Lenition and Metathesis in Hawu (now understood as a quantity sensitive language)

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Hawu (Malayo-Polynesian) shows highly unusual distributions of phonological strength and weakness (Walker 1982, Grimes 2006, Blust 2008). Firstly, Hawu appears unique in restricting schwa to stressed positions and excluding it from all prosodically weak positions. Secondly, the language has rampant intervocalic lenition of consonants, however, it is only after a schwa that consonants have been immune to lenition. These conditions have resulted in unusual V-to-Stress and V-C phonotactics, as well as setting up some interesting structural contrasts: (a) <w ~ b:> [qá**w**u] 'secret' vs. [ɗə**b:**u] 'sugarcane'. (b) <ʔ ~ k:> [ní**ʔ**i] 'fruit bat' vs. [lə**k:**u] 'fold'. (c) <r ~ d:/ɗ:> [tá**r**a] 'cockspur' vs. [kə**ɗ:**u] 'stand up'. (d) <d ~ t:> [má**d**a] 'eye' vs. [wə**t:**a] 'split'. (e) <∅ ~ p:> [ní] 'dream' vs. [ə**p:**at] 'four'.

This paper shows that these distributions can be insightfully handled in the Strict CV framework. On the surface, Hawu is near unique. It may even appear to violate a linguistic universal, however this is all due to its unusual phonetic mapping. In fact, analysed phonologically, its distribution of strength and weakness is revealed to be commonplace, highly reminiscent of Tuscan Italian. This account relies on three analytic steps. Firstly, schwa, a phonologically featureless vowel, consists of three allophones: [e] in pre-tonic position, [ə] in stressed position, and [a] in post-tonic position. It actually has no phonological positional restrictions. Secondly, Hawu is reanalysed as a quantity-sensitive language with 'metrical bolstering'. Schwa is a weak vowel and cannot satisfy the quantity requirement of a stressed position. For this reason, it triggers automatic gemination of a neighbouring consonant. Thirdly, in stressed position, full (non-schwa) vowels are phonologically heavy but this phonological weight is manifested phonetically as a non-reduced vowel quality, rather than increased duration. This phonology-to-phonetics mapping, known as 'virtual length' (Scheer 2014), is robustly attested in Semitic (Lowenstamm 1991, 2011) and Berber (Ben Si Saïd 2011) though this is its first attestation in Austronesian.

In traditional terms one can say that, despite appearances, Hawu is a quantity-sensitive language. There is a metrical requirement for each Hawu word contain a heavy syllable. Weight in Hawu comes from either: (a) *non-schwa vowel*, or (b) a *schwa + geminate consonant*. The phonological weight of full vowels is not mapped to a phonetic length contrast. Instead, the phonetic interpretation of phonological quantity is expressed by a vowel's unreduced quality.

This analysis brings with it three explanatory advantages over previous models. Firstly, it provides an explanation for the lack of (C)əV word-shapes. Secondly, it explains the strange condition on Hawu metathesis, that it must apply across a consonant: *$V_{\alpha}CV_{\beta}$ > $V_{\beta}CV_{\alpha}$ - *ika > [ək:i] 'tie/bind' vs. *VαVβ **(> VβVα) *bua > [búe] **[béu] 'fruit'. In this Strict CV account, both facts fall out of the fact that their outputs would violate the quantity restrictions imposed by the language's metrical system. Moreover, there is an important implication for phonological theory; because, under the standard analysis, Hawu's uniqueness implies that this phonological system had developed only once in human history. In fact, its uniqueness is merely the product of language specific phonetic mappings (surface effects) and the phonological system is commonplace.

1 Hawu facts and typological implications

Hawu is a Malayo-Polynesian language spoken by approximately 100,000 people on Savu and Raijua of the Lesser Sunda Islands. The closely related language, Dhao is spoken by some 5000 people on the nearby island of Ndao. Much of what is discussed in this paper is true also for Dhao, but there are significant differences and the languages are no longer mutually intelligible.

Literature discussing Hawu consists primarily of Blust (2008 and 2012), Grimes (2006) and Walker (1982) as well as some older sources whose findings are largely incorporated into Blust (2008). Blust (2008) provides a detailed diachronic account of the development of Hawu phonology. The Hawu consonant and vowel inventory is listed in (1).

(1)

Consonants					Vowels		
p	t		k	ʔ	i		u
b	d	ɟ	g		e	ə	o
ɓ	ɗ	ɗʲ	ɠ			a	
m	n	ɲ	ŋ				
				h			
	l						
	r						
w							

All syllables are open and there are no tautosyllabic consonant clusters. Hawu has many words of the shape (C)V_x.V_y, these sequences are disyllabic (Grimes 2006). Long vowels cannot be found preceding a consonant: *CVVCV(CV). If they do occur (they appear to be final: [niŋa:] 'what' and maybe ideophonic, even so, long vowels are always disyllabic (Grimes 2006). Stress falls regularly on the penultimate syllable (Walker 1982). The only vowel in the antepenultimate syllable is 'e'. The canonical word-shape is: (C)(e)(C)V(C)V (Blust 2008:7).

1.1 Vowel quality and its position in the word

The requirement that all words are composed of open syllables and that vowel-vowel sequences are disyllabic, *and* that stress is penultimate creates a regular prosodic shape to words.

Vowels can be located in three essentially uniform positions: the stressed position, the post-tonic position and (optionally) the pre-tonic position. As is shown in (2), Hawu has some strict phonotactic restrictions regarding the alignment of vowel quality and these three canonical positions.

(2) Positions of vowels

Pre-tonic		Stressed		Post-tonic	
C	V	C	V	C	V
	{e}		{i, a, u, o, e, ə}		{i, a, u, o, e}

In the pretonic position, all vowels were diachronically neutralized to schwa and subsequently shifted to 'e' (Blust 2008:70): *s**u**maŋed > h**e**maŋa 'soul/life force', *k**a**mali > k**e**mali 'men's house', *k**a**l**i**-wati (> *k**ə**l**ə**wati) > k**e**late 'earthworm' (Blust 2008:69).

Schwa is restricted to stressed positions. It is inherited from *e, which was also stressed: *b**é**qak > [ɓ**ə́**k:a] 'split', *l**é**ku > [l**ə́**k:u] 'fold' (Blust 2008:70).[1] Meanwhile, *e shifted to 'a' if it became word-final through final consonant loss: *tan**e**m > dan**a** 'bury', *dal**e**m > ɗar**a** 'in/inside', *tel**e**n > [dəl:**a**] 'to swallow' (Blust 2008:70). Additionally, the final position also gained 'e' and 'o' from monophthongisation of *aj: *b-in-ahi (> *bin**aj** > bin**e**) > [bən:i] 'woman', *beR**aj** > wi**e** 'give', and *aw: *pan**aw** > [an**o**] 'leucoderma' (Blust 2008:69). The final position also gained 'i' and 'u' through metathesis (described in section 1.3), as well as inheriting these vowels directly: *lek**u** > [lək:**u**] 'fold'.

