syllable and one or more weak ones.* A foot may be degenerate, i.e., dominating a single syllable.

c. *The word, which is the highest level, consisting of a strong foot and one or more weak feet.* For example, see (7) (from Luangthongkum, 1977).

```
(7)            Word                 (word level)
               /   |
              F     F               (F = foot)
             / |   / |

           σ  σ  σ  σ               (syllable level)
           |  |\  |  |\\
        na-mát-sa-kaan
        'to pay respect'
```

A strong node, denoted by a vertical line at the level of either F or W, represents prominence.

4. THAI SYLLABLES

Surface structures of Thai syllables can be summarized as follows:

(8) $C_1(C_2)\ \{V(V)(C_3)\}$

That is, all the structures in (9) are possible phonetic forms, with constraints shown in (10);

(9) a. $C_1(C_2)V$ b. $C_1(C_2)VV$ c. $C_1(C_2)VC_3$ d. $C_1(C_2)VVC_3$

(10) Syllable-Structure Constraints

a. $C_2 = \{l, r, w\}$, and
if $C_2 = [w]$, then $C_1 = [k, kh]$ (Luksaneeyanawin, 1993)

b. *[α son] [α son]

That is, in a cluster onset, the consonants cannot both be [+son] or both be [-son]. For example, *pt, *rl, or *kk are all ill-formed. The language does not allow a sequence of stops or approximants in the onset position.

c. $C_3 = \{m, n, ŋ, w, j, p, t, k, ʔ\}$

4.1 Cluster Onsets

Two types of cluster onsets are observed:

a. True Cluster

In a true cluster, both consonants in the onset position cannot be separated (Tumtavitikul, 1992). For example, see (11).

(11)	trii	'three'	>	trai-jaaŋ, *tàʔraijaaŋ
	klaaŋ	'middle'	>	*kàʔlaaŋ
	pràp	'fine'	>	*pàʔràp

Such clusters have an internal structure as in (12), with a multiple-mapping between 'melodic' segments and C-segment in the onset position such that vowel insertion will create association line-crossing and thus, is prohibited. The result is an unbreakable cluster onset

```
(12)        σ
           /|
          O R
          |
          C
         /\
        t  r_
```

b. CC-cluster

CC-cluster is a complex onset in which the two consonants can be separated due to the following internal structure, as in (13).

```
(13)        σ
           / |
          O  R
         /\
        C C
        | |
        t r_
```

Examples are given in (14).,

(14)	trùət	'check'	>	tamrùət	'policeman'
	pràap	'raid'	>	bamràap	(p > b)
	tràt	'speak'	>	damràt	(t > d)

Such cluster onsets consist of two C-slots, each mapping to a "melodic" segment in a one-to-one fashion; thus the cluster is breakable without violating the association line-crossing constraint.

4.2 Complex Coda

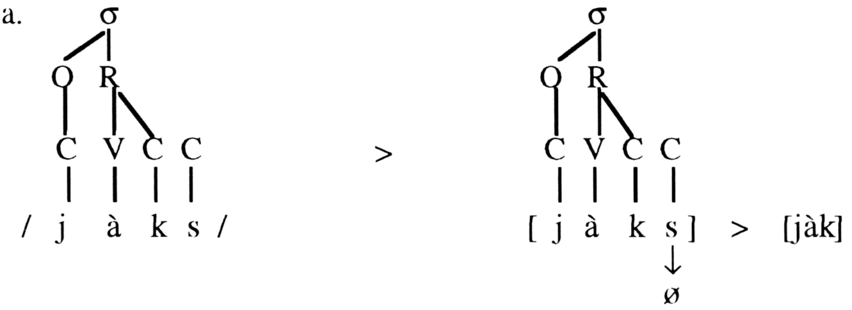
A complex coda consists of one or more "extrasyllabic" segments which are not linked to the syllable underlyingly; nevertheless, they form a part of the lexical entry. The extrasyllabic segment will surface only if it is syllabified in the word-formation process, otherwise it will delete on the surface. An extrasyllabic segment is denoted by parentheses. A single extrasyllabic segment is comparable to [tua kàʔran] in Thai grammar. Examples are given in (15).

