NONUNIFORMITY OF CODA WEIGHT IN KUUKU-YAʔU*

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This paper discusses a language with nonuniformity of coda weight. In Kuuku-Yaʔu (Pama-Nyungan), the weight of CVC syllables is non-transparent. Closed syllables are generally light, as they fail to attract quantity-sensitive primary stress, which falls on the rightmost long vowel in the word (else on the initial syllable). However, CVC syllables are contextually heavy in initial position, as evidenced by a process of gemination that closes a light, open syllable bearing default primary stress in order to satisfy a constraint requiring stressed syllables to be heavy. Analyzing this pattern within traditional Moraic Theory (Hayes 1989), in which CVC is considered either uniformly heavy or light, creates a rule ordering paradox and generates opaque forms that are non-surface-true. It is shown that the context-dependency of coda weight in this language can be accounted for within Optimality Theory through simultaneous comparison of monomoraic and bimoraic parses of closed syllables for constraint evaluation.

1. Introduction

Coda consonants can vary crosslinguistically in terms of how they contribute weight for stress purposes. On the one hand, CVC syllables can pattern with CVV as heavy in contrast to light CV. The Latin stress rule makes this distinction (Allen 1973). In Latin, stress falls on the penultimate syllable if it is heavy, else the antepenultimate syllable. Syllables containing long vowels or a coda consonant count as heavy ([a.míː.kus] 'friend', [or.na.mén.tum] 'equipment'), while open syllables with short vowels count as light ([sí.mu.laː] 'simulate (2sg.impf)'). In other languages, however, closed syllables pattern with CV as light in contrast to heavy CVV. For instance, in Khalkha Mongolian (Walker 1997), stress falls on the rightmost nonfinal heavy syllable, else on the initial. Only syllables containing long vowels and diphthongs are considered to be heavy for the purposes of stress assignment ([dalaegáːraː] 'by one's own sea'). CVC syllables pattern as light with CV syllables and are passed over for stress in favor of heavy syllables with long vowels, even if they occur closer to the right edge of the word ([baegúːlagdax] 'to be organized'). These two main typological distinctions of coda weight are summarized in (1).

(1) Typological patterns of coda weight[1]

Language	Light σ	Heavy σ
Khalkha Mongolian	CV, **CVC**	CVV
Latin	CV	CVV, **CVC**

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[1] Another language that patterns like Khalkha Mongolian with respect to coda weight is Huasteco. Languages that pattern like Latin include Classical Arabic, Cayapa, Yana, and English.

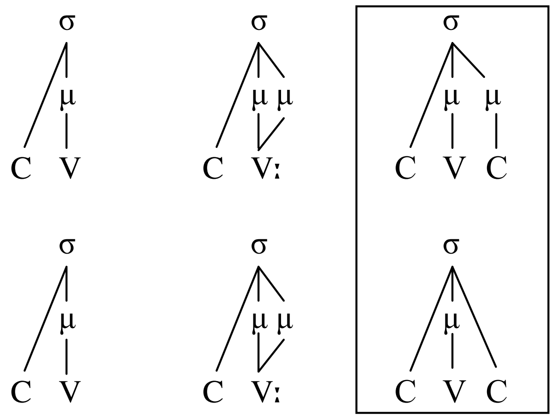
IUWPL6: Phonological Opacity Effects in Optimality Theory (2008), ed. by
Ashley W. Farris-Trimble and Daniel A. Dinnsen, pp. 55-70. Bloomington, IN: IULC Publications.

This distinction between heavy and light syllables is captured within Moraic Theory (Hayes 1989; Hyman 1985; McCarthy and Prince 1986/1996) in terms of the moraic content of the syllable. CVV syllables are heavy due to their bimoraicity. In languages like Latin, where CVC patterns with CVV as heavy, the coda consonant is assumed to be moraic and contributes, along with the vowel, to the overall bimoraic weight of the syllable. When CVC patterns as light, as in Khalkha Mongolian, the syllable is monomoraic with no mora associated with the coda consonant.

(2) Moraic representations of syllable types

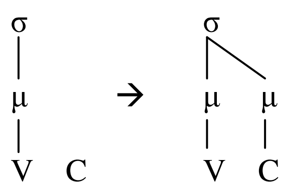
a. Latin (Allen 1973)

b. Khalkha Mongolian (Walker 1997)



While long vowels are underlyingly bimoraic, the moraic status of coda consonants is language-specific and is assigned via a rule of Weight-by-Position (Hayes 1989).