Returning to the restrictions on schwa, there is no stressed schwa in a (C)V_xV_y word structure: **(C)ə́V (Blust 2012:7).[2] Blust (2008) attributes this to a further (more general) condition that schwa is never found in contact with another vowel (Blust 2012). In fact, this condition resembles a much earlier historical condition that occurred prior to Proto-Samba-Hawu where *e is also deleted when in contact with a vowel: *qah**e**lu (> *qa**e**lu) > [alu] 'pestle', *ma-buh**e**k (> *mabu**e**k > mabuk) > [mawo] 'drunk' (Blust 2008:70). This historical contingency eliminates a large potential source for (C)ə́V sequences. Because schwa in Hawu is inherited from *e, Hawu sequences of the shape (C)ə́V are primarily expected to develop from *(C)eV sequences, however these had already shifted to (C)V. Said that, the historical condition banning *e in contact with other Vs is not synchronically active in modern Hawu: *keli > [kei] 'dig/dig up'. While the restriction on (C)ə́V sequences is. There have been no subsequent vowel shifts to (C)ə́V, and yet there have been ample opportunities for these sequences to form, primarily from metathesis (section 1.3).

1.1.1 Typological observations

The synchronic vocalic restrictions of Hawu are summarized here.

(3) (a) Schwa can only occur in stressed positions. (corollary) Schwa is banned from prosodically weak positions.
(b) Schwa is banned from (C)ə́V sequences.
(c) Only 'e' is allowed in pretonic position.

While it is common in related languages of the region to neutralize pre-tonic vowels to a vowel other than schwa, it is not common for this to be done in languages that also have a schwa vowel.

Timugon Murut (phonologically schwaless), limits the pretonic positions to 'a' (or 'o' under vowel harmony (Kroeger 1994, Barnes 2003). This proceeded via an earlier schwa stage (Blust 2008:69, cf. Barnes 2003). Hawu is particular in having only pretonic 'e' (Blust 2008).

When it comes to the distribution of schwa Hawu is shown to go against typological preferences. Almost universally schwa constitutes a weak vowel. Fittingly, it is often restricted to unstressed positions or elided (merged with zero) in weak positions. Also, it is frequently banned from stressed positions.

[1] The behaviour of *e is highly suggestive of a schwa. These *e are in fact sometimes given as schwa (Blust 2012:8).
[2] Grimes (2006) does give a few forms though many are sub-minimal words, grammatical items. These do not appear in Blust (2008). Schwa is claimed not to be found before vowels (Blust 2012:7). Perhaps with a few exceptions.

Indeed, a number of languages ban word-final schwa, such as Hindi (Pandley 1990, and references within). However, very few languages, if any, ban schwa from all and only prosodically weak positions. What is far more common is for schwa to be excluded from stressed positions. English is one well-known example; it has pre- and post-tonic schwa but schwa is excluded from stressed position (Harris 1994, Gussmann 2002:125). In fact, there are many other languages that share this restriction. To name three unrelated examples, one could give: Indonesian (Cohn 1989)/Javanese (Ras 1982), Dutch (van Oostendorp 2000:204, Flemming 2007), and Tundra Nenets (Salminen 1993). Other languages have schwa in all positions and only stress the schwa if no full vowel is present in the word. In these languages, the placement of fixed stress shifts away from its canonical position when the canonical position contains schwa: T'boli (Southern Mindanao, Austronesian) (Awed et al. 2004), Tondano (Sneddon 1975) and Sye (Vanuatu) (Crowley 1998, Ulfsbjorninn 2014). Another common situation is for languages to have prosodically irrelevant epenthetic or intrusive schwas (for careful discussion and many examples Hall 2006). Finally, while there are some few languages that permit stressed schwas (some dialects of Catalan and Zabiče Slovene (Crosswhite 2001)), all these languages also allow schwa in prosodically weak positions.

To the author's knowledge there is no language like Hawu (or Hawu-Dhao to be more precise) where schwa is restricted to the stressed position. We could even say that Hawu violates the universal constraint against 'schwa being restricted to stressed positions/excluded from all weak positions)'. Hawu's schwa distribution seems to have developed only once in human history.

1.2 Consonant lenition

Final consonants were all deleted in Hawu (Blust 2008:64). This was not a consequence of phonetically motivated gradual lenition. It was a one-step, categorical, phonological rule of the type discussed in Blevins (2004).

The diachrony of Hawu shows that the initial position is only sporadically affected by lenition. Elsewhere the intervocalic position underwent regular and pervasive lenition. Curiously, there was only one intervocalic context where consonant lenition was resisted: following a schwa. This situation creates some unusual structural contrasts.

(4) Intervocalic lenition and contrast in Hawu (based on Blust 2008:64-69)

			Weak				**Strong**			
*p	>	(p ~ ∅)	*ní**p**i	>	ní	'dream'	*é**p**at	>	ə**p:**at[3]	'four'
*t	>	(t ~ d)	*má**t**a	>	má**d**a	'eye'	*bé**t**ak	>	wə**t:**a	'split'
*k	>	(k ~ ʔ)	*paní**k**i	>	ní**ʔ**i	'fruit bat'	*lé**k**uq	>	lə**k:**u	'fold'
*b	>	(b ~ w)	*qá**b**u	>	qá**w**u	'secret'	*sé**b**u	>	hə**ɓ:**u	'stream'
							*té**b**uh	>	ɗə**b:**u	'cane'
*d	>	(d/ɗ ~ r)	*tá**d**a	>	tá**r**a	'cockspur'	*ké**d**en	>	kə**ɗ:**u	'stand'
*ɟ	>	(ɗ ~ r)	*pá**ɟ**ay	>	pa**r**e	'rice'	*qapé**ɟ**u	>	pə**ɗ:**u	'gall'

[3] Blust (2008) and subsequent work never marks consonantal phonetic length of geminates because it is entirely predictable, this will be marked consistently in this paper as their length is key to the analysis.

As shown in (4b), all consonants are automatically geminated after a stressed schwa (Walker 1982). Blust (2012) hypothesizes that the geminate status of these post-schwa consonants allowed them to resist lenition via the well-known effect of geminate inalterability (Kenstowicz and Pyle 1978, Guerssel 1978, Kenstowicz 1994)).

1.2.1 Typological observations

Typologically, post- and inter-vocalic spirantisation is extremely common, but it is far less common for the quality of the vowels to be a determining factor. Conditions such as 'lenite after labial but not coronal vowels' is unheard of. Even though schwa is more structural than these features[4], it is not standardly expected for intervocalic lenition to be blocked in post-tonic position. Indeed, post-tonic intervocalic positions are one of the weakest possible environments (Harris 1997). Consider the English pattern: [tʰɒ́m] 'Tom', [tʰɒ́ʔə] 'totter', [ǽʔəm] 'atom', [ətʰɒ́mɪk] *[əʔɒ́mɪk] 'atomic'.[5]

1.3 Metathesis

Hawu is perhaps best known for regular diachronic metathesis (Blust 2008, 2012).[6] The generalization can be stated as in (5).

(5) Metathesis generalisation

(a)	***If***	V_2[–high]	***prec***	C	***prec***	V_1[+high]
	Then	V_1[+high]	***prec***	C	***prec***	V_2[–high]
(b)	***And***	V_1 shifts to [ə]				
		C geminates				

Though there is an exceptional form (*bine > [bə́n:i] 'female/woman'), the [–high] vowel in the generalisation is almost exclusively 'a' (Blust 2008:71). The metathesized word-shapes are therefore practically always iCa or uCa (ibid.). The order of the high and non-high vowel is reversed (5a). In all cases, the metathesized 'a' (or 'e') becomes schwa once it is stressed.

