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On foot templates and root templates

René Kager

0. Introduction

Many languages impose prosodic restrictions on the shape of the (canonical) root. For example, restrictions may hold w.r.t. maximal root length (e.g. four syllables) or the distribution of quantity (e.g. vowel length occurs in even-numbered syllables). The notion of *canonical root* will be defined by frequency, (ir)regularity, repair, etc. The central claim of this paper is canonical roots are members of *template pools* (Kager 1994a). A template pool is the natural class of prosodic shape invariants that together characterize a morphological category. Template pools are defined in terms of metrical feet, and are maximally two feet long. As an example, consider the template pool of Japanese loan abbreviations (Itô 1992). This pool has two bimoraic feet [H] or [LL] as its maximum. Each template begins with a foot:

(1) a	Strict MinWd	Ft	LL	suto (raiki)	'strike'
b	Loose MinWd	Ft+σ_μ	H+L	dai ya (moNdo)	'diamond'
			LL+L	tere bi (zyoN)	'television'
c	Compound	Ft+Ft	H+H	baa teN (daa)	'bartender'
			H+LL	koN bini (eNsu)	'convenience store'
			LL+H	ea koN (dishonaa)	'airconditioner'
			LL+LL	asu para (gasu)	'asparagus'

In contrast to the parametric approach of Kager (1994a), I will derive the notion of template pool from *foot alignment* constraints. McCarthy and Prince (1993) obtain prosodic minimality from MCat = PrWd, i.e. both edges of a morphological domain must coincide with edges of a PrWd. Prosodic maximality can be obtained likewise by constraining the distribution of feet within MCat, hence within PrWd. The idea is that some edge (L/R) of every foot must stand at some edge (L/R) of MCat. This is stated in the *asymmetrical* alignment constraint ALIGN (Ft, Rt) (2a). Maximally two feet per MCat can satisfy this requirement; therefore the highest level at which MCat maximality may be imposed is what Kager (1994a) calls *Compound*. Sharpening the demands on foot distribution, all feet may be required to stand at a designated (i.e. *either* L *or* R) edge of Mcat (2b, c). This gives a MCat in which a single foot stands at the designated edge, i.e. what Kager (1994a) calls *Loose MinWd*. Finally, *Smw* is the situation in which every foot is required to stand at the opposite edge as well.

(2) a ALIGN (Ft, Rt): Some edge of every Ft coincides with some edge of a Rt.
b ALIGN-L (Ft, Rt): The L-edge of every Ft coincides with the L-edge of a Rt.
c ALIGN-R (Ft, Rt): The R-edge of every Ft coincides with the R-edge of a Rt.

When these constraints are permuted with PARSE ('input material must reoccur in the output'), a typology arises.

(3) a PARSE > ALIGN (Ft, Rt) > ALIGN-L (Ft, Rt) > ALIGN-R (Ft, Rt)
(No maximality of MCat observed.)
b ALIGN (Ft, Rt) > PARSE > ALIGN-L (Ft, Rt) > ALIGN-R (Ft, Rt)
(Maximal MCat is a left-headed Cpd.)
c ALIGN (Ft, Rt) > ALIGN-L (Ft, Rt) > PARSE > ALIGN-R (Ft, Rt)
(Maximal MCat is a left-headed Lmw.)
d ALIGN (Ft, Rt) > ALIGN-L (Ft, Rt) > ALIGN-R (Ft, Rt) > PARSE
(Maximal MCat is a Smw.)

Note that Japanese loan abbreviations can be characterised by ranking (3b):

(4) /asuparagasu/	ALIGN (Ft, Rt)	PARSE	ALIGN-L (Ft, Rt)	ALIGN-R (Ft, Rt)
([a.su].[pa.ra])		gasu	*	*
([a.su].pa)		ragasu!		*
([a.su])		paraga!su		
([a.su].[pa.ra].ga)	*!	su	*	*
([a.su].[pa.ra].[ga.su])	*!		**	**

This approach expresses implications within template pools that were predicted by Kager (1994a). *Vertical*: If Cpd occurs in the pool of some MCat, then Lmw and Smw should occur as well. If Lmw occurs in a pool then Smw should occur as well. *Horizontal*: If Cpd (e.g. H+LL) occurs in a pool, then other Cpds (e.g. LL+LL) should occur as well. If Lmw (e.g. H+L) occurs in a pool, then other Lmws (e.g. LL+L) should occur as well. *Asymmetrical*: If left-headed templates (e.g. H+L) occur in a pool, then right-headed templates (e.g. *L+H) should not occur, and vice versa.