(3) Weight-by-Position (Hayes 1989)



Within derivational theory, this rule is essentially parametric: if the rule applies in a language, all coda consonants will be moraic, causing CVC syllables to uniformly be heavy. If the rule fails to apply, codas are nonmoraic and CVC syllables will uniformly be light. However, in some languages, the weight of coda consonants is not uniform. In such cases, it seems that the rule of Weight-by-Position applies selectively within and across words, either over- or underapplying depending upon context.

In this paper, I discuss a language in which the weight of CVC syllables is nonuniform. In Kuuku-Yaʔu (Thompson 1976, 1988), coda weight varies according to the position of the syllable within the word as well as to the type of stress the syllable bears. That is, closed syllables in this language cannot be analyzed as uniformly heavy or light. While this type of variation (referred to as 'Weight-by-Position by Position' by Rosenthall and van der Hulst 1999) is problematic for a derivational theory of phonology that has parametric application of the Weight-by-Position rule, it is shown to be readily accounted for within canonical Optimality

Theory through the parallel comparison of monomoraic and bimoraic parses of closed syllables for constraint evaluation.

This paper is organized as follows. In section 2, I present data from Kuuku-Yaʔu, including the basic phonological facts of the language, as well the unique stress pattern and its dependence on syllable weight. An OT analysis is presented that accounts for the location of stress as well as for its quantity sensitivity. Section 3 introduces additional data sets that seem to support analyses of closed syllables as both light and heavy. This nonuniformity of coda weight is shown to be accountable within OT through simultaneous evaluation of competing parses of candidates with both moraic and nonmoraic codas. Section 4 concludes the paper.

2. Kuuku-Yaʔu

2.1 Background

Kuuku-Yaʔu (Thompson 1979, 1988) is a Pama-Nyungan language spoken in Cape York, Australia. The phonemic inventory consists of 15 consonants, including voiceless stops and nasals across five places of articulation, and 6 vowels.

(4) Kuuku-Yaʔu phonemic inventory

a. Consonants

	Bilabial	Dental	Alveolar	Palatal	Velar	Glottal
Stop	p	t̪	t	c	k	ʔ
Nasal	m	n̪	n	ɲ	ŋ	
Lateral			l			
Trill			r			
Glide	w			j		

b. Vowels

	Front	Central	Back
High	i, iː		u, uː
Low		a, aː	

It is important to note that there is a phonemic length contrast for vowels but not for consonants. Phonotactically, long vowels cannot occur word finally, though they can occur in the final syllable if it is closed by a coda consonant.[2] The only consonants that are allowed in word-final position are [n], [l] and [j].

2.2 Stress

The stress pattern of Kuuku-Yaʔu is described by Thompson (1976, 1988) and is analyzed within a derivational framework by Hayes (1995) and within an OT framework by Baković (2004), McGarrity (2003), and Walker (1997). Stress assignment in this language is promi-

[2] There is one exception to this constraint: [ŋiː]/[ɲiː] ‘yes’.

nence-driven, based on syllable weight. As shown in (5) below, primary stress falls on the only long vowel in the word or on the rightmost if there is more than one (5a); if there is no long vowel, primary stress falls on the initial syllable (5b). Syllables containing long vowels are considered to be heavy for the purposes of stress assignment, as they are underlyingly bimoraic. According to Thompson, closed syllables and syllables containing short vowels are light and do not attract stress.

(5) Kuuku-Yaʔu primary stress pattern

a. Primary stress falls on the rightmost underlying long vowel[3]

[páːla]	'behind'	[mùːmáːɲa]	'rub'
[wíːmumu]	'large number of ants'	[pùːtáːwu]	'red bream'
[ʔìlpíːna]	'return'	[pàːtáːna]	'daylight'
[kùláːn]	'possum'		
[tàwuráːlu]	'with a knife'		

b. In words with no long vowels, primary stress falls on the initial syllable

[cílpu]	'old man'	[kúnpantin]	'flog'
[kúlkul]	'skin/bark'	[púɟŋat̪iɲa]	'shut'

Note in the forms in (5) that closed syllables do not appear to be heavy for the purposes of stress assignment as they do not attract stress at the right edge of the word. I will return to this issue in section 3.

Data illustrating the secondary stress pattern are given in (6). According to Thompson (1976:217), secondary stresses fall on all remaining long vowels not bearing primary stress (6a), as well as on the initial syllable (6b).[4]

(6) Secondary stress pattern

a.	[mùːmáːɲa]	'rub'	b.	[ʔìlpíːna]	'return'
	[pùːtáːwu]	'red bream'		[tàwuráːlu]	'with a knife'
	[pàːtáːna]	'daylight'		[ùntàːkúːpi]	'archer fish' (T 1988)

This type of pattern is often referred to as a 'default-to-opposite-side' stress pattern. When there are heavy syllables in the word, stress falls towards the right edge of the word (i.e., on the rightmost heavy syllable). When there are no heavy syllables in the word, default stress falls towards the opposite edge (i.e., on the initial syllable).[5]

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[3] All of the Kuuku-Yaʔu data presented here are from Thompson (1979) with the exception of a few forms taken from Thompson (1988) that are marked accordingly.