(15)a. /ják(s)/	>	[ják]	'giant'
	>	[jáksàá], [jáksìí]	
b. /phát^h(n)/	>	[phát]	'progress'
	>	[phátt^{h}áʔnaa]	

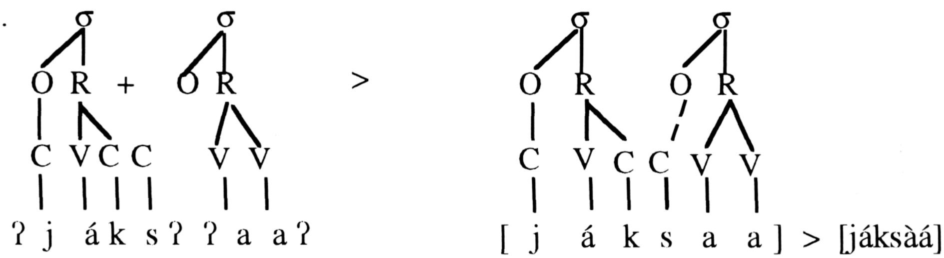
(15)a. can be charted as in (16).

(16)

a.



b.



4.3 Syllable Reduction

Two types of syllable reduction are observed:

a. Vowel Reduction.

Vowel reduction mainly occurs on unstressed CVʔ surface syllables. The reduction mainly takes place in the form of a > ə, or i > ɪ. A final glottal deletion always precedes vowel reduction, which is most often accompanied by tone neutralization to mid, as shown in the examples in (17).

(17)	a. rátt̲ʰà̲ʔbaan	>	rátt̲ʰà̲baan	'government'
		>	rátt̲ʰa̲baan	
		>	rátt̲ʰə̲baan	
	b. raac̲ʰì̲ʔnii	>	raac̲ʰì̲nii	'queen'
		>	raac̲ʰi̲nii	
		>	raac̲ʰɪ̲nii	

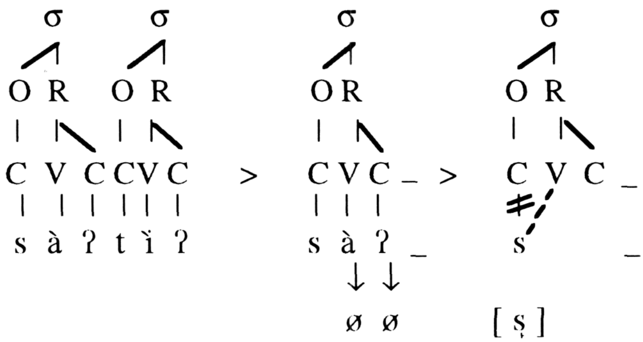
b. Vowel Deletion

Vowel deletion is a further step beyond vowel reduction. It often occurs with surface CVʔ with a fricative onset, as in (18).

(18)	s̲à̲ʔtìʔ	>	s̲à̲t̲ìʔ
		>	s̲a̲tìʔ
		>	s̲ə̲tìʔ
		>	s̲t̲ìʔ

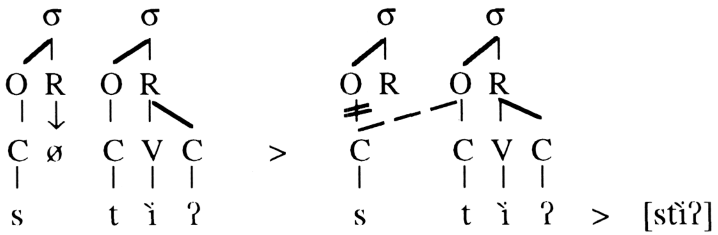
It is noted that all word-final CVʔ syllables are inherently stressed (Luksaneeyanawin, 1993). This matter will be taken up under Stress Assignment. (18) can be charted as in (19).

(19)



Syllabic reduction may have introduced a mew surface structure into the language, namely, a syllabic consonant, e.g., [s̩]. Another possible surface form that vowel deletion may have brought into the language is the surface cluster onset [st] as in (20).

(20)



Whether we like it or not, either (19) or (20) or both surface forms are indicative of an ongoing process of language change in modern Thai. More examples are given in (21).

(21)	s̩nàps̩nǔn	<	sàʔnàp-sàʔnǔn	'support'
	kìtc̩^{h}kaan	<	kìtcàʔkaan; (c^{h} < c)	'business'
	s̩t^{h}àábaan	<	sàʔt^{h}àábaan	'institution'

4.4 Surface and Underlying CV-Syllables

It is clear from 4.3 that Thai does have surface CV-syllables from syllable reduction, which is a late phonetic process of glottal deletion, vowel reduction or deletion, and tone neutralization.