1. Prosodic constraints on root shapes

Below I will discuss canonical root shapes of five East Australian languages: Yidiɲ (Dixon 1977), Wargamay (Dixon 1981), Mbabaɽam (Dixon 1991), Gumbayŋgir (Eades 1979) and Uradhi (Crowley 1983). All are genetically related, and interesting variations occur in root shapes and stress. I will show that canonical roots in all five languages form template pools of the maximal type 'Compound' in the typology of MCats in (3). I will also show that for each language, the foot required for its *stress* pattern mirrors the foot required for its root definition (grammars are *prosodically coherent* in the terminology of Dresher and Lahiri 1991). Also, *extrametricality* and *catalexis*, if required for stress, are mirrored in canonical root shape. Finally, the alignment of stress feet with PrWd edge is mirrored by L/R-headed root templates.

An important issue, which will not be fully resolved here, is that of the level at which constraints on canonical roots take effect. Often root-based constraints seem to be violated at the level of the word. E.g. in Yidiɲ long vowels only occur in even-numbered root syllables, while within a word odd-numbered root syllables may be long by pre-suffixal lengthening, cf. *wuɲabaa-ɟi-ŋ* 'hunt-:ɟi-PRES'. Similarly, the Uradhi root contains maximally one long vowel, but again word-level pre-suffixal lengthening may lead to two long root vowels, cf. *taaraa-namu* 'reef-GEN'. Here a 'domains' approach might be contrasted with a 'stratal' approach. Under the former, constraints on roots are evaluated at word level in terms of root-prosody alignment constraints. It is significant that in both examples given above the 'misbehaved' long vowel stands at the edge of the root, where it could be analysed as bi-morphemic. Under the 'stratal' approach of Lexical Phonology, the lexicon is sub-divided into *strata*, including root, stem and word. In *Optimality Theory* each stratum may define its own ranking of constraints (McCarthy and Prince 1993a). Canonical root shapes are defined by a set of ranked constraints on the output of the earliest lexical stratum - before derivation nor affixation has taken place. Still, root-level constraints may be shared with other lexical levels. For example, Gumbayŋgir root-level constraints are active at word-level, where they both trigger and constrain a length shift.

A crucial property of all languages to be discussed below is that their roots may occur as stems or even words in isolation, where they mark the *absolutive* case. For all languages except Yidiɲ, the prosodic shape of the root in its word-level isolation form is highly similar to its canonical shape. Transparency of canonical root shapes at word level may be a factor enhancing the rôle of root-based constraints in these languages. (Conversely we would expect root constraints to be much less apparent in languages in which each root is obligatorily inflected by non-zero material.)

2. Yidiɲ

Below the distribution of 836 roots in Dixon's (1977) vocabulary of Yidiɲ is given, per prosodic type, by descending frequency:

(5)

Type	*Number*	*Example*
LL	590	gala 'spear', gugaɽ 'large guanna'
LLL	219	/gindanu/ [gindaan] 'moon', /gudaga/ [gudaaga] 'dog'
LLLL	12	ɟulugunu 'black myrtle tree', yiŋgilibiy 'bee'
LH	11	durguu 'mopoke owl', giŋaa 'vine species'
LLLLL	2	/ɟilibugabi/ [ɟilibugaabi] 'next day'
LHLL	1	waɽaabuga 'white apple tree'
LLLH	1	galambaɽaa 'march fly'

Note that Yidiɲ has no monosyllabic roots, L nor H. Furthermore, vowel length contrasts are restricted to *even-numbered* syllables of roots. (We will return to the absence of LHL below.) As Dixon (1977:86) observes, there is no theoretical reason why we should not have an odd-syllabled root ending in a long vowel, e.g. LLH, as this length would surface in inflected words with an even number of syllables, e.g. CvCvCvv-*gu*. (Below the relevance of syllable number will be clarified.) And no roots have length in the initial syllable (e.g. *HL, *HLL), since initial length never surfaces in even-numbered words. Finally, the only two LLLLL roots may well be morphologically complex (e.g. *ɟilibugabi* 'next day', cf. *ɟili* 'eye', *buga* 'night').