(6) Metathesis

(a) *iCa > əC:i

*miŋak	(> *miŋ**a**)	>	[mə́ŋ:i]	'fatty, oily'
*lim**a**		>	[lə́m:i]	'five'
*piɟa	(> *pir**a**)	>	[pə́r:i]	'how (many)'[7]

[4] Schwa's interaction with syllable structure appears more direct.

[5] English examples of post-tonic intervocalic lenition after schwa cannot be supplied because schwa is not strong enough to occupy this position. Highlighting again Hawu's unsual strength distributions.

[6] This has been reanalysed as pseudometathesis (feature spreading) by Lysvik (2014). The argument in this paper speaks to either proposal.

[7] Here and in many other forms we see that the stop had lenited before metathesis, however, many other forms show the metathesised form without. In all cases the consonant is automatically geminated after schwa (Walker 1982, Blust 2012).

(b) *uCa > ə́C:u

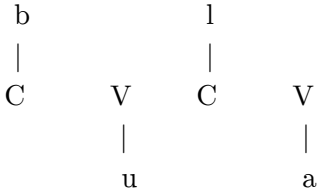
*pusej	(> *uh**a**)	>	[ə́h:u]	'navel'
*kuden	(> *ur**a**)	>	[ə́r:u]	'cooking pot'
*sukat	(> *suk**a**)	>	[hə́k:u]	'measure'

In addition to these facts there is a curious condition on Hawu metathesis. The C shown in generalization (5) is obligatorily part of the context. Metathesises can only apply if a consonant intervenes: (a) *buaq (> *bu.a) > [bu.e] **[bə́.u] or **[bá.u] or **[bu(:)] 'fruit', (b) *liaŋ (> *lia) > [li.e] **[lə́.i] or **[lá.i] or **[li(:)] 'cave' (Blust 2008:71, 2012).

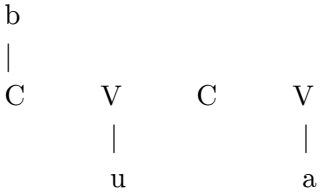
There is no natural explanation for metathesis obligatorily occurring across a consonant. In this language, all V_xV_y sequences are disyllabic, so the metathesis is essentially being blocked by an empty onset. This point is particularly evident considering the pseudometathesis account presented in Lysvik (2014).[8]

(7) Empty onset blocks metathesis

(a) *bula > [bə́l:u] 'forget'



(b) *bu.a > [bu.e] **bə́u 'fruit' (no metathesis)



Lysvik (2014) represents this VV metathesis as final vowel loss plus feature spreading (7a). Whatever the mechanism, (7b) shows how arbitrary it is for metathesis to be blocked by an empty onset.

1.4 What requires analysis?

The Hawu facts that require discussion and reanalysis or explanation are summarized in (8).

(8) Explananda

(α) Schwa, a universally weak vowel, can only occupy the stressed position. It is excluded from prosodically weak positions. (This distribution appears unique to Hawu).

(β) Schwa triggers gemination of a right-adjacent C. Diachronically this allowed C to resist lenition. Synchronically it appears that the position after a schwa is a strong position, while the position after all other vowels is weak: [lə́**k:**u] 'fold' vs. [ní**ʔ**i] 'fruit bat'.

(δ) There are are no CəV sequences. Metathesis is blocked in $CV_{[+high]}.V_{[-high]}$ forms. Metathesized final 'a' becomes schwa in stressed position.

[8] Though this paper is focused on metathesis in general and does not discuss CV.V forms

2 Hawu as a quantity sensitive language and its schwa

2.1 Schwa in Hawu

I start by addressing explanandum (α), the unusual distribution of schwa. It is helpful to distinguish between phonetic and phonological definitions of schwa. Phonetically, schwa refers to a vowel quality approximated by the IPA symbol: [ə]. Phonologically, a schwa is a 'featureless vowel' or a null set dominated by a nucleus, often referred to as 'empty nucleus'. The phonetic interpretation of this empty nucleus is language specific, some examples are shown in table (9).

(9) Empty nuclei and phonetic interpretation (for more cf. Scheer 2004)

Phonetic Vowel Quality	Language	Source
[ə]	French	Charette 1991
	Tocharian	Koller 2008
	Patep	Ulfsbjorninn 2012
	Upper Chehalis (Salish)	Kinkade 1998
	Malayalam	Sadanandan 1999
	"Southern Italian"	
	Chukchi, Itelman, Karo Batak, Ladahki, Malay, Wolof	DeLacy 2002, Lombardi 2002
[ɨ]	Moroccan Arabic	Kaye 1990
	Turkish	Charette and Göksel 1998
	Pattani Malay	Topintzi 2010
[i]	Yawelmani	Archangeli 1984
	Arabic dialects (Lebanese)	Abdul-Karim 1980
	Yoruba, Samoan	Uffmann 2007
	Tongan	Kitto 1997
	Cantonese	Yip 1993
	Navaho	Lombardi 2002
[ɯ]	Japanese	Itô and Mester 1995
[e]	Hebrew	Bolozky 2005
	"Central Italian"	
	Gengbe (at least in initial position)	Lombardi 2002
[ɛ]	Sawai (in final position)	
[ʌ]	Tundra Nenets	Ulfsbjorninn 2014
	Tigre	Faust to appear
[a]	Axininca, Lardil, Marathi, Balochi, Brahui, Sundanese, Wapishana, Iraqw, Klamath, Dakota, Coos, Mabalay Atayal.	Lombardi 2002

2.1.1 Schwa allophony in Hawu

The hypothesis I pursue for Hawu is that only phonetic schwa is restricted to stressed positions. Defined phonologically, there are no positional restrictions on the placement of schwa. It occurs in pre-tonic, stressed and post-tonic positions.

There are three allophones of schwa. Schwa surfaces as [e] pretonically, [ə] in stressed position, and [a] post-tonically. Diachronically the development of pre-tonic e-schwa and post-tonic a-schwa both result from neutralisations.

Hawu's pretonic [e] originates from the neutralization of all vowels to schwa: *s**u**maŋed (> *həmaŋa) > h**e**maŋa 'soul/life force', *k**a**mali (> *kəmali) > kemali 'men's house', *k**a**l**i**-wati (> *kələwati) > k**e**late 'earthworm' (Blust 2008:69). This first step in this change, the neutralization to schwa, is consistent with lenition (and loss of vocalic distinctive features) in unstressed positions (Harris 2005). The second stage, I hypothesize, is not phonological. The subsequent 'shift to e' is merely allophonic, a change of mapping to the phonetic form. Therefore, even in synchronic Hawu, pre-tonic positions remain largely featureless.