(22) Glottal Deletion (Phonetic Implementation Rule)

ʔ > ø / CV__]σ_x (σ_x = unstressed syllable)

(23) Vowel Reduction (Phonetic Implementation Rule)

$$\underset{[-\text{high}]}{\overset{}{V}} \quad > \quad ə \;/\; C\_\_]\sigma_x \qquad\qquad (\sigma_x = \text{unstressed syllable})$$

Underlying CV-syllables are more controversial. Gandour (1974) suggests that there are no underlying CV-syllables in Thai. His suggestion is based mainly on the arguments concerning surface vs. underlying glottal stop in Thai. I would like to propose here that there are underlying CV-syllables in Thai; in fact, I would like to suggest that all surface CVʔs are from underlying /CV/, with the glottal final coming from a glottal insertion rule (24).

(24) Glottal Insertion (Post-Lexical Rule)

$$\emptyset \quad > \quad ʔ \;/\; CV\_\_]\sigma$$

The justification for glottal insertion is as follows:

a. /b, d/ *are Thai phonemes which occur only syllable-initially. It is not unusual to have* /ʔ/ *restricted in the same manner, since* /b, d, ʔ/ *do behave similarly with respect to tone assignments at syllable onset position.*

b. *For* CVV[-son] *syllables, only* /p, t, k/ *occur at syllable coda, but a glottal final with long vowel is absent (as noted by Gandour, 1974).* Such a gap cannot be explained if there is underlying /ʔ/ at syllable-final in a CVʔ syllable.

c. *Underlying* /CV/ *helps count syllable weight such that all surface (not word-final)* CVʔs *can be counted as light syllables.* Thus, stress assignment in Thai can be simplified to depend mainly on syllable quantity.

5. STRESS ASSIGNMENTS IN THAI

Luksaneeyanawin (1983, 1993) has given the following generalizations for stress assignments in Thai:

(25) Stress Assignments in Mono-Morphemic Polysyllabic Words

a. Thai distinguishes two types of syllables, linker syllable (i.e., [Ca]) and non-linker syllables of all other types.

b. Thai recognizes double stress in a word, primary and secondary. The last syllable always receives primary stress, and secondary stress is sometimes suppressed in casual or fast speech.

c. Between linker and non-linker syllables in all other positions (non-final in a word), non-linker syllables attract stresses.

d. In a word of two to four syllables stress patterns are usually the following:

- | (- = unstressed, | = stressed)
| - |
- | - |

e. However, if in a three-syllable word the first syllable is a linker and the second is a non-linker, the stress pattern is as follows:

- | |

f. Also, in a four-syllable word in which the first syllable is a non-linker but the second is a linker syllable, the stress pattern is as follows:

| - - |

g. When both the first and second syllables are non-linker syllables, the degree of syllable weight gives precedence to stress assignment—the heavier the rime, the more likely it is to attract stress. Shown here is how the degree of syllable weight is given:

$$\left\{\begin{array}{l} \mathrm{CV(V)[-son]} \\ \mathrm{CV(V)[+nas]} \end{array}\right\} > \mathrm{CVV}, \text{ and}$$

$$\mathrm{CV(V)[+nas]} > \mathrm{CV(V)[-son]} > \mathrm{CV}ʔ$$

For word-compounds, the generalizations in (25) do not apply; rather, stress assignment is determined by "the morphological derivation of the compounds." For example, see (26) (from Luksaneeyanawin, 1993, p. 287).

(26)	a. [náam sôm]	'orange juice'	- |
	[náam sôm k^{h}án]	'fresh orange juice'	- | |
	b. [kàp k^{h}ǎàw]	'dish (of food)'	- |
	[túù kàp k^{h}ǎàw]	'kitchen cabinet'	| - |

What I attempt to do in this paper is to account for the generalizations give in (25) for mono-morphemic polysyllabic words as well as for word-compunds by a single set of rules in metrical phonology.