Turning to (word-level) stress and length, we find an interesting correlation with canonical root shape. In odd-numbered words, long vowels only occur in even-numbered syllables. Actually, the penult of an odd-numbered word always contains a long vowel by *Penultimate Lengthening* (Dixon 1977:43). Such words have iambic feet [L**H**], [L**L**] throughout. Final vowels outside a foot are apocopated except when an illegal coda would result (6d) - *Final Syllable Deletion* (Dixon 1977:58).

(6)	a	/gudaga/	[gu.dáa].ga	'dog-ABS'
	b	/gali-ɲu/	[ga.líiɲ]	'go-PAST'
	c	/maɟinda-ɲunda/	[ma.ɟín].[da.ɲúun]	'walk up-DAT SUB'

Kirchner (1990) argues that *Penultimate Lengthening* is a compensatory effect that is triggered by *Final Syllable Deletion*, which is in its turn driven by the preference for all syllables to be parsed into disyllabic feet (Dixon 1977:41), i.e. PARSE-σ.

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(7) /gali-ɲu/          [(ga.lí:ɲ)⟨u⟩]
      ||   |               | |\
      μμ   μ               μ μ  μ
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When the underlying form has no long vowels, and an even number of syllables, all feet in the word are balanced trochees [**L**L] (8a-d). When a long vowel occurs in an even-numbered syllable, feet are iambic throughout the word (8e-f). Finally, when the word contains a special suffix that induces length in the preceding syllable, long vowels occur in odd-numbered syllables, with trochaic feet [**L**L] or [**H**L] (8g-h):

(8)	a	/waɽil/	[wá.ɽil]	'doorway-ABS'
	b	/gudaga-ni/	[gú.da].[gá.ni]	'dog-GEN'
	c	/wawal-ɲunda/	[wá.wal].[ɲún.da]	'see-DAT SUB'
	d	/maɟinda-ŋal-ɲunda/	[má.ɟin].[dá.ŋal].[ɲún.da]	'walk up-COM-DAT SUB'
	e	/durguu/	[dur.gúu]	'mopoke owl-ABS'
	f	/durguu-nu-la/	[dur.gúu].[nu.lá]	'mopoke owl-GEN-LOC'
	g	/gali-ŋal-:ɟi-ŋ/	[gá.li].[ŋáa.ɟiŋ]	'go-COM-:*ɟi*-PRES'
	h	/wuŋaba-:ɟi-ɲunda/	[wú.ŋa].[báa.ɟi].[ɲún.da]	'hunt-:*ɟi*-COM-DAT SUB'

We find that stress feet at word level are strictly disyllabic [**L**L], [L**H**], or [**H**L], excluding *[**H**]. Iambic [L**L**] occurs under pressure of prominence harmony only (Dixon 1977:41, McCarthy and Prince 1986). However the unbalanced trochee [**H**L] *never occurs in roots* - its only source is pre-suffixal length. (If roots such as HL would occur, we would expect even-numbered forms with trochaic stress, cf. 8g-h). Accordingly the root stratum strictly enforces the *optimal feet* [LL] and [LH], in a template pool *Cpd-Left*:

(9) a	Smw	([LL])	([LH])		
		([ga.la])	([dur.guu])		
b	Lmw	([LL]+L)	*([LH]+L)		
		([gu.da].ga)	(*gap, see below*)		
c	Cpd	([LL]+[LL])	([LH]+[LL])	([LL]+[LH])	([LH]+[LH])
		([ma.raŋ].[gar.ga])	([bu.raa].[ba.di])	([ga.lam].[ba.ɽaa])	(*gap*)

Note that the root level does not require exhaustive parsing of syllables by disyllabic feet, in contrast to the word level. We find that root structure is, one the one hand, more restrictive than word structure in disallowing [HL] feet, but on the other hand less restrictive, in allowing for Lmw.