[4] Thompson (1976:217) also describes a posttonic secondary stress on the syllable immediately following the initial primary stress in words with no long vowels. Hayes (1995:296) questions the status of these syllables as being metrically strong and instead attributes the perceived stress to a pitch effect. I therefore do not mark these stresses, though their stressed/unstressed status does not affect the analysis presented here.

[5] See, however, Gordon (2000) who questions the existence of default-to-opposite-side stress systems, proposing instead that they should be analyzed as systems of intonational prominence rather than stress.

2.2.1 OT analysis of the location of primary stress

Within Optimality Theory (McCarthy and Prince 1993, 1995; Prince and Smolensky 1993/2004), this type of default-to-opposite-side stress pattern can be accounted for by constraints proposed by Zoll (1997). She proposes that patterns of conflicting directionality arise from the opposition between the preferred edge of association for a prosodic unit and the need for marked prosodic structure to be licensed by a strong position. In Kuuku-Yaʔu, the rightmost heavy syllable (containing a long vowel) receives the stress; otherwise the initial syllable is stressed. The constraint responsible for ensuring that primary stress falls as close to the right edge as possible in words containing long vowels is the head-peak alignment constraint given in (7).

(7) Head Peak-alignment constraint

ALIGN-R($\acute{\sigma}$, PrWd): Primary stressed syllables should be word final.

This constraint (abbreviated ALIGN-$\acute{\sigma}$-R) demands that primary stress be final in the word. It is violated gradiently, assessing one violation mark for each syllable separating the primary stress from the end of the word.

ALIGN-$\acute{\sigma}$-R stands in opposition to a licensing constraint aligning light stressed syllables at the left edge of the word.

(8) Licensing constraint

ALIGN-L($\acute{\sigma}_{\mu}$, PrWd): Light stressed syllables should be word initial.

According to Zoll, this constraint (abbreviated ALIGN-$\acute{\sigma}_{\mu}$-L) is motivated by the fact that marked structures must be licensed by strong positions. The relevant marked structure for Kuuku-Yaʔu is a light stressed syllable. That light stressed syllables are marked is evident by the fact that so many languages stress heavy syllables or make stressed syllables heavier via processes of vowel lengthening or consonant gemination. That such syllables must be left-aligned in Kuuku-Yaʔu stems from the fact that they must be licensed by a prosodically strong position, namely, the initial syllable. This constraint is violated categorically, whenever a candidate contains a stressed light syllable that falls anywhere in the word except in the initial syllable.[6]

The ranking of these two conflicting constraints for Kuuku-Yaʔu is given in (9).

(9) Ranking: ALIGN-$\acute{\sigma}_{\mu}$-L >> ALIGN-$\acute{\sigma}$-R

In a word with one or more heavy syllables, ALIGN-$\acute{\sigma}$-R will be decisive in selecting the optimal candidate.

[6] Zoll (2004) refers to such licensing constraints that are violated categorically as COINCIDE constraints. I use the more familiar ALIGN here.

(10) Word containing heavy syllables

/paːtaːna/ 'daylight'	ALIGN-σ́$_{\mu}$-L	ALIGN-σ́-R
a. paːtaːná	*!	
b. ☞ paːtáːna		*
c. páːtaːna		**!

Candidate (a), with stress on the only light syllable, violates the licensing constraint fatally since the marked structure of a light stressed syllable is not in word-initial position. Candidate (c), with the leftmost heavy syllable stressed, violates ALIGN-σ́-R twice, since the primary stressed syllable is two syllables away from the right edge. Candidate (b) wins, since it does not violate licensing and the rightmost of the two heavy syllables is stressed, which best satisfies ALIGN-σ́-R.

The following tableau demonstrates how this ranking selects the winner in a word with no heavy syllables.

(11) Word with no heavy syllables

/kunpantin/ 'flog'	ALIGN-σ́$_{\mu}$-L	ALIGN-σ́-R
a. ☞ kúnpantin		**
b. kunpántin	*!	*
c. kunpantín	*!	

Since all syllables in the word are light, any stressed syllable that is not word-initial will violate the high-ranked licensing constraint. Thus, candidates (b) and (c) are eliminated. Candidate (a) is selected as optimal since it stresses the initial syllable, even though it fares worst with respect to ALIGN-σ́-R.