5.1 Thai Metrical Structure

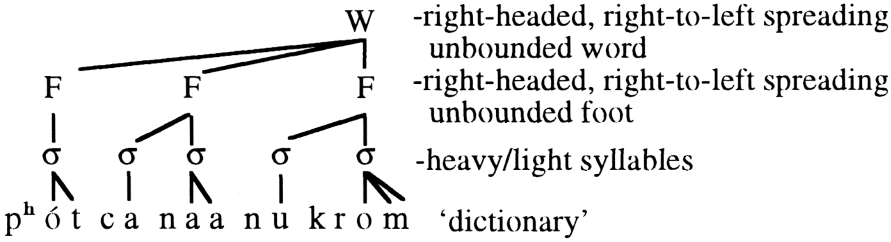
As discussed in sections 3 and 4.1, I distinguish two types of Thai syllables according to rime projection, light and heavy. All surface (not word-final) CVʔ-syllables are considered to be "light" from an underlying CV. By this, I distinguish stress assignment in emphatic words as optional (emphatic rule), where each and every syllable of the word emphasized is stressed.

With this convention, stress assignments in Thai can be derived from the metrical tree with the following tree-building rules:

(27) Thai Metrical Tree
a. Count syllable weight according to rime-projection. An exception is a word-final CV-syllable which, by its position, is inherently "heavy" despite its internal structure.
b. Build right-headed metrical feet with a leftward spreading unbounded foot tree for each foot.
c. Build a right-headed foot tree with a leftward spreading unbounded word.

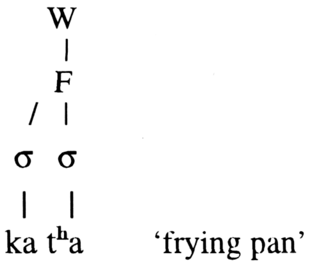
For word-compounds, (27) applies cyclically in the lexicon as a stress-assignment rule in word-formation. For example,

(28)



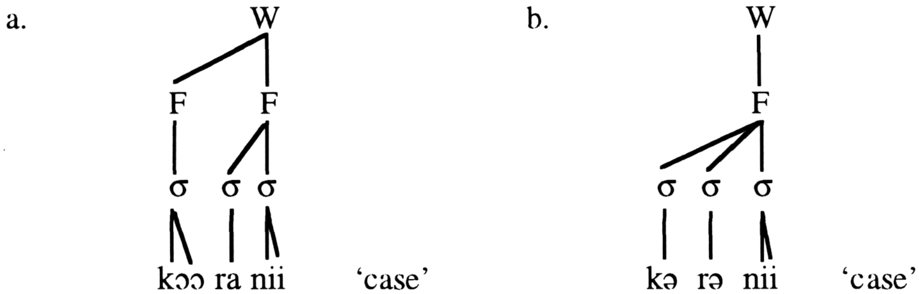
Stress pattern: | - | - |, where the last syllable receives primary stress.
By Glottal Insertion (GI, (24)), we have [pʰótcàʔnaanúʔkrom]

(29)



Stress pattern: - |

With the application of GI (24), we have [kàʔtʰáʔ]. In casual speech, Glottal Deletion (GD, (22)) and Vowel Reduction (VR, (23)) apply, yielding [kətʰáʔ].
(30)



Stress pattern: | - | - - |

(30)a is comparable to the stress pattern given by Luangthongkum's (1977) careful speech style, and (30)b is comparable to her casual speech pattern. It is noted that (30)b can be derived from (30)a by secondary-stress suppression. The metrical tree in (30)a assigns primary stress to the last syllable [nii] and secondary stress to the first syllable [kɔɔ]. If secondary-stress suppression applies, a vowel shortening rule (31) shortens the syllable.

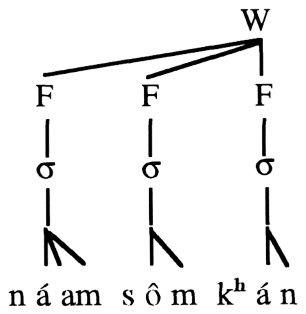
(31) Vowel Shortening

VV > V / [-stress σ]

That is, a long vowel in an unstressed syllable is shortened.

If the word-compounds are reanalyzed as monomorphemic polysyllabic words, that is, indivisible unit words, the metrical rules given in (27) apply. However, in the case that the compounds are perceived as compounds, (27) applies in cyclical applications in lexical phonology. For example,

(32)



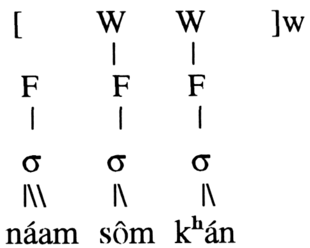
'fresh orange juice'

Stress pattern: - - |

With Vowel Shortening (VS (31)), we have [nám sôm kʰán].