Let us now turn to the puzzling absence of LHL roots. No trisyllabic roots occur whose second syllable length surfaces in even-numbered case forms. E.g. given an LHL root */*gudaagu*/, we might expect a quadrisyllabic case form *[*gu.dáa*].[*ga.ní*]. However, the only attested type of form is [*gú.da*].[*gá.ni*]. Reduplication is another source of evidence for lack of LHL roots, since putative length is not copied along, cf. /*waguɟa*/ [*wagúuɟa*] 'man-ABS', [*wagú=wagúuɟa*] *[*wagúu=wagúuɟa*] 'lots of men-ABS' (Dixon 1977:69). The absence of LHL roots may be due to the fact that the effect of *Penultimate Lengthening* is abstracted away from the underlying root.

3. Wargamay

Consider the distribution of 917 roots in the Wargamay vocabulary (Dixon 1981):

(10)

Type	*Number*	*Example*
LL	489	bada 'dog', gawal 'call'
LLL	268	gagara 'cane dilly-bag', girawan 'scrub hen'
LLLL	69	gayambula 'white cockatoo', ɟigubina 'falling star'
HL	58	wiigi 'no good', muugil 'freshwater black bream'
HLL	17	giibaɽa 'fig tree', giirigin (proper name)
H	15	yaa 'top of a tree', ɟiin 'eyebrow'
LLLLL	1	burayɲɟubaɽa (proper name)

The picture is much different from Yidiɲ. First, a fair number of monosyllabic roots occur. Significantly, all are heavy syllables, pointing to a bimoraic minimum, e.g. Root = PrWd. Second, vowel length is contrastive in the first root syllable only. Third, no quadrisyllabic HLLL occurs next to LLLL, but rather HLL next to LLLL. Again this points to the bimoraic foot [H], [LL], maximal root length equalling two feet. As in Yidiɲ, the rarity of LLLLL shows that it must be non-canonical.

Stress in Wargamay falls on a heavy syllable (11a-c), and in words that have no heavy syllables, on the initial syllable in even-numbered words (11d, f) and on the second syllable in odd-numbered words (11e, g), which is slightly lengthened. Secondary stress goes on the penult, but no clash is allowed:

(11)	a	yáa 'top of tree'	d	báda 'dog'
	b	múuba 'stone fish'	e	gagáˑra 'dilly bag'
	c	gíibaɽa 'fig tree'	f	gídawùlu 'freshwater jewfish'
			g	ɟuɽáˑgay-mìri 'Niagara Vale - FROM'

Arguably, the stress foot is bimoraic [**H**] or [**L**L]. Iambic [L**L**] occurs to avoid lapse (cf. Kirchner 1990 on Yidiɲ). The slight lengthening of non-initial stressed vowels may be a weak form of iambic lengthening. The mixed trochaic/iambic pattern is highly reminiscent of Yidiɲ, where it is also quantitatively supported by Penultimate Lengthening. In section 5, we will see another instance of the effect in Gumbayŋgir, i.e. a length shift. The Wargamay template pool is *Cpd-Left*:

(12)		*Smw*			*Lmw*			*Cpd*	
	a	H	([yáa])	c	H+L	([múu].ba)	e	H+LL	([gíi].[ba.ɽa])
	b	LL	([bá.da])	d	LL+L	([ga.gá].ra)	f	LL+LL	([gí.da].[wù.lu])

Note that the compound root ([gíi].[ba.ɽa]) does not display the secondary stress on the penult that its templatic analysis would predict. This discrepancy between the root and word structure may be due to an undominated word-level constraint ruling out clash, *[gíi].[bà.ɽa], or final stress, *[gíi].[ba.ɽà] (Dixon 1983:20). We must then conclude that prosodic conditions on canonical roots may function as 'analytic' only, i.e. 'the root can be analysed as a Cpd', not: 'the root has two stress feet'.