The final position also underwent a neutralization, though a less drastic one. Word-finally *e became schwa, which later merged with 'a': *tan**e**m (> *tanə) > dan**a** 'bury', *dal**e**m (> *dalə) > ɗar**a** 'in/inside', *tel**e**n (> *telə) > [dəl:**a**] 'to swallow' (Blust 2008:70). The first stage of the development *e to schwa is typologically expected. The second stage, the merger with 'a', is attested in a different way. It is widely accepted that [ə] can be the phonetic expression of an unstressed 'a' (cf. Malagasy among others), turning that on its head, the hypothesis for Hawu is that unstressed 'a' is schwa, phonologically featureless.[9]

(10) Distribution of schwa and phonetic interpretation

		Pre-tonic		Stressed		Post-tonic	
		C	V	C	V	C	V
If	Phonology:		{ }		{ }		{ }
Then	Phonetics:		[**e**]		[**ə**]		[**a**]

This analysis of schwa in Hawu has the consequence of nullifying the typologically oddity of Hawu, from a phonological perspective. Hawu does not have a unique distribution of vocalic strength and weakness, rather Hawu has the typologically ordinary pattern of permitting less contrasts in pre-tonic and post-tonic positions as well as hosting a larger array of contrasts in stressed position (cf. Crosswhite 2001). Phonologically schwa is not restricted to the stressed position, it is found in all positions.

Although schwa has no phonological positional restrictions, there is one strong phonotactic restriction on a stressed schwa. Its discussion takes us directly into the heart of explanandum (β).

(11) ***If*** *schwa is in stressed position,* ***Then*** *it must be in a closed syllable (prec a geminate)*

[9] It seems that final position does not have phonological, underlying /a/, |A|. This is only found in stressed position (the pretonic is always empty).

This distribution of schwa is similar to a family-wide preference in Salish languages to ban schwa from open syllables (Kinkade 1998:209). These languages often feature əC.C vs. á.CV alternations such as this one from Upper Chehalis: s-p**əl**xw-t-n & sp**ála**xw-t-n, s-p**əl**'xw-n & p**ála**xw-n 'doctor, cure.transitive' (ibid:206). Like Hawu, schwa is permitted to be stressed but only in closed syllables.

2.2 Gemination, lenition and schwa

The previous section demonstrates that, in stressed position, schwa is restricted to closed syllables. This observation has wide reaching implications that speak to explanandum (β), repeated here for convenience.

(12) **Explanandum β** - Schwa triggered gemination of a right-adjacent C. Diachronically this allowed C to resist lenition. Synchronically it appears that the position after a schwa is a strong position, while the position after all other vowels is weak: [lə**k:**u] 'fold' vs. [ní**ʔ**i] 'fruit bat'

The relevant structural contrast is: əC(strong) vs. ÁVC(weak). Abstracted from its quality, the pattern can be interpreted as: $V_{(weak)}C_{(strong)}$ vs. $V_{(strong)}C_{(weak)}$.

This configurational contrast is highly reminiscent of the weight trade-offs between Vs and Cs in languages with Metrical Lengthening (i.e. Standard Italian).

(13) Metrical Lengthening in Standard Italian[10]

(a)	[ví:peɾa]	**[vípeɾa]	'viper'	vs.	[dít:eɾo]	**[dí:t:eɾo]	'fly genera'
(b)	[muɾé:na]	**[muɾéna]	'moray eel'	vs.	[dén:i]	**[dé:n:i]	'Danny'

Standard Italian shows a structural opposition based on length: (V:C vs. VC:).

Tuscan Italian maximizes the parallel to Hawu because there is accompanied lenition of singleton consonants but not of geminates (for a recent discussion see Ulfsbjorninn 2017).

(14) Gorgia Toscana and length

(a)	/póko/	[p**ɔ:x**o]	'few/little'
(b)	/kɔ́k:o/	[k**ɔ́k:**o]	'coconut'

The Tuscan pattern reveals a structural contrast based on both length and strength of the consonant. In stressed positions, long vowels are accompanied by lenited singletons and short vowels accompany strong, unlenited consonants. The parallel with Hawu is sketched in (15).

[10] This refers to Standard Italian 'Dialect A'. Vowel length is not restricted to open syllables in penultimate position (for more discussion see Ulfsbjorninn 2016, in prep.).

(15) Strength and length distributions in stressed positions in Tuscan and Hawu

(a)	Tuscan			
	ɔ́:x		ɔ́k:	
	V long	C short	V short	C long
	Strong	Weak	Weak	Strong
(b)	Hawu			
	íʔ		ə́k:	
	V full	C short	V schwa	C long
	Strong	Weak	Weak	Strong

The Tuscan contrast shown in (15a) demonstrates that a strong, long vowel is offset by a weak consonant. Conversely, the weak, short vowel is compensated for with a strong, long consonant. But notice that it is not the weakness of the vowel that ultimately causes the strengthening of the consonant. That misunderstanding underlies the apparent paradox embodied in explanandum (β): 'schwa (the weakest of vowels) causes the strengthening of consonants'. In fact, it is the strength inherent to the stressed position that is not satisfied by a weak vowel. Neither a short vowel of Tuscan or a schwa of Hawu can satisfy it.

In both languages, the stressed position requires more in the way of phonological weight than a short vowel or a schwa can provide. In both languages, however, a stressed position containing a weak vowel is well-formed if it also contains the weight of an adjacent consonant.[11]

I propose therefore that like Tuscan Italian (and also Norwegian, Icelandic and many other languages), Hawu is quantity sensitive. Expressed in standard terms: all words must contain a syllable dominating two moras. In Hawu the first of these moras is supplied by a schwa, the other comes from the geminate: (lə́$_{\mu}$k$_{\mu}$)σ.ku 'fold'. In order to be explicative, this weight requirement is minimal and maximal. The stressed position must minimally and maximally contain two units of weight: (a) Italian - [ká:ne] **[káne] *cane* 'dog' & [kán:e] **[ká:n:e] *canne* 'spliffs' (b) Hawu - [lək:u] **[láku] 'fold'.

In both languages, a coda consonant or geminate will be present in the phonetic form. From this, the learner can deduce the weight it provides to its syllable. In Italian, the phonological weight of vowels is phonetically expressed as a prolonged duration of the vowel. Hawu is the same, except that what Tuscan does with duration, Hawu does with vowel quality. In stressed position, phonetic vowels with a full quality (a, e, i, o, u) correspond to phonologically heavy objects, they

[11] In a derivational analysis, an underlyingly a short-vowel of Tuscan lengthens to satisfy the weight requirement of a stressed position. The geminates of Tuscan are lexical and already satisfy the weight requirement. While in Hawu it is the geminates that spread to compensate for the weakness of schwa in stressed position.

are underlyingly bimoraic. Schwa, on the other hand, cannot be underlyingly heavy (bimoraic), it is always monomoraic.

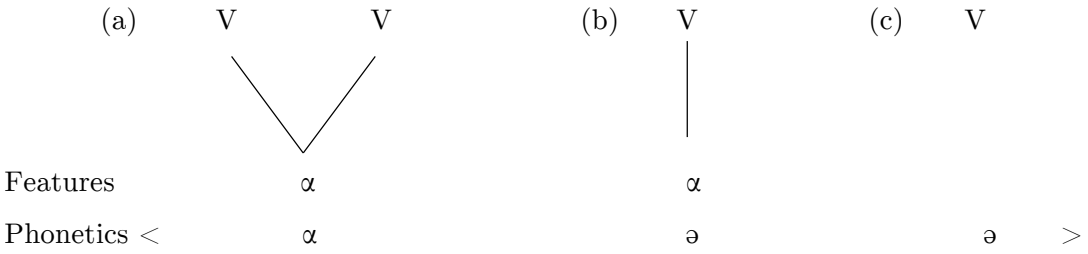
This mapping of phonological weight to vowel quality rather than duration is known as *virtual length*. Because not all readers may be familiar with this concept, I introduce virtual length briefly in the following subsection.