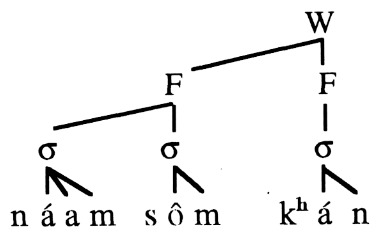
In (32) the compound is reanalyzed as one polysyllabic word. If the compound is taken as a compound from morpheme concatenation, we then have (33).

(33)



Word-Compounding

With Foot-Percolation, (27) reapplies yielding,



Stress pattern: - | |

In the same manner, we may have [túù kàp kʰáàw] with the stress pattern - - l, or we may have it with the pattern l - l as the word-compound stress pattern. Hence, we have both monomorphemic polysyllabic words and word-compounds accounted for by a single set of rules in metrical phonology.

5.2 Evidence

If we truly have the rules for building Thai metrical trees, (27) should not only account for stress assignments, but also other phenomena related to the metrical structure, e.g., syllable reduction, syllable deletion, foot deletion, etc.

a. *Syllable Reduction*

For syllable reduction, (27) predicts that all unstressed syllables, either those dominated by weak nodes at the foot-level, i.e. [CVʔ] syllables, or those subject to secondary-stress suppression, i.e., those dominated by strong nodes at the foot-level but by weak nodes at the word-level, are susceptible to syllable reduction. While [CVʔ] syllables are almost always reduced in casual speech, secondary-stress suppression is optional.

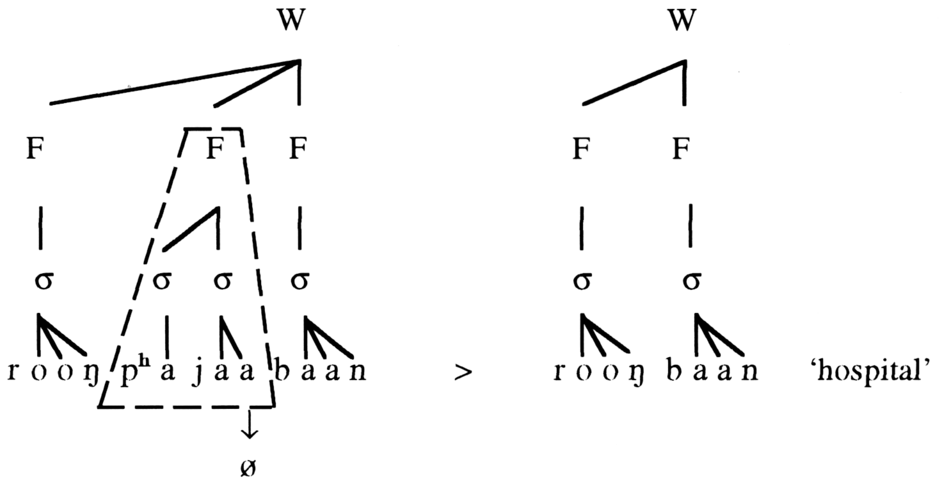
(34) sàʔtrɔɔbəərîi > sətrɔɔbəərîi, or sətrɔɔbərîi 'strawberry'
- l l l - l - l
(2nd stress suppression)

GD (22) and VR (23) apply to [sà] in both cases, but secondary-stress suppression only applies only to the latter, not the former, in (34), and VS (31) applies to [bəə] yielding [bə]. It is noted that [sàʔ] might have gone all the way to become [s̩] or [st]-cluster in both cases.

b. *Syllable and Foot Deletion*

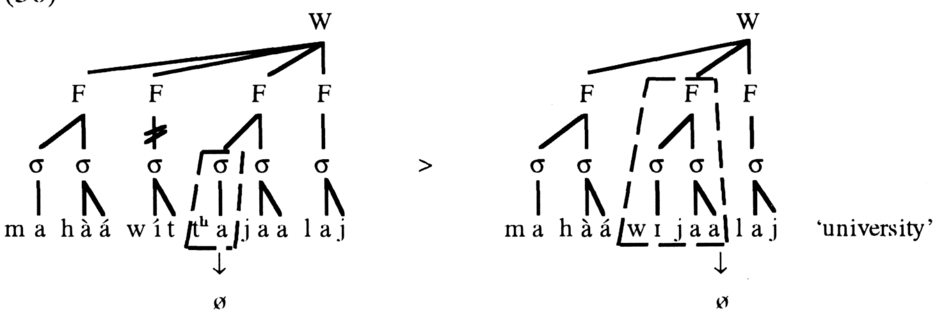
Both syllable and foot deletions are good testing grounds for the metrical constituents proposed for Thai in (27). For example, see (35).

(35)



The metrical foot [pʰajaa] deletes as a constituent in (35).

(36)



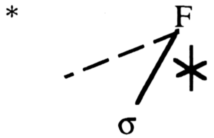
unstressed-syllable deletion
2nd stress suppression

wít > wí > wɪ (syllable reduction)
re-footing
foot-deletion

The final phonetic reduced form is [mahàálaj].

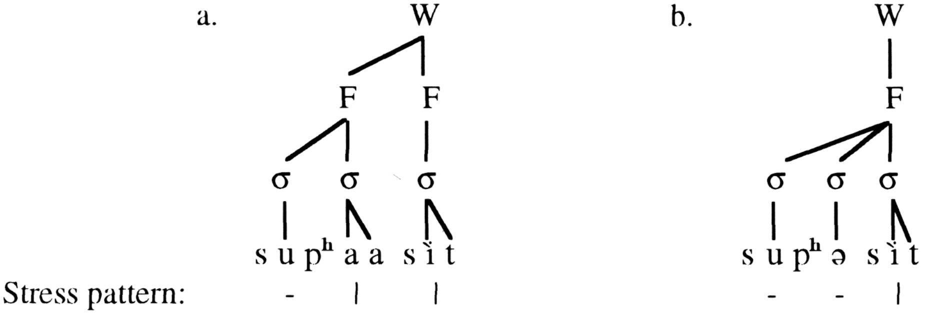
In (36) there are both unstressed-syllable deletion and foot-deletion. It is noticeable that secondary-stress suppression chooses a non-branching, i.e., a degenerate foot. This is not at all surprising given the principle of heavy and light contrast at the syllable level in (5) and (6); the same principle seems to be operative at the foot level in this case and also in (34). However, secondary-stress suppression also applies to a branching foot when no degenerate foot carrying a secondary stress is available. In this case, stress assignment is subject to Foot Constraint as in (37).

(37) Foot Constraint



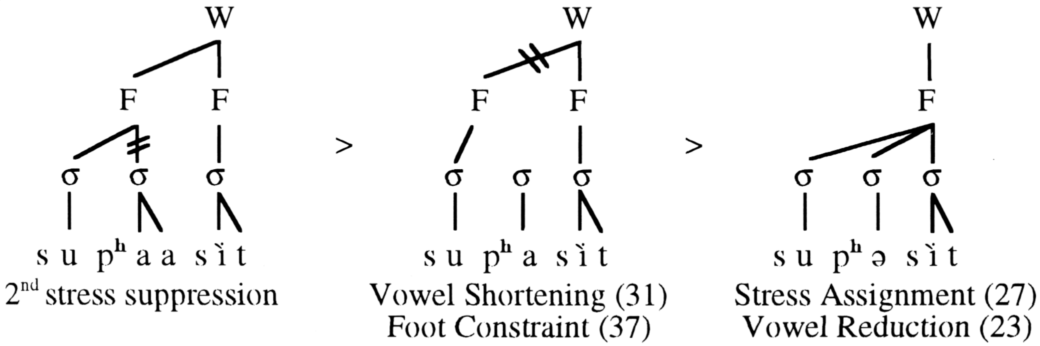
That is, there can be no foot-tree without a strong node dominating a strong syllable. For example, see (38) (from Luangthongkum, 1977).

(38)



The casual speech style (38)b is derived from the careful speech style (38)a via secondary-stress suppression followed by vowel shortening (31), re-footing due to cyclical application of stress assignment (27) which is subject to Foot Constraint (37), and followed by vowel reduction (23), as shown in (39).

(39)



6. CONCLUDING REMARKS

What I have introduced in this paper is an analysis of the metrical structure of Thai in a non-linear perspective. Previous works, e.g., Luangthongkum (1977) and Luksaneeyanawin (1983, 1993) have been tremendously helpful in laying out the generalizations in the language with respect to rhythms and word accents. I hope that in future research non-linear phonology will play a significant role in the analysis of Thai metrical structure beyond the word level.

ACKNOWLEDGMENTS

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