2.2.2 OT analysis of quantity sensitivity and secondary stress assignment

The alignment constraints mentioned in the previous section account for the placement of primary stress in Kuuku-Yaʔu. To account for secondary stress placement and the fact that stress assignment in this language is quantity sensitive, additional constraints are needed. Quantity sensitivity results from satisfaction of the WEIGHT-TO-STRESS PRINCIPLE (Prince 1990).

(12) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy syllables must be stressed.

This constraint requires that all bimoraic syllables must receive a stress. As all long vowels are assigned some kind of stress in this language, WSP must be undominated. It is ranked above an antagonistic constraint *GRIDSTRUC (Prince and Smolensky 1993/2004), which penalizes multiple stresses.

(13) *GRIDSTRUC: Do not have grid marks (i.e., stresses).

This constraint is part of the *STRUC family and is used by Walker (1997) to distinguish between those prominence-based stress systems that do have secondary stresses, such as Khalkha Mongolian and Kuuku-Yaʔu, and those that do not. A candidate incurs a violation of this constraint for each stress it contains. *GRIDSTRUC is only perfectly satisfied if a word has no stresses; therefore, it must be dominated by LX≈PR (Prince and Smolensky 1993/2004), which requires that every lexical word be a prosodic word and have at least one stress. I assume this constraint is undominated and leave it out of the tableaux for space considerations.

Finally, recall that a secondary stress falls on the initial syllable in words with non-initial primary stress (shown above in (6)). This can be accounted for by a high-ranking alignment constraint demanding that every word have some stress aligned with the left edge.

(14) ALIGN-L(PrWd, σ́): The left edge of every prosodic word must be aligned with some stress peak.

This constraint (abbreviated ALIGN-PrWd-L) reflects the more general crosslinguistic tendency for stress to demarcate word edges (Kager 1999). Like WSP, it must outrank *GRIDSTRUC to ensure that a secondary stress will appear on an initial syllable in a word with non-initial primary stress.

A tableau demonstrating how these constraints account for the pattern of secondary stresses on any long vowels not bearing primary stress, as well as on the initial syllable, is given in (15).

(15) Secondary stress pattern: ALIGN-PrWd-L, WSP >> *GRIDSTRUC

/untaːkuːpi/ ‘archer fish’	ALIGN-PrWd-L	WSP	*GRIDSTRUC
a. untaːkúːpi	*!	*	*
b. untàːkúːpi	*!		**
c. ùntaːkúːpi		*!	**
d. ☞ ùntàːkúːpi			***

Candidate (a) fails to assign any secondary stresses. As a result, while it best satisfies *GRIDSTRUC, it does so at the expense of violating undominated ALIGN-PrWd-L and WSP. Candidate (b) places a secondary stress on the heavy syllable, but not the initial syllable, while candidate (c) does the reverse. As such, both are eliminated by the undominated constraints. Candidate (d) wins by satisfying the quantity sensitive nature of secondary stress in this language as well as the demand for initial prominence.

3. The moraic status of closed syllables in Kuuku-Yaʔu

3.1 CVC as light

In the previous section, the quantity sensitive nature of stress assignment in Kuuku-Yaʔu was illustrated by words containing long vowels. Only syllables with long vowels attract stress away from the default initial syllable. This was accounted for by a constraint demanding that heavy, bimoraic syllables be stressed (WSP). According to Thompson (1979), closed syllables do not attract stress and thus behave, along with open syllables containing short vowels, as light. The following data bear this out.

(16) CVC syllables behave as light

a. Fail to attract stress away from a long vowel

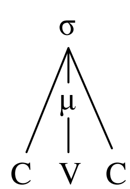
[ká:waj]	'south'
[wí:nipinta]	'policeman'
[pìtalpitá:ɲcimaŋka]	'always understanding'

b. Fail to attract stress away from default initial stress

[kúlkul]	'skin/bark'
[kúnpantin]	'flog'
[límʔintaka]	'hawk'
[táŋkaltaŋaŋka]	'continues aching'

Given that the rightmost heavy syllable receives primary stress in this language, it might be expected that a closed syllable to the right of a long vowel would receive primary stress, if it is assumed that CVC is bimoraic. However, as seen in (16a), this is not the case in Kuuku-Yaʔu: the sole long vowel in the word receives primary stress even though there is a closed syllable closer to the right edge. This means that CVC behaves as a light syllable; coda consonants must not be moraic. The data in (16b) likewise show that closed syllables near the right edge of the word do not attract stress away from the default initial syllable in words with no long vowels. Thus, they behave like CV syllables as light. The moraic representation of closed syllables as they must be for this dataset is given below (repeated from (2)).