2.2.1 Virtual length

Virtual length is the term for a certain kind of phonology-to-phonetics mapping. At the phonological level, it involves bipositional structures (one-to-many relations) that define *phonological length* (Scheer 2014), or as I refer to it: *phonological weight* or perhaps more neutrally: *bipositionality*.

Virtual length is a situation where the bipositionality of a phonological structure is phonetically translated as anything other than increased duration. There is a large phonetic range of phonetic properties have been argued to correlate with phonological bipositionality (see Scheer 2014 for a summary). The type of mapping that relates to Hawu is one that is robustly attested in Afro-Asiatic languages. A number of languages have been analysed to show that vowels with a phonetic 'full' quality (a, e, i, o, u) are phonologically bipositional, attached to two positions of syllable structure. For the argumentation as relates to Semitic and Kabyle Berber see Lowenstamm (1991, 2011) and Ben Si Saïd (2011) respectively.

(16) Virtual length (Scheer 2014)



The diagram in (16) shows how a bipositional phonological object, in opposition with a monopositional object, can be phonetically interpreted as a short vowel with a full vowel quality. Meanwhile, a monopositional structure is interpreted as schwa. A featureless schwa vowel would also be the phonetic interpretation of a single V position, except that the V is not attached to phonological features.

2.3 Hawu vowel quality and phonological weight

The metrical framework used here is based on Ulfsbjorninn (2014), a Strict CV grid-theory of word stress that builds on Scheer and Szigetvari (2005). Because it is a rather new approach, the metrical model is introduced in the following subsection. Then we will return to discussion of the weight requirements and phonetic interpretation of that weight in section (2.3.2).

2.3.1 Strict CV metrics

This approach models phonological quantity without using syllables or moras. It is a grid system where metrical structure is projected directly from the skeletal tier (CV). Only V-slots can metrically project. The projection of empty V-slots is parametrically controlled, whereas filled V-slots inherently project a metrical position. Filled V-slots project to Line 2. Empty V-slots (including the second position of long vowels and diphthongs) project to Line 1 (Ulfsbjorninn 2014). The different height of projection reflects their head-dependent status. The various configurations/word shapes are shown below. In (17) we show just the basic projections, the forms sketched there are not shown with the final step – the winning projection that determines weight (those are in 18).

(17) Basic projections with hypothetical forms. (a-b) and heavy (c-e)

(a) CVCV 'tudo'

2		*		*
1		*		*
	C	V	C	V
	|	|	|	|
	t	u	d	o

(b) $CV_x.V_y$ 'tu.o' "hiatus"

		*		*	
		*		*	
C	V	c	V		
|	|		|		
t	u		o		

(c) CV_xV_x /tu:/ "long vowel"

2		*		
1		*		*
	C	V	c	V
	|	|		
	t	u		

(d) CV_xV_y /tai/ "diphthong"

		*			
		*		*	
C	V	c	V		
|	|		|		
t	a		i		

(e) CVC 'tuk'

2		*		
1		*		*
	C	V	C	v
	|	|	|	
	t	u	d	

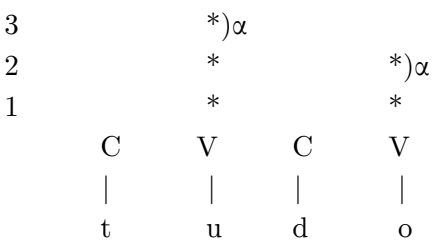
Feet always a form a dependency relation and in this model that which is traditionally a "heavy syllable" is a type of foot. In this model, these are feet that incorporate dependents at Line 1. Whereas traditional "feet" incorporate a dependent at Line 2.

The difference is shown in the next set of diagrams. As is shown in (18), the incorporation of a CV-dependent allows the CV-head to project to the next line (L3). The forms in (18a-b) are phonologically light forms and (18c-e) are the phonologically heavy ones.

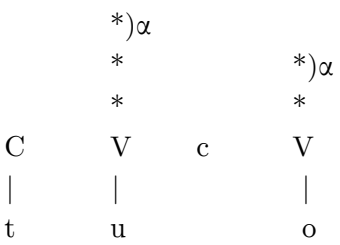
Languages vary parametrically in two ways: (a) the word structures/configurations that are available, (b) the types of incorporation that are permitted.[12]

(18) Incorporation and projection

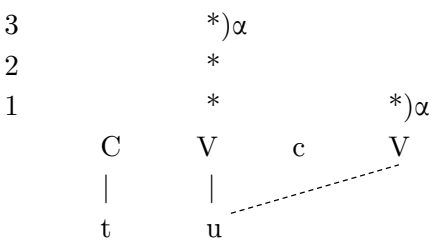
(a) CVCV 'tudo'



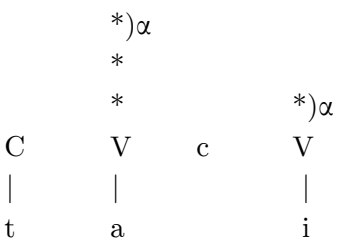
(b) $CV_x.V_y$ 'tu.o' "hiatus"



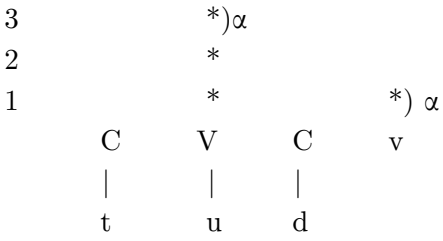
(c) CV_xV_x /tu:/ "long vowel"



(d) CV_xV_y /tai/ "diphthong"



(e) CVC 'tuk'