Two residual issues should be addressed. First, why don't we find ([H]+[H]) and ([LL]+[H]) compound templates? A tentative answer may be provided by conflicting undominated word-level constraints governing main stress: (i) the leftmost foot must be main-stressed, while (ii) heavy syllables must be main-stressed. Assuming these two constraints to dominate PARSE at word-level, we need not complicate the set of root structure constraints. Second, low frequency of Lmw ([H]) roots as compared to Lmw ([LL]) roots might reflect a cross-linguistic tendency of minimal disyllabicity. It is found in Japanese loan abbreviations (and in morphological categories of many more languages, see Kager 1994b).

4. Mbabaɽam

Next consider the distribution of 332 roots in Mbabaɽam vocabulary (Dixon 1991):

(13)	*Type*	*Number*	*Example*
	LL	169	muga ‘aunt’, wuɽgun ‘young boy’
	L	94	mba ‘belly’, bib ‘breast’
	LLL	30	agaɟu ‘to scratch’, yaraman ‘horse’
	H	19	bii ‘ear’, wiiɽ ‘head hear’
	LH	17	abuu ‘ground’, nambuuɽ ‘big brown snake’
	HL	2	nɔɔmbɨ ‘big red wallaroo’, ŋɔɔlmbu ‘small’
	LLLL	1	ŋarabulgan ‘Mount Mulligan’ (loan)

On the whole, Mbabaɽam roots are much shorter than Yidiɲ or Wargamay roots. Monomoraic (‘sub-minimal’) roots L are not only allowed, but quite numerous. Also roots exceeding three syllables are rare. Vowel length contrasts are almost restricted to monosyllables and to the second syllable of disyllabic roots (i.e. *LHL).

Shortness of the canonical root is closely related to the stress pattern through the notion of *catalexis*, as I will now show. Mbabaɽam stress is complex and lexically variable. Heavy syllables are always stressed (14a-b). An initial /a/ never bears main stress, which usually falls on the second syllable (14b-d). Disyllabic full-vowel roots stress are stressed on the second syllable (14g-h), or the initial syllable (14 i-j). Most trisyllabic full-vowel roots are stressed on the second syllable (14k-l), some on the final syllable with an initial secondary stress (14m-n):

(14)											
	a	nambúuɽ	(snake)	e	ɟibú	‘no good’	i	d̪ambáɽa	‘nulla nulla’
	b	abúu	‘ground’	f	miɟál	‘lip’	j	malgáɟir	‘very big’
	c	abáɽ	‘sister’	g	búmba	‘ashes’	k	gùrid̪ál	‘eaglehawk’
	d	aráman	‘woomera’	h	láŋgil	‘light’	l	gùludún	‘dove’

Accordingly, the stress foot is the *moraic trochee*, with optional *mora catalexis.* Catalexis is a segmentally empty mora at the right edge of the root (Kiparsky 1991, Kager 1995), making a final light syllable count as heavy (hence ‘L$^+$’). The foot is right-aligned in the root. The root template pool is *Cpd-Right* modulo μ catalexis.

(15)						
a	Smw	94	([**L**$^+$])	mbá		
		12	([**L**L])	búmba		
		19	([**H**])	bíi		
b	Lmw	152	(L+[**L**$^+$])	ɟibú	93 of which (*a*+[**L**$^+$])	(e.g. abáɽ)
		23	(L+[**L**L])	yuwágil	10 of which (*a*+[**L**L])	(e.g. aráman)
		17	(L+[**H**])	muɽáal	10 of which (*a*+[**H**])	(e.g. abúu)
c	Cpd	5	([**L**L]+[**L**$^+$])	gùludún		
		1	([**L**L]+[**L**L])	ŋàrabúlgan		

We are now able to state the distribution of initial /a/: its syllable must occupy the 'adjunct' (pre-head) position in Lmw. Under this analysis, only four roots resist a 'canonical' analysis. They are: *àɽuŋgúl* 'kite hawk' (which has initial /a/ in non-adjunct position); *nɔ́ɔmbɨ* 'big red wallaroo' and *ŋɔ́ɔlmbu* 'small', both of which have the left-headed Lmw structure [H]+L; and *mbábaɽam* (language name), which also has a left-headed Lmw structure [LL]+L.

Furthermore, attested roots have gaps as compared to predictions of the template pool. Absence of noncatalectic Cpd ([**L**L])+([**H**]) must be an accidental gap. The fact that no Cpds have a heavy initial foot (e.g. ([**H**])+([**L**+]), ([**H**])+([**L**L]), ([**H**])+([**H**])), may well be due to clash avoidance.

5. Gumbayŋgir

The distribution of 473 roots in the Gumbayŋgir vocabulary (Eades 1979) is below:

(16)

Type	*Number*	*V*	*N*	*Part*	*Example*
HL	126				miimi 'mother', ɟaawan 'pheasant', yiila 'to cook'
LL	108				baga 'knee', badaɟ 'rat, mouse', bira 'to dig'
LH	80				duluu 'ankle', babaar 'club', bagii 'to burn'
LLL	71				bulari 'two', balawir 'flying fox', bagulwa 'to slay'
LHL	36				guluura 'bone', ŋaluuŋgir 'clever man', baguuli 'to lie down'
H	20				ɟuum 'smoke', ɲaa 'to see' (irregular)
HLL	8	5	2	1	ɟuuliyam 'fig', ɲaagili 'to find', guuɽulaw 'tomorrow
LLLL	8	2	6	-	maraŋgarga 'spider', bilagara 'to run'
LHLL	2	1	1	-	wuruuŋaga 'salt water oak tree', buraabadi 'to return'

We first observe that the minimal root is bimoraic (The exception *bu*(*m*) 'to hit' always surfaces as a bimoraic stem by an augment, e.g. imperative *bum-a*). Second, no adjacent heavy syllables occur (e.g. *HH, *HHL). Third, vowel length does not occur outside the first two root syllables. (e.g. *LLH, *LLHL, *HLHL). Fourth, a closer look at roots of the shapes LLLL, HLL, and LHLL reveals that almost all are verbs. One of the two nominal HLL roots (*gaaguɲ-ga* 'fig tree') has the 'tree suffix' *-ga*, which also occurs in three out of six LLLL nominal roots (*balawun-ga* 'ti-tree', *barigir-ga* 'ironbark tree', *gayabar-ga* 'boxtree'), and the single nominal LHLL root (*wuruuŋa-ga* 'salt water oak tree'), although no meaningful roots can be identified as bases. Two more LLLL nominal roots are semi-compounds (e.g. *galam=bila* 'Coff's harbour', cf. *galaamga* 'oak tree', Eades 1979:354). Finally, no roots longer than four syllables occur (two apparent exceptions *yariyapini* 'Yarihapini Mountain' and *ɟinaŋgubala* 'to kick' are arguably morphologically complex, Eades 1979:265).

The question then is: can the canonical root shapes (those above the bar in 16) all be captured by a single root formula? Let us first look into the stress pattern. Stress falls on a heavy syllable (17a-d). When there are no heavy syllables, stress is initial and optionally on the second syllable of words longer than two syllables (17e-f):

(17)	a	[ɟúum]	'smoke'	e	[ɲá.mi]		'woman'
	b	[míi].mi	'mother'	f	[gá.lu].gun **or** [ga.lú].gun		'one'
	c	[ŋa.líi]	'ldu inc S,A'				
	d	[ŋa.lúuŋ].gir	'clever man'				

That is, the stress foot is minimally bimoraic and maximally disyllabic, with vowel length aligning with right edge of foot: the 'uneven iamb' [H], [LH], [LL]. The actual choice between trochaic [**L**L] and iambic [L**L**] depends on rhythm. That is, default prominence in [LL] feet is trochaic, but *lapse avoidance* in trisyllabic words causes optional second syllable stress, with [L**L**]. We then arrive at a template pool *Cpd-Left* for verbal roots, and *Lmw-Left* for nominal roots:

(18)	a	Smw	([H])	([LL])	([LH])
		(N, V)	([ɟuum])$_{\mathrm{