(17) CVC syllables pattern with CV as light, monomoraic



Within derivational theory, this would mean that the rule of Weight-by-Position does not apply in this language. However, an OT analysis of the data presented here must account for this fact without reference to rules. The moraic status of coda consonants instead results from the interaction of two constraints: one requiring codas to be moraic and an antagonistic constraint that prohibits moraic codas. These constraints and their ranking for Kuuku-Yaʔu are given in (18).

(18) Constraints and ranking for nonmoraic codas

a. WEIGHT-BY-POSITION (WBP): Coda consonants must be moraic.
b. *μ/CONS : Moraic coda consonants are banned.
c. *Ranking*: *μ/CONS >> WBP

The first constraint demands that coda consonants must be moraic, and is simply Hayes' (1989) Weight-by-Position rule formulated as an OT constraint. Because codas are nonmoraic in this language, this constraint must be dominated by *μ/CONS which prohibits moraic coda consonants. The tableau in (19) demonstrates this ranking for Kuuku-Yaʔu.

(19) CVC fails to attract stress away from default initial syllable

/kunpantin/ 'flog'	*μ/CONS	WBP
a. ☞ kún.pan.tin		***
b. kún_{μ}.pan.tin	*!	**
c. kún_{μ}.pan_{μ}.tin_{μ}	*!**	

In a word with all closed syllables, the stress defaults to the initial syllable. If any one of the syllables is analyzed as having a moraic coda (indicated by a subscript μ), as in candidates (b) and (c), it will result in a fatal violation of high-ranking *μ/CONS. Candidate (a) violates WBP three times by virtue of having three monomoraic closed syllables, but emerges as the winner due to the fact that it perfectly satisfies *μ/CONS.

The following tableau demonstrates the same principle in a word with a long vowel and a closed syllable to its right.

(20) CVC fails to attract stress away from a long vowel

/kaːwaj/ 'south'	WSP	*μ/CONS	WBP
a. ☞ káː.waj			*
b. kàː.wáj_{μ}		*!	
c. kaː.wáj_{μ}	*!	*	
d. kaː.wáj	*!		*

Candidates (c) and (d), which each stress the closed syllable, are eliminated by undominated WSP since they fail to stress the heavy long vowel. Candidate (b), with secondary stress on the long vowel, satisfies WSP but violates *μ/CONS due to the evaluation of the closed syllable as bimoraic. This leaves candidate (a) as the winner with primary stress on the long vowel and an unstressed light closed syllable.[7]

While the data presented in this section seem to support the nonmoraic status of coda consonants in this language, other data seem to support an analysis of closed syllables as bimoraic. This is addressed in the following section.

3.2 CVC as heavy: Posttonic gemination

In many languages, the relationship between heavy syllables and stress is bidirectional. That is, while heavy syllables often attract stress, it is often the case that the assignment of stress to a

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[7] I left out of the tableau another candidate like (d) but with secondary stress on the initial syllable (*[kàːwáj]). It would appear to tie with the winner, but would be eliminated by the ranking ALIGN-$\acute{\sigma}_{\mu}$-L >> ALIGN-σ́-R presented in section 2.2.1.

syllable will cause it to be heavy, through processes like vowel lengthening or consonant gemination. This is the case in Kuuku-Yaʔu; light, open syllables bearing default initial primary stress are made heavy through a process of consonant gemination, whereby the onset of the second syllable geminates. According to Thompson (1988:6), "the first part of the length serves as an ending of the first syllable, and the second part of the length serves as the onset of the second syllable." Consider the data in (21) below.

(21) Consonant gemination following light, open syllables bearing default primary stress

a.	/pama/	→	[pám.ma]	'Aboriginal person'
b.	/waliʔi/	→	[wál.li.ʔi]	'spotted lizard'
c.	/kacinpinta/	→	[kác.cin.pin.ta]	'female'
d.	/maʔupimana/	→	[máʔ.ʔu.pi.ma.na]	'build/make'
e.	/jital/	→	[jít.tal]	'small stick'
f.	/lawalawa/	→	[láw.wa.la.wa]	'boastful'
g.	/mukana/	→	[múk.ka.na]	'big'
h.	/mukamukana/	→	[múk.ka.mu.ka.na]	'very big' (T 1988)

Underlyingly, each of these words contains all light syllables with no long vowels. As a result, they receive default initial stress. Phonetically, however, these words are pronounced with a long consonant following the stressed vowel. That the geminates are derived from underlying singletons is evident from the alternations found between certain roots and their related reduplicated forms, as in (21g) and (21h).[8]

I argue that the process of gemination occurs to satisfy a constraint requiring primary stressed syllables to be heavy.