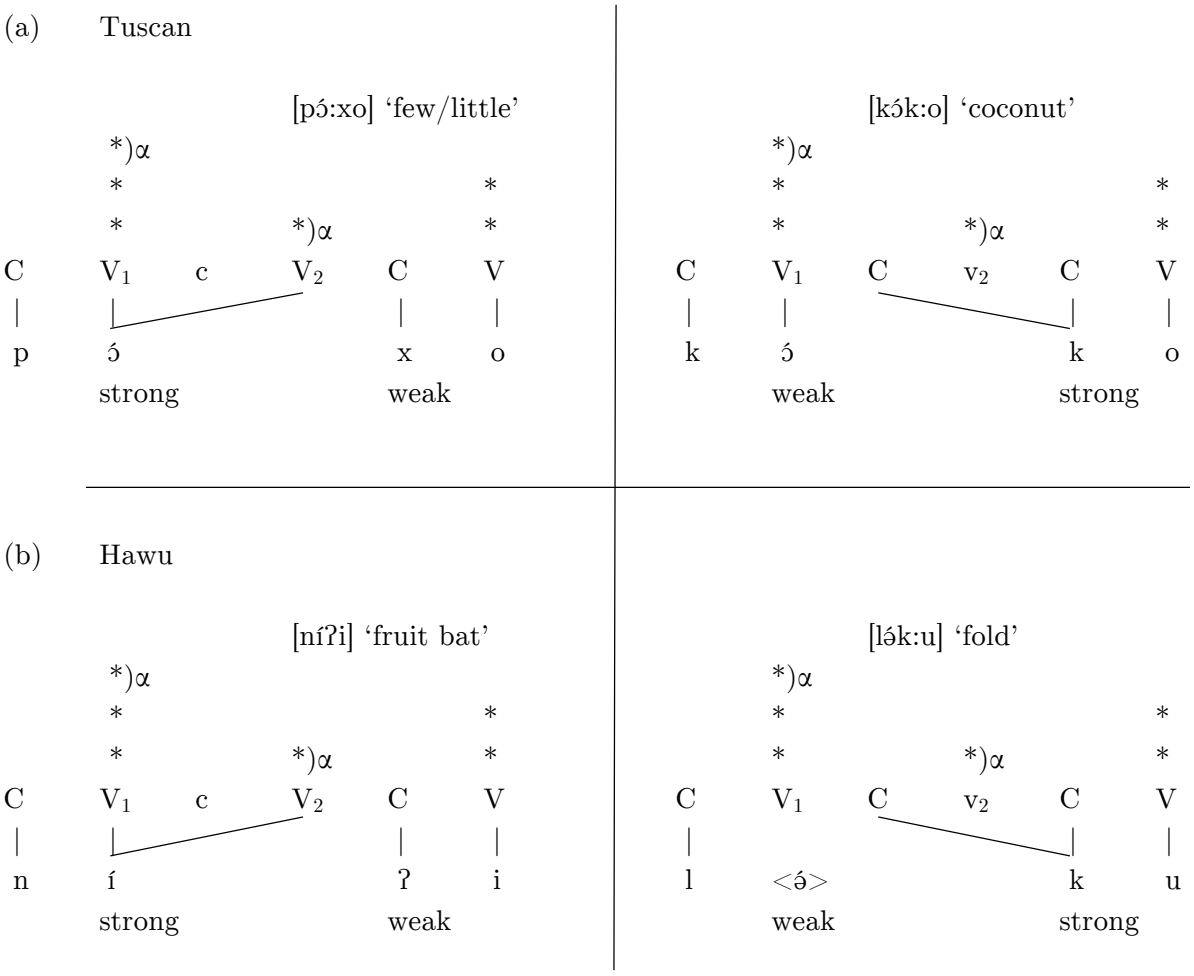
2.3.2 Minimal word and its satisfaction Hawu

I hypothesise that 'full quality vowels' of Hawu when located in the stressed position of open syllables are underlyingly bipositional. They are in effect 'bimoraic' but their bimoracity is expressed through vowel quality rather than increased duration.[13]

[12] Readers are encouraged to consult Faust and Ulfsbjorninn (to appear) for a self-contained demonstration of its application (in this case to Arabic dialects).

[13] I assume this is true only for vowels in the stressed position, though it's not clear what evidence could be used to test the weight of non-stressed positions. It is reasonable to assume, I believe, that a learner would, in absence of evidence elsewhere, assume that a virtual length interpretation of vowel quality applies only in stressed position.

(19) Weight and strength in Tuscan and Hawu[14]



As the comparision between Hawu and Tuscan shows, in both languages and in all forms, the V that projects main stress (V_1) must incorporate a V position to its immediate right (V_2). Thusly identified, the incorporated position (V_2) is given a bracket and is indexed (α) (V_2 in (17)). By virtue of having incorporated a dependent, (V_1) gains a grid-mark and projects to line 3.

Reaching Line 3 is the core metrical prerequisite of Hawu – it is equivalent to a minimal word condition.

(20) Minimal word condition of Hawu

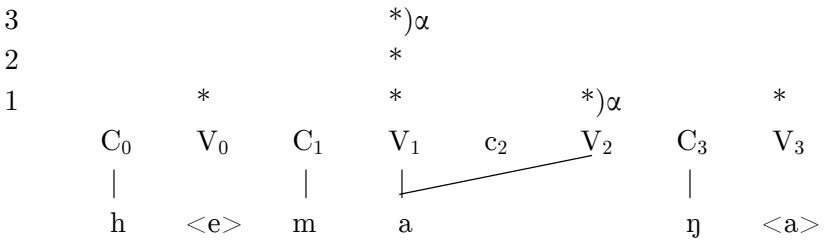
ω must contain a metrical head that projects to Line 3
a **H**(ead) incorporates a **d**(ependent) at line 1

The condition in (20) means that if a V position wants to project main stress, it must incorporate a dependent position to its right.

[14] Positions that remain empty even after phonological computation are shown in small caps.

Vowels with a full phonetic quality are underlyingly bipositional (CVCV) (a.k.a. bimoraic). Therefore, although they are phonetically short, this bipositionality allows them to satisfy the metrical conditions of the minimal word (see 19b in analogy with Tuscan 19a). A further Hawu example is shown beneath.

(21) /hmáŋ/ [heməáŋa] 'soul/life force'

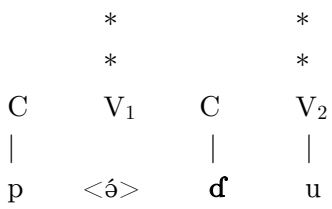


The word shown in (21) has a pre-tonic metrically weak (CV_0) with its e-schwa allophone. Then it has the metrical head (CV_1) with its (full quality) bipositional vowel, followed by the metrically weak (CV_3) and its a-schwa allophone.

In (21), the metrical head is V_1. At the metrical level, the head incorporates the dependent position (V_2). The metrical dependent (CV_2) is occupied melodically by the bipositonal vowel that spreads across V_1 and V_2. The fact that V_1 incorporates V_2 allows V_1 to project one level further to Line 3, thereby satisfying the metrical condition of word-hood.

Schwa on the other hand is the phonetic expression of an empty nucleus, a single V-slot. On its own, a schwa cannot project to L3. As shown in (22), this results in a word shape that does not meet the minimal word condition.

(22) Ill-formed word **[pəɗu]



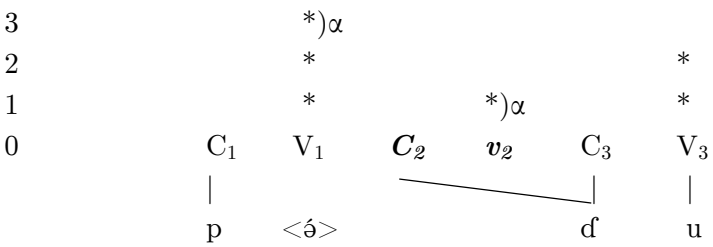
A word of the shape CəCV is illicit because its metrical head lacks a dependent. But even if a dependent CV is inserted (as shown in (23) in bold italics), there is a problem at the featural level. A schwa has no phonological features; therefore, it can spread nothing to fill CV_2. Under these conditions, it is incumbent on the local consonant (C_3) to spread.

Gemination is a way for structures like (22) to be salvaged. In (23) we show how. In (23) C_3 fills the dependent position (CV_2) and forms a geminate. This is essential because, metrically, V1 must incorporate a dependent but melodically this position needs to be filled somehow. If it failed to gain any featural content the dependent position would violate the phonological ECP.[15] As (23) shows, the metrical conditioned is satisfied because the head (CV_1) incorporates the

[15] The empty space cannot be left completely empty due to the Phonological ECP (a condition banning multiple adjacent empty positions (Kaye et al. 1990)).

dependent position (CV_2). Also, the ECP is satisfied because CV_2 can be filled by the featural content of C_3.

(23) Geminate satisfying weight of stressed schwa, [pə**ɗ**ːu] 'gall'



In the absence of any other heterosyllabic configuration (rime-onset sequences), the geminate is the only structure of Hawu that can occupy the dependent CV of a schwa-vowel. It is for this reason that a stressed schwa is only permitted in a 'closed syllable'.

This quantity sensitive account of Hawu explains the (automatic) gemination after schwa and its absence after any vowels of a full vowel quality. These are already big enough to incorporate a dependent and so they do not require extra structure.

Essentially this analysis fully resolves explanandum β.

3 Implications for word-shapes and metathesis

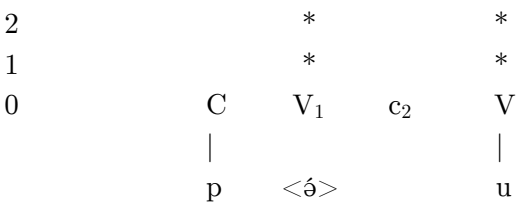
The previous section reveals Hawu to be a quantity sensitive language and concludes with a definition of the metrical condition licensing its words. These metrical conditions also explain two other facts about the language that have been grouped together as explanandum (δ): (a) (C)əV words are illicit, and (b) metathesis has the strange condition that it must apply over a consonant.

3.1 Motivating the ban on (C)əV

As has already been shown, (C)əCV words are illicit in Hawu (shown in 24). In these structures, the metrical head does not project high enough to meet the minimal word condition. When the schwa is a metrical head it needs to be bolstered by incorporating a dependent CV. However, because schwa is featureless it cannot spread, ruling out forms such as **(C)ə:CV. Conversely as has just been demonstrated in the previous section, (C)əC:V is a licit word structure (shown in 25). In this form, the dependent CV (CV_2) is present and it gets featurally filled by a consonant.

From this discussion, the restriction on **(C)əCV words falls out automatically. The representation for this is shown beneath.

(24) Illicit structure of **(C)əV words



The structure in (24) does not allow the metrical head (V_1) to project sufficiently. A dependent CV could be included and metrically it would be incorporated satisfying the projection requirements of heads. The difficulty in this syllabic configuration lies in how to fill/license that empty structure that is metrically required, this is shown in (25), the empty pieces of structure are in bold and italics.

(25) Empty structure in **(C)ə́V word

3		***(*)***				
2		*				*
1		*		****)***		*
0	C_1	V_1	***c_2***	***v_2***	***c_3***	V_3
	|					|
	p	<ə́>				u

As we have already seen, the schwa in V_1 is featurally empty, therefore it is not able to spread and occupy the empty structure (CV_2). Elsewhere, in a (C)ə́CV shape word, the content of C_3 would spread to fill C_2 and form a geminate but in (25) C_3 is empty and it cannot spread. The emptiness of C_3 means that the usual means by which schwa-headed words to gain weight are missing.[16,17]

This discussion shows that there is no way of licensing structures such as (25), thereby neatly explaining why (C)ə́CV are unattested in Hawu. Conversely, $CV_x.V_y$ words are fully permissible. Their dependent CV is occupied by bipositional, full-quality vowels, their structures are shown below.

(26) Empty structure in CV.V word [bu.e] 'fruit'

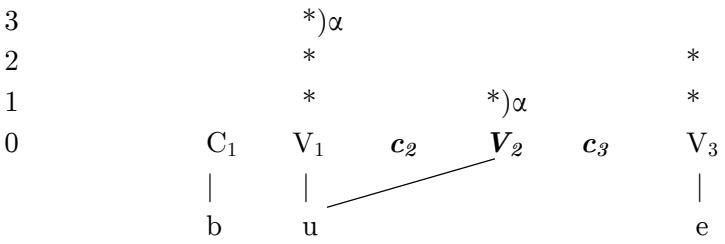
(a) Underlying form

3						
2		*				*
1		*		*		*
0	C_1	V_1	***c_2***	***v_2***	***c_3***	V_3
	|	|				|
	b	u				e

[16] The 'u' of V_3 cannot spread to V_2. V_1 is the metrical head and 'u' spreading would create an ill-formed iamb and the designated metrical head would not have reached its required height of projection.

[17] Government Phonology and Strict CV have developed strong and simple formal conditions on the licensing/permissability of empty structure. Successively empty structure cannot be left unfilled due to the (universal) phonological ECP condition (Kaye et al. 1990). Moreover, empty onsets also parametrically count as empty categories that require filling or licensing. In certain languages they are relevant to the ECP Charette (2003), Ulfsbjorninn (2007), Faust (2015), Faust et al. (in prep.). Without going into the details here, the outcome of these conditions would be that forms such as (24) could not license C_2 or V_2. This means that the dependent CV cannot be licensed in **(C)ə́V shaped words. Consequently, this shape does not meet the metrical minimal word condition.

(b) Computed form



As is shown in (26), the spreading of the full quality vowel leaves only the onsets C_2 and C_3 as empty categories. These are straightforwardly licensed by their adjacent filled nuclei.

3.2 Explaining why metathesis is blocked by empty onsets

The discussion so far handles the first part of explanandum (δ), relating to the impermissibility of (C)ɘCV word shapes. The second part of explanandum (δ) relates to the strange condition that metathesis is blocked over an empty onset.

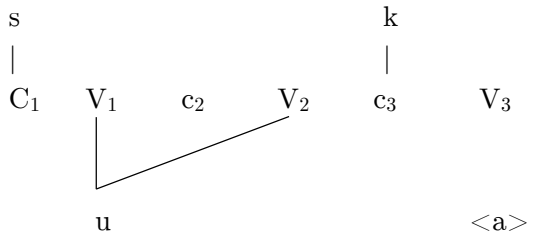
As we discussed in section (1.3), Blust (2008, 2012) describes Hawu metathesis as a swapping of the order of vowels when V_1[+high] precedes V_2[–high]: *suka > [hɘ́k:u] 'measure'. In practice metathesis almost exclusively occurs to uCa and iCa sequences.

According to the analysis in this paper, the final 'a' in Hawu is the phonetic interpretation of an empty nucleus. It is a featureless schwa vowel in final position. Blust (2008) notices a further oddness of the metathesis rule he describes. When 'a' is metathesized it becomes schwa in stressed position: *suk**a** > [hɘ́k:u] 'measure'.

In our account, this finds a ready explanation because both schwa and 'a' are featureless vowels. Both schwa and final 'a' are contextually determined phonetic interpretations of the same featureless vowel.[18] As we demonstrate in (29), this account confirms and even simplifies Lysvik's (2014) analysis of metathesis.[19]

(27) Pseudo-metathesis with my schwa analysis (based on Lysvik 2014)[20]

(a) *suka



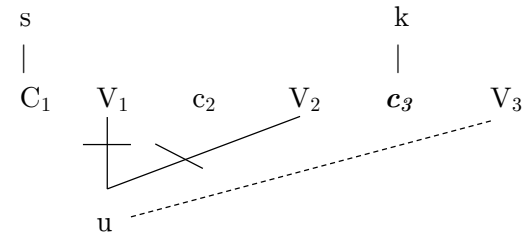
[18] There may be even a fourth allomorph : 'e' in the context of post-vocalic and word-final, or another explanation (see footnote 21).

[19] it seems to offers a better supported diachronic path.

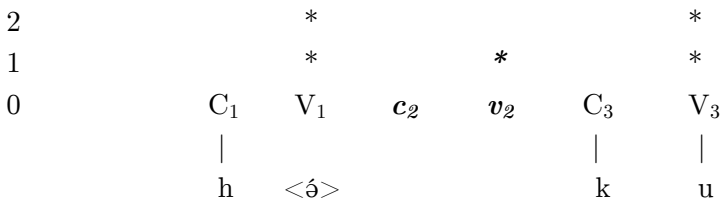
[20] The actual mechanism of metathesis is not at issue here, so I presented the consonants and vowels on separate tiers as Lysvik (2014) does for convenience.

(b) Metathesis

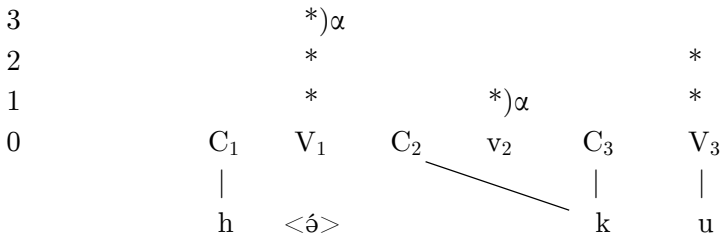
(i) Step 1



(ii) Outcome[21]



(d) Metrical bolstering and modern form [hə́k:u] 'measure'



The allophonic schwa analysis that is proposed in (2.1.1.), and the metrical condition on stressed positions (section 2.3.2) have conspired to prevent (C)ua or (C)ia from metathesizing into modern Hawu. The outcome of these forms should be **(C)əV, but this form fails to meet the quantity requirement of a stressed position and there is no way to repair it through spreading (as shown in 3.1).

(28) Metathesis is blocked by an empty onset (Blust 2008:71)

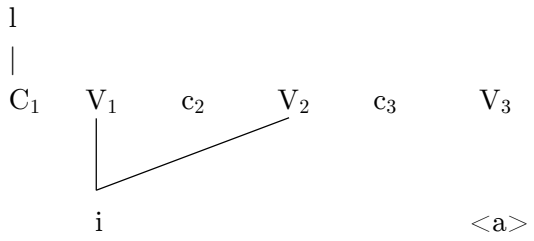
(a)	*buaq	(> bu.a) > [bu.e]	**[bə́.u]	**[bá.u]	**[bu(:)]	'fruit'
(b)	*liaŋ	(> lia) > [li.e]	**[lə́.i]	**[lá.i]	**[li(:)]	'cave'

The following diagrams sketched in (29) show that a metathesis derivation cannot operate on (C)ua or (C)ia stems. This is because the output of the process finds no way to be licensed.

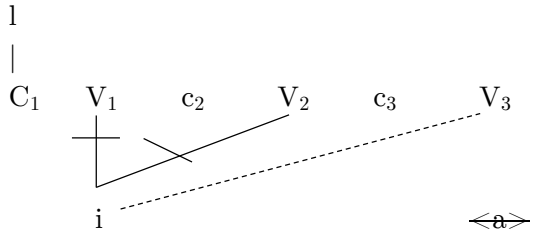
[21] 's to h' is a process that appears very recent, the etymological 's' is preserved for instance in the name of the island named because at the point of Hawu's earliest documentation (Wijngaarden 1896), the language still had 's'.

(29) *liaŋ (> *lia) > [li.e] **[lə́.i], **[lá.i], **[li(:)] ‘cave’

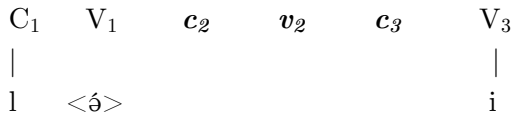
(a) *lia



(b) **Metathesis



(c) Outcome



The derivation reaches an impasse with structure in (29c). There are multiple empty positions to license or fill through spreading: the dependent CV (C_2V_2) and the empty onset C_3. Schwa is featureless, it cannot spread. Likewise, C_3 is empty, so this position is also unable to spread so as to fill dependent CV_2. The ‘i’ in (V_3) could spread but this would leave the stressed position (V_1) without the means to meet the metrical condition on word-hood. The weight would not be correctly attributed to the metrical head. This discussion shows why the metathesis output of **(C)ə́V sequences cannot be licensed.[22]

[22] Most, if not all(?), of the final a-schwa of Cua and Cia sequences was shifted to ‘e’. This could be analysed as ‘e’ or ‘i’-insertion. If that is the case it would seem that there is a diachronic filling of this final position with actual phonological material *in lieu* of metathesis. This change might suggest the diagnosis of the underlying cause of metatheis, though more research is required to confirm this is the case and establish the cause.

4 Conclusion

This paper started by showing that Hawu appears to present rare (if not unique) distributions of phonological strength and weakness. These odd conditions were summarized as follows: (α) Schwa, a universally weak vowel, can only occupy the stressed position. It is excluded from prosodically weak positions. (β) Schwa triggers gemination of a right-adjacent consonant. Diachronically this allowed C to resist lenition. Synchronically it appears that the position after a schwa is a strong position, while the position after all other vowels is weak: [lə**kː**u] 'fold' vs. [ní**ʔ**i] 'fruit bat'. (δ) There are are no (C)əV sequences. Metathesis is blocked in (C)$V_{[+high]}$.$V_{[-high]}$ forms. Metathesized final 'a' becomes schwa in stressed position.

The paper explained that these facts were all connected to a central organising fact of Hawu phonology that had so far gone unnoticed: Hawu is a quantity sensitive language. The vowel/ə phonotactics of Hawu were shown to be strictly analogous to those of Tuscan Italian and its Metrical lengthening/bolstering and lenition. Hawu was shown also to have Metrical bolstering. The reason why Hawu's quantity sensitivity went unnoticed is because length is not the sole phonetic interpretation of phonological bipositionality. Instead, consistent with an effect called 'virtual length', full vowel quality was shown to be the phonetic correlate of bipositionality for vowels (vowel weight, bimoraicity etc...). The quantity requirement of stressed positions were shown to be satisfied by either (a) a vowel with full phonetic quality or (b) a schwa followed by a geminate. We then showed that this diagnosis rules out words of the shape *(C)əV and simultaneously it explained the lack of metathesis in *(C)ua or *(C)ia word-shapes.

Language specific phonetic mappings can often obscure the structural similarities in the phonology of languages. Though they look rather dissimilar, Hawu is phonologically similar, and typologically of the same type, as Tuscan Italian, Norwegian, Icelandic and other quantity sensitive languages with metrical lengthening/bolstering. This conclusion has important implications for phonological theory; because, under the standard analysis, Hawu appears to have a unique distribution of strength and weakness therefore implying that this phonological system had developed once in human history. In fact, under this reanalysis the phonological system seems typologically common and it is language specific phonetic mappings that lead to Hawu's typological rarity.

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