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AN OPTIMALITY THEORETIC ANALYSIS OF PAAMESE STRESS[1]

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1. Introduction

This paper analyzes the Paamese stress pattern from the optimality theoretic perspective. Two issues of analytic interest presented by the Paamese data are cases where an unstressable vowel should fall in a strong foot position and stress in words with glide formation. I show that the analysis offered within optimality theory (henceforth OT) is superior to the pre-OT analysis of Hayes (1995).

In Paamese, stress typically falls on the antepenultimate syllable in words with three or more syllables while stress goes on the pre-antepenultimate position if the antepenultimate vowel is unstressable ($\breve{V}$). In disyllabic words, stress goes to the penultimate syllable, i.e. the initial syllable. Penultimate stress is also observed in trisyllabic words when the initial syllable has an unstressable vowel.

To account for these apparently complicated stress facts, Hayes (1995) proposes the lexical exception of syllable extrametricality and foot extrametricality. Crowley (1982) presents a rule-based analysis. However it will be shown that we can dispense with rules or exceptional markings: Constraints and their ranking present a satisfactory account for the Paamese stress pattern. Moreover, the analysis offered here applies unproblematically to words with glide formation

[1] Paamese, an Austronesian language, is spoken in the Republic of Vanuatu located between

without reference to rules of stress shift as in Crowley (1982).

Section 2 presents the basic foot structure shown by the Paamese stress pattern through constraint interaction and it also offers an account of the data where a weak vowel could fall in a strong foot position. Section 3 analyzes data involving on-glide and off-glide formation. The OT analysis accounts for these data unproblematically whereas previous analyses had to make reference to stress shift. Section 4 briefly introduces Hayes's (1995) moraic trochee analysis and suggests that Paamese is a syllabic trochee language. Section 5 summarizes and concludes the paper.

2. Foot Structure

This section deals with the basic foot structure shown in Paamese using constraint interaction. We will first begin with basic footing and later incorporate data with underlying weak vowels.

2.1 Basic Footing

Paamese stress falls on the antepenultimate syllable of words consisting of three or more syllables while stress falls on the penultimate syllable in disyllabic

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the Solomon Islands, New Caledonia and Fiji in the South-West Pacific.

words. The data shown in (1) and all data hereafter are excerpted from Crowley (1982).[2]

(1)	visókono	'morning'
	manekólii	'darkness'
	vasíie	'all'
	áni	'fever'
	vée	'it is'
	múnge	'uncircumcised'

Paamese may be analyzed as a quantity-insensitive trochaic stress language.[3] This can be straightforwardly captured by two constraints: *Trochee* and Foot Binarity (*FtBin*). *Trochee* selects a left-headed foot and *FtBin* forces a foot to have exactly two syllables. The fact that stress goes to the antepenultimate indicates two things. The final syllables are extrametrical and the head foot stands as close to the end of a prosodic word. Final syllable extrametricality may be captured by the constraint, Nonfinality (*NonFin*), requiring that word-final syllables be unfooted. More interestingly, based on the observation that Paamese does not have secondary stress, the alignment constraint *All-Ft-R* is posited. *All-Ft-R* comes into play in explaining the location of the stressed syllable and the lack of secondary stress. Finally, since syllables are parsed into feet, *Parse-σ*

[2] In phonetic realization, the final vowel becomes very weak and sometimes is deleted. For example, visókono becomes either [visókon°] or [visókon]. I will not be concerned with the phonetic variation of word-final vowels in this paper.
[3] Hayes (1995:179) analyzes the Paamese stress pattern with a moraic trochee system and he disregards glide formation and weak vowel effects which give rise to stress shift. This paper,

prohibiting unfooted syllables is required. (2) shows the constraints roughly sketched so far.

(2) Constraints and their motivation:[4]

a) Rhythm type-Trochee (=*Trochee*): (Prince & Smolensky (1993:53))

Feet are left-headed.

b) Foot Binarity *(=FtBin)*: (Prince & Smolensky (1993:47))

Feet are binary at the syllable level.

c) Nonfinality *(=NonFin)*: (Benua (1997:179))

Word-final syllables are not footed.

d) Align (Ft, R, PrWd, R) (=*All-Ft-R*) (McCarthy & Prince (1993b:14))

All feet stand at the right edge of a prosodic word.

e) *Parse-σ*: (McCarthy & Prince (1993:11))

Syllables are parsed by feet.

Trochee in (2a) and *FtBin* in (2b) are observed by all the data, thus they are assumed to be undominated in Paamese. The final syllable is extrametrical except in disyllabic words and in trisyllabic words with initial unstressable vowels.

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however, proposes that Paamese is a syllabic trochee language, since there is no underlying vowel length contrast in Paamese as given in Crowley (1982:22).

[4] Paamese also observes the following undominated constraints:

a) *Lex=PrWd* (Prince & Smolensky (1993:43)): A lexical word must have prosodic structure.

b) *Max* (McCarthy & Prince (1995:16)): Every segment of the Input has a correspondent in the output (i.e. no phonological deletion is allowed).

c) *Dep* (McCarthy & Prince (1993:16)): Output segments correspond to the input segments

NonFin in (2c) comes into play to explain that the word-final syllable is unfooted. In disyllabic words, final syllable extrametricality must be revoked to block a less optimal foot form. This implies that *FtBin* outranks *NonFin*. Final syllables are left unparsed even in violation of *All-Ft-R* in (2d), otherwise we would expect penultimate stress. Therefore *NonFin* is ranked over *All-Ft-R*. *Parse-σ* shown in (2e) is low-ranked, crucially dominated by *All-Ft-R* because there is just one foot for each word under lack of secondary stress. (3) indicates the constraint ranking based on the discussion above.

(3) Constraint ranking: (*Undom* stands for undominated constraints.)

Trochee, FtBin (Undom) >> NonFin >> All-Ft-R >> Parse-σ

Now let us consider how this constraint ranking shown in (3) selects the optimal output in tableau (4).

(i.e. no phonological insertion is tolerated).

(4) The evaluation tableau of /visókono/ 'morning'

/visokono/	*Undom*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x .)(x .) vi.so. ko.no		*!	**	
☺ b) (x) (x .) vi.so.ko.no			*	**
c) (x) (x .)(x .) vi.so. ko.no		*!	**	
d) (x) (x .) vi.so.ko.no		*!		**
e) (x) (x .) vi.so.ko.no			**!	**

All candidates are faithful to the undominated constraints. (4a), (4c) and (4d) are ruled out because they violate the highly ranked constraint, *NonFin.* (4e) does not fare better than (4b) since it has an additional *All-Ft-R* violation. Therefore (4b) is chosen as the optimal form. Note that *All-Ft-R* is gradiently evaluated throughout the paper. Here we see that *All-Ft-R* can explain the lack of secondary stress though all syllables are not exhaustively parsed into feet.

Tableau (5) illustrates the parallel evaluation of a disyllabic word.

(5) The evaluation tableau of /múnge/ 'uncircumcised'

/munge/	Undom	NonFin	All-Ft-R	Parse-σ
☺ a) (x) (x .) mun.ge		*		
b) (x) (x) mun.ge	*FtBin !		*	*
c) (x) (x) mun.ge	*FtBin !	*		*

Given the constraint ranking, (5a) is optimal because (5b) and (5c) fatally violate the undominated constraint, *FtBin*. Here it is important to note that the constraint ranking of *FtBin* >> *NonFin* can explain the observation that final-syllable extrametricality must be revoked to eliminate a less optimal foot form.

Now consider the evaluation of the word which has a sequence of identical vowels. Note that two identical vowels must be heterosyllabic based on Crowley's (1982:26) statement that there are no long vowels in underlying representation in Paamese. This can be explained by positing *NoLongVowel* that prohibits the identical vowel sequences within a syllable. But to incorporate other observations related to glide formation (to be discussed in section 3), I will assume the following *OCP* constraint.

(6) *OCP (Seg)*

Two identical segments are not allowed within a syllable.

The constraint in (6) will effectively eliminate long vowels within a syllable as well as such GV sequences as /yi/ and /wu/, which are not attested in Paamese. *OCP(Seg)* is assumed to be undominated in Paamese. Now consider the evaluation in (7).

(7) The evaluation tableau of /manekólii/ 'darkness'

/manekolii/	*Undom*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x)(x .)(x .) ma.ne.ko. li.i	**FtBin !*	*	******	
b) (x) (x .) (x .) ma.ne.ko.li.i		*!	***	*
c) (x) (x .)(x .) ma.ne.ko.li.i			**!**	*
d) (x) (x .) ma.ne.ko.lii	**OCP(Seg)!*		*	**
☺e) (x) (x .) ma.ne.ko.li. i			*	***

(7d) is eliminated due to the undominated constraint, *OCP(Seg)*. Likewise (7a) violates the undominated constraint, *FtBin*. (7b) cannot be saved because it violates the next higher ranked constraint *NonFin*. The winning candidate is (7e), since (7c) fares worse on *All-Ft-R* in comparison to (7e).

As such, the constraint interaction can explain the Paamese stress pattern successfully. Stress usually goes to the antepenultimate syllable of the word because *NonFin* plays a crucial role in explaining why the word-final syllable is unfooted. *FtBin*, however, does compel a violation of *NonFin* in disyllabic words since a degenerate foot is not tolerated in Paamese. Moreover, the constraint ranking *All-Ft-R* >> *parse-σ* accounts for the lack of secondary stress without need to refer to the sympathetic stress proposal of de Lacy (1999) or to stress conflation as in Hayes (1995).

2.2 Unstressable Vowels

Now let us consider the data where a weak vowel (i.e. unstressable vowel) might surface in head foot position. The data given in (8) observe that stress shifts leftward to the next stressable vowel to avoid stressing the underlying weak vowels.

(8)	tárĭpenge	'lazy'
	ná+tăhosi	'I am good'
	tăhósi	'he is good'

In order to account for the lack of stress on weak vowels in Paamese, we refer to the constraint, *ə́, which militates against weak vowels standing in foot head position. (9) shows the added constraint.

(9) *ə́ (No stressed schwa): (Y. Lee (1999:44) and Féry (1999:117))

Avoid a stressed weak vowel.

The constraint *ə́ in (9) is undominated because it is observed by all surface forms. Let us consider the tableau (10).

(10) The evaluation tableau of /ná+tə̆hosi/ 'I am good'

/na+tə̆hosi/	*Undom*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x .)(x .) na.tə̆.ho.si		*!	**	
☺ b) (x) (x .) na.tə̆. ho.si			**	**
c) (x) (x .) na.tə̆.ho.si		*!		**
d) (x) (x .) na.tə̆.ho.si	*ə́!		*	**
e) (x) (x .)(x .) na.tə̆.ho.si		*!	**	

(10d) fatally violates the undominated constraint *ə́ Note that a weak vowel occurs in the strong position of a foot in (10d). (10a), (10c) and (10e) are also disregarded since they violate the next highly ranked constraint, *NonFin*. Therefore (10b) is the winning candidate.

Tableau (11) illustrates the similar evaluation under the present constraint ranking.

(11) The evaluation tableau of /tə̆hosi/ 'he is good'

/tə̆hosi/	*Undom*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x .) tə̆.ho.si	*ə́ !		*	*
☺b) (x) (x .) tə̆.ho.si		*		*
c) (x) (x) tə̆.ho.si	*FtBin !		*	**

(11a) and (11c) are automatically disregarded because they have fatal violations of the undominated constraints, *ə́ and *FtBin*, respectively. Therefore (11b) is chosen as the winning candidate. In the tableaux shown in (10) and (11), *ə́ punishes a weak vowel standing in the strong position of a foot. To avoid that in (11), the dominated constraint *NonFin* is sacrificed in the optimal form. The proposal of *ə́, therefore, can explain two deviant stress patterns, pre-antepenultimate stress and the penultimate stress since the deviation is caused by the presence of an unstressable vowel.

Parallel OT, as such, can successfully deal with the Paamese stress pattern without Crowley's (1982:28) basic stress rule and the complicated stress shift rule that he proposes for the case where an unstressable vowel occurs in the strong position of a foot.

3. Stress in Words with Glide Formation

Constraint interaction may give rise to glide formation to avoid certain vowel sequences so as not to have onsetless syllables. This section deals with stress shift phenomena resulting from on-glide and off-glide formation through constraint interaction.

3.1 On-glide

Even though Crowley (1982:30,34) posits separate rules of on-glide and off-glide formation to account for stress shift, here glide formation is viewed as the result of the constraint interaction.[5] The data showing on-glide formation are given in (12).

(12)	vuási	[vwási]	'pig'
	uáni	[wáni]	'cross-cousin'
	uíite	[wíite]	'octopus'
	vuéli	[vwéli]	'it is not visible'
	úpuase	[úpwase]	'breadfruit type'
	úriovu	[úryovu]	'end wall of house'
	i+áli	[yáli]	'they will walk'
	i+óle	[yóle]	'they will chase'
	lu+áli	[lwáli]	'you two walk'

[5] Given Crowley's rule system, several derivational processes are required to obtain the final landing site of stress as below:

/vuasi/	→	vúasi	→	vuási	→	vwási	→	[vwási]
	stress rule		stress shift rule		glide formation rule			

Glide formation is assumed to be a strategy to reduce the number of syllables to avoid onsetless syllables. This involves the following additional constraints shown in (13).

(13) Additional constraints

a) *Onset*[6]

Syllable must have onsets.

b) *Max-μ*

Input moras must surface in the output.

Onset in (13a) requires that every syllables start with a consonant. Glide formation is a way of observing the highly ranked *Onset* constraint though it sometimes results in mora deletion. Therefore, *Max-μ* in (13b) is crucially dominated by *Onset* to ban the syllable starting with a vowel. Given the constraint argument, (14) schematizes the revised constraint ranking thus far.

(14) Revised constraint ranking

*SyllTroc, FtBin, *ə′*
|
Onset
| \
Max-μ *NonFin*
|
All-Ft-R
|
Parse-σ

[6] As discussed in footnote 4, there is no insertion or deletion to satisfy *Onset* because *Max and Dep* are undominated in Paamese.

Let us take a look at the tableau (15) based on (14).

(15) The evaluation tableau of /uíite/ 'octopus'

/u i i te/ $\mu\,\mu\,\mu\,\mu$	*Undom*	*Onset*	*Max-μ*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x .) u.ii.te	**OCP(Seg)!*	**			*	*
b) (x) (x .) uy.i.te		**!	*		*	*
c) (x) (x .) u.yi.te	**OCP(Seg)!*	*	*		*	*
☺d) (x) (x .) wi.i.te		*	*		*	*
e) (x) (x .) u. i. i. te		**!*			**	**

Here we see that *OCP (Seg)* eliminates both a long vowel as well as the *yi* sequence within a syllable at the same time. Therefore (15a) and (15c) are ruled out. Among other candidates, (15d) is the one that fares better with respect to *Onset*, since the other two have one or two additional violations of *Onset*.

Tableau (16) shows another example illustrating on-glide formation.

(16) The evaluation tableau of /úriovu/ 'end wall of house'

/uriovu/ μ μ μ μ	*Undom*	*Onset*	*Max-μ*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x .)(x .) u.ri.o.vu		**!		*	**	
☺b) (x) (x .) u.ryo.vu		*	*		*	*
c) (x) (x .) u.ryo.vu		*	*	*!		*

(16a) is already ruled out because of an additional *Onset* violation in comparison with the winning candidate (16b). The crucial ranking *NonFin* >> *All-Ft-R* renders (16c) suboptimal.

As shown in tableau (15) and (16), a high vowel before another vowel becomes a glide to avoid the violation of *Onset*. There is no stress shift which Crowley's derivational account proposed. The effects of stress shift are directly captured in the OT analysis from the constraint interaction of *Onset* >> *Max-μ*. Here note that we do not need Crowley's (1982:30) stress shift rules resulting from glide formation.

3.2 Off-glide

The constraint ranking of *Onset* >> *Max-μ* can also deal with off-glide formation.

(17) displays the data showing off-glide formation[7].

(17)	mésai	[mésay]	'he is sick'
	hóai	[hóay]	'tree type'
	kó+va+sau	[kóvasaw]	'you will sing'
	voté+i+tasi	[votéytasi]	'seabed'
	tahúi=neke	[tahúyneke]	'that tahui banana'
	távoi	[távoy]	'naval tree'
	mátou	[mátow]	'dry coconut'

Now let us consider the tableau (18) given the interaction of *Onset* >> *Max-μ*.

(18) Parallel evaluation of /mésai/ 'he is sick

/mesai/	*Undom*	*Onset*	*Max-μ*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x .) me.sa. i		*!			*	*
b) (x) (x .) me.sa.i		*!		*		*
☺ c) (x) (x .) me.say			(*)	*		

(18c) is chosen as optimal because it does not violate *Onset* which other candidates violate. More specifically, tableau (18) shows the crucial ranking of *Onset* over *NonFin*. If *NonFin* is higher than *Onset*, (18a) may wrongly be chosen as the

[7] Paamese shows the vowel sequence such as /ao/ or /iu/ over a morpheme boundary. /ao/ becomes heterosyllabic while in the /iu/ sequence, the front vowel assimilates to the backness of the following back vowel as in /i+umo/ 'they will work' → [uumo] → [ūmo]. This seems to show

optimal form. Note that off-glide formation may or may not violate *Max-μ*. Either evaluation does not affect the result.

Tableau (19) provides the similar explanation.

(19) Parallel evaluation of /kó+va+sau/ 'you will sing'

/ko+va+sau/	*Undom*	*Onset*	*Max-μ*	*NonFin*	*All-Ft-R*	*Parse-σ*
a) (x) (x .)(x .) ko.va.sa.u		*!		*	**	
☺b) (x) (x .) ko.va.saw			(*)		*	*
c) (x) (x .) ko.va.saw			(*)	*!		*
d) (x) (x .) ko.va.sa.u		*!			*	**

(19a) and (19d) fail because they violate high ranking constraint *Onset*. (19c) gives way to (19b) because (19c) violates *NonFin* which the optimal form (19b) respects.

A high vowel after a non-high vowel is turned into a glide due to the constraint *Onset*. Off-glide formation may also be accounted for under the same constraint ranking of *Onset* >> *Max-μ*, though this time *Max-μ* may not be crucially relevant.

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that only the high vowels are realized as a glide if it is not identical to the adjacent vowel.

4. Hayes' (1995) Moraic Trochee Analysis

Hayes (1995:178) analyzes the Paamese stress pattern within the moraic trochee system as in (20). For his analysis, he posits lexical exceptions to syllable extrametricality and foot extrametricality as well.

(20) The analysis

a) Syllable extrametricality: $\sigma \rightarrow \langle\sigma\rangle$ / ____] $_{word}$

b) Foot construction: Form moraic trochees from right to left.

(Degenerate feet are forbidden absolutely.)

c) Foot extrametricality: $F \rightarrow \langle F\rangle$ / ____] $_{word}$

d) Word Layer Construction: End rule right

Given his analysis, we cannot always determine the application of syllable or foot extrametricality. This is seen in the comparison of (21a) with (21c), each of which has the same number of syllables.

(21) Hayes' s (1995:179) exemplary representation (slightly revised)

a)	b)	c)	d)
(x)	(x)	(x)	(x)
(x .)	(x .)	(x .)<(x .)>	(x .)<(x .)>
vi só ko <no>	tăhósi	ná-tă hosi	mátu- va a

Syllable extrametricality in (20a) is applied to (21a) to make the rightmost syllable not peripheral thus stress falls on antepenultimate syllable. However Hayes states that syllable extrametricality does not apply to exceptional stems like /tahosi/ in (21b). On the other hand, foot extrameticality is applied to (21c) and (21d) because they are lexically exceptional to syllable extramericality. Thus we see that there is a degree of unpredictability in Hayes's application of syllable and foot extrametricality.

Hayes's moraic trochee system suffers from at least two theoretical problems. First, as just discussed, there is no way to encode the exceptionality in a consistent way. Some words are exceptional to syllable or foot extrametricality, but we cannot tell which is which. Second, Hayes's moraic trochee analysis wrongly predicts that the words with off-glide formation such as [mesay] and [hoay] have stress on the final syllable. Let us look at the output representation of the data illustrating off-glide formation.

(22) Exemplified representation: (syllabic trochee (a &b) vs. moraic trochee (c & d))

	a)	b)	c)	d)
	(x)	(x)	* (x)	* (x)
	(x .)	(x .)	(x)	(x)
Syll:	me.say	ho.ay	me.say	ho.ay
UR:	/mesai/	/hoai/	/mesai/	/hoai/

In (22a) and (22b), we see the actual metrification, while in (22c) and (22d), we see the metrication of Hayes (1995). The metrification shown in (22) thus provides evidence that Paamese has a syllabic trochee rather than a moraic trochee since these words have stress on the initial syllable. Were it a moraic trochee, (22c) and (22d) would have stress falling on the final syllable because the final syllable is a heavy syllable. Thus the syllable trochee analysis that I offer here is less problematic than the moraic trochee analysis. Further, the present analysis does not necessitate the use of lexical exceptions or complicated stress shift rules.

5. Conclusion

This paper has examined the Paamese stress pattern from an OT perspective. This paper maintains that there is no motivation for the moraic trochee analysis (contra Hayes (1995)). Constraints and their interaction explain the stress facts of Paamese. *Trochee* licenses the left-headed foot. *ə́ punishes a weak vowel on the syllable head. Though an unstressable vowel occurs on the strong position of a foot, stress shifts to the next possible landing site occurs because of the command of *ə́. Since Paamese does not allow a degenerate foot, *FtBin* requires every foot to be binary. *NonFin* can account for final-syllable extrametricality leading to the lack of stress on the final syllable. *NonFin,* however, is sacrificed by *FtBin* which militates against a less optimal foot form in the case of disyllabic words or trisyllabic words with initial weak vowels.

More interestingly, the lack of the secondary stress is straightforwardly captured by the ranking *All-Ft-R* over *Parse-σ*. There is no need to adopt sympathy theory or stress conflation. Stress shift phenomena resulting from glide formation can be explained by the constraint ranking *Onset* >> *Max-μ*. To avoid *Onset* violation, glide formation may arise even if it involves the *Max-μ* violation. As such, the Paamese stress pattern may be well captured via constraints and their ranking within the parallel OT framework.

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