(22) PRIMARY-STRESS-TO-WEIGHT (S1-to-W): Primary stressed syllables must be heavy.

This constraint is a more specific version of Prince's (1990) Stress-to-Weight Principle, which requires that all stressed syllables must be heavy or bimoraic. That this constraint must refer specifically to primary-stressed syllables to the exclusion of secondary-stressed syllables is evident in the following data.

(23) No gemination following initial secondary-stressed syllable

[tà.wu.ráː.lu]	'with a knife' (cf. *[tàw.wu.ráː.lu])
[kù.láːn]	'possum'
[wà.t̪áː.ya]	'permit'
[mì.jáː.ŋi.na]	'show himself'

In each of these words, primary stress falls on the sole long vowel and secondary stress is assigned to the initial syllable. However, unlike the data in (21), gemination does not occur

[8] Alternations do not exist for all forms as the derivational and inflectional morphology of Kuuku-Yaʔu is exclusively suffixing. Only reduplication of nouns and adjectives yields alternating forms.

following the initial stressed syllable, even though it is light and open. The difference is that in the data in (23), the initial syllable bears secondary stress.

The fact that consonants lengthen to close an initial primary-stressed syllable in order to satisfy S1-to-W implies that in such instances, these coda consonants must be moraic. This is further supported by the fact that gemination is blocked when the initial primary-stressed syllable is already heavy.

(24) No gemination following initial heavy syllable bearing primary stress

a.	[páː.la]	'behind' (cf. *[páːl.la])	b.	[cíl.pu]	'old man'
	[káː.waj]	'south'		[kúl.kul]	'skin/bark'
	[kúː.ca.ɲa]	'look'		[kún.pan.tin]	'flog'
	[níː.na.na]	'sit'		[púj.ŋa.t̪i.ɲa]	'shut'

As shown here, gemination does not occur following an initial primary-stressed syllable if it contains a long vowel (24a). Since long vowels are underlyingly bimoraic, a stressed long vowel bearing primary stress will vacuously satisfy S1-to-W; geminating the following consonant serves no purpose. In fact, it would create a trimoraic syllable, which is cross-linguistically more marked and, thus, dispreferred. Notably, however, gemination also fails to occur following an initial primary-stressed syllable that contains an underlying coda consonant (24b). While this could be due to a phonotactic constraint against geminate + consonant sequences, it is also consistent with the dispreference for trimoraic syllables if it is assumed that the coda consonants in this position are moraic.[9]

In sum, there are two conditions that must hold for gemination to occur: the preceding syllable must bear primary stress (and not secondary stress) and it must be light. Gemination is motivated by the demand for primary-stressed syllables to be heavy. This means that CVC syllables behave in this context as if they are bimoraic. This is in contrast to the discussion in 3.1 above, which found that CVC syllables in Kuuku-Yaʔu pattern with CV syllables as light since they fail to attract quantity-sensitive stress.

Taken together, the data presented in these two sections demonstrate that coda weight cannot be analyzed uniformly in this language. If CVC is considered heavy, then a word like [wíː.ni.pin.ta] 'policeman' is non-surface-true. In derivational terms, stress assignment would have to precede the application of Weight-by-Position to ensure that the primary stress falls on the long vowel and not on the closed syllable to its right. However, this yields an opaque form in which the rightmost heavy syllable does not receive the stress. If CVC is considered light, a word like [kúl.kul] 'skin' is also non-surface-true; it appears that the Weight-to-Stress Principle (requiring primary stressed syllables to be heavy) has underapplied, as the initial syllable is not overtly lengthened.

In the following section, I show that the apparent contradiction of CVC syllables being simultaneously light and heavy can be reconciled within Optimality Theory through evaluation of competing monomoraic and bimoraic parses of closed syllables in parallel.

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[9] Additional evidence supporting the moraic status of coda consonants in an initial syllable bearing primary stress comes from minimal words. In Kuuku-Yaʔu, there is a bimoraic word minimum; words must be bisyllabic or monosyllabic CVV or CVC.

4. Variability and context dependency of coda weight

In the previous sections, it was shown that closed syllables in Kuuku-Yaʔu sometimes behave as if they are light, and sometimes as if they are heavy. However, it is not the case that coda weight is unpredictable. Closed syllables are generally light, failing to attract primary stress. However, in a particular context, they are predictably heavy, namely in initial position when bearing primary stress.

Rosenthall and van der Hulst (1999), henceforth RvdH, examine data from other languages with similar patterns of nonuniform coda weight. They refer to this type of context-dependent coda weight variability as 'Weight-by-Position by position'. They analyze two different typological patterns of variable coda weight, given below in (25).

(25) Weight-by-Position by Position (Rosenthall and van der Hulst 1999)[10]

a. CVC is *generally heavy* but *contextually light*: ℂ >> WBP >> *μ/CONS
b. CVC is *generally light* but *contextually heavy*: ℂ >> *μ/CONS >> WBP

Recall from the discussion in 3.1 that the moraic content of a closed syllable is determined by the interaction of two constraints: *μ/CONS, which bans moraic coda consonants, and its antagonist WEIGHT-BY-POSITION (WBP), which demands that coda consonants be moraic.[11] If a language has light closed syllables, *μ/CONS outranks WBP. If a language has heavy closed syllables, the ranking is the reverse. According to RvdH, when the weight of a closed syllable is contextually dependent, it is due to a higher-ranking metrical constraint ℂ whose satisfaction must be met in a particular context at the expense of violating the coda weight constraints. When ℂ >> WBP >> *μ/CONS, CVC syllables are generally heavy, but contextually light. When ℂ >> *μ/CONS >> WBP, CVC is generally light, but contextually heavy.

RvdH's constraint schema can be used to account for the Kuuku-Yaʔu data. The pattern of coda weight in Kuuku-Yaʔu resembles the schema in (25b): CVC is generally light for the purposes of quantity-sensitive stress assignment in that it does not attract stress, but contextually heavy to satisfy a higher ranking metrical constraint, namely, S1-to-W.

(26) Weight-by-Position by Position in Kuuku-Yaʔu: S1-to-W >> *μ/CONS >> WBP

That closed syllables are generally light in this language is evident whenever there is a long vowel in the word to receive primary stress. Undominated WSP will ensure that the long vowel will be stressed. As a result, high ranking S1-to-W will be vacuously satisfied, leaving the ranking of *μ/CONS >> WBP to select a winning candidate with a light closed syllable. Tableau (20) from section 3.1 is repeated here in (27) with S1-to-W added to the hierarchy to demonstrate RvdH's schema.

[10] cf. Gordon (2004) who argues that certain cases of coda weight variability cannot be accounted for using Rosenthall and van der Hulst's (1999) analysis. Instead, he appeals to positionally-restricted Weight-by-Position constraints that only apply in strong positions, such as the initial syllable or syllables in the root.

[11] Rosenthall and van der Hulst (1999:502) refer to this constraint as *APPEND(to-σ): 'No nonmoraic syllable appendix'. I continue to use the more conventional WEIGHT-BY-POSITION for expositional clarity.

(27) CVC is generally light

/kaːwaj/ 'south'	WSP	S1-to-W	*μ/CONS	WBP
a. ☞ káː.waj				*
b. kàː.wáj$_{\mu}$			*!	
c. kaː.wáj$_{\mu}$	*!		*	
d. kaː.wáj	*!	*		*

In a word with a long vowel and a closed syllable to its right, the long vowel will receive the primary stress. Candidates (c) and (d) are eliminated by their failure to stress the long vowel. Of the remaining two candidates, high-ranking S1-to-W is vacuously satisfied in both, as the primary stress falls on a heavy syllable. The selection of candidate (a) as the optimal form is determined by the *μ/CONS >> WBP, which causes closed syllables to be monomoraic.

High-ranking S1-to-W *is* active in selecting an optimal form with a bimoraic closed syllable in a particular context: when the initial syllable is underlyingly light and open and receives primary stress.

(28) CVC is contextually heavy[12]

/pama/ 'Aboriginal person'	S1-to-W	*μ/CONS	WBP
a. pá.ma	*!		
b. ☞ pám$_{\mu}$.ma		*	
c. pám.ma	*!		*

The segmentally faithful form in (a) is eliminated by its fatal violation of S1-to-W, since the stressed syllable is light and open. Of the remaining two candidates with gemination, candidate (b) is the winner as it satisfies the demand for a heavy stressed syllable at the expense of creating a moraic coda, in violation of *μ/CONS.

The moraic representation of closed syllable weight and its variability as a function of context is given in (29).

(29) CVC is heavy, *iff* it is in initial position and bears primary stress

[12] I assume an undominated constraint (e.g., WT-IDENT[V]) demanding faithfulness to input vowel length to rule out candidates with lengthened vowels instead of geminated consonants. The fact that this language uses gemination instead of vowel lengthening to satisfy S1-to-W may be the result of contrast preservation, since a candidate with a lengthened vowel would neutralize the phonemic vowel length distinction.

That the context for heavy closed syllables is dependent not only on syllable position (it must be initial), but also on stress type (it must bear primary stress, not secondary) is readily accounted for by the ranking presented here, as shown in the tableau in (30).

(30) No gemination following initial secondary stressed syllable

/kulaːn/ 'possum'	S1-to-W	*μ/CONS	WBP
a. ☞ kù.láːn			*
b. kùl$_{\mu}$.láːn		*!	*
c. kùl.láːn			**!

Once again, high-ranking S1-to-W is inactive; in each of these candidates, primary stress falls on the long vowel, satisfying the constraint. As this constraint is specific to main stress, it does not evaluate the syllables bearing secondary stress. Thus, the ranking of *μ/CONS >> WBP is decisive in selecting the winner. All three candidates share a violation of WBP due to the final nonmoraic consonant. Candidate (a) with no gemination is the eventual winner, as the geminated candidates in (b) and (c) are eliminated by their extra violations of *μ/CONS and WBP, respectively.

The tableaux presented in this section demonstrate that within OT, the weight of closed syllables in Kuuku-Yaʔu is determined by comparing different moraic parses of candidates with closed syllables for evaluation by the constraint hierarchy; no additional OT machinery is needed. As a result of this parallel comparison, it is sometimes the case that competing candidates are phonetically identical, differing only in their moraic structure. This type of 'Freedom of Analysis' (Prince and Smolensky 1993/2004), in which any amount of structure can be posited in an output candidate, is fundamental to the OT framework. This is particularly evident in comparing forms with an initial CVC that is present underlyingly (rather than derived via gemination), as shown in the tableaux in (31) and (32).

(31) CVC is heavy in initial primary stressed syllable

/cilpu/ 'old man'	S1-to-W	*μ/CONS	WBP
a. cíl.pu	*!		*
b. ☞ cíl$_{\mu}$.pu		*	

(32) CVC is light in initial secondary stressed syllable

/ʔilpiːna/ 'return'	S1-to-W	*μ/CONS	WBP
a. ☞ ʔìl.píː.na			*
b. ʔìl$_{\mu}$.píː.na		*!	

The same constraint hierarchy selects, for an initial syllable that is primary-stressed, the moraic parse for the coda consonant, as in (31), but for the secondary stressed initial syllable, the nonmoraic parse, as in (32). The initial syllables in these two words are nearly identical phonetically, but differ crucially in their phonological representations.

The display in (33) summarizes all of the ranking arguments presented in this analysis, as well as some relevant forms which support each of the crucial rankings. The final ranking for Kuuku-Yaʔu is given in (34).

(33) Ranking Summary

	Ranking argument	Example
a.	ALIGN-$\acute{\sigma}_{\mu}$-L >> ALIGN-σ́-R	[paː.táː.na] ≻ *[paː.taː.ná], [kún.pan.tin] ≻ *[kun.pan.tín]
b.	WSP >> *GRIDSTRUC	[mùː.máː.ɲa] ≻ *[muː.máː.ɲa]
c.	ALIGN-PrWd-L >> *GRIDSTRUC	[tà.wu.ráː.lu] ≻ *[ta.wu.ráː.lu]
d.	*GRIDSTRUC >> ALIGN-σ́-R	[kúl$_{\mu}$.kul] ≻ *[kùl.kúl$_{\mu}$]
e.	ALIGN-PrWd-L >> ALIGN-σ́-R	[kúl$_{\mu}$.kul] ≻ *[kul.kúl$_{\mu}$]
f.	*μ/CONS >> WBP	[ʔɪl.píː.na] ≻ *[ʔɪl$_{\mu}$.píː.na]
g.	S1-to-W >> *μ/CONS	[kúl$_{\mu}$.kul] ≻ *[kúl.kul]

(34) Final Ranking

ALIGN-PrWd-L, ALIGN-$\acute{\sigma}_{\mu}$-L, WSP, S1-to-W >> *GRIDSTRUC, *μ/CONS >> WBP, ALIGN-σ́-R

5. Conclusion

In this paper it was shown that coda weight in Kuuku-Yaʔu is nonuniform; it is contextually dependent upon the position of the syllable and the type of stress the syllable bears. Closed syllables are generally light with nonmoraic codas, failing to attract quantity sensitive stress. However, in the context of an initial syllable bearing primary stress, closed syllables are heavy. This nonuniformity of coda weight is problematic for derivational analyses that must parametrically apply Weight-by-Position to all coda consonants in a language. However, it was shown that an optimality theoretic analysis is able to account for such coda weight variability, following Rosenthall and van der Hulst (1999), through the parallel comparison of competing candidates with mono- vs. bimoraic representations of closed syllables for constraint evaluation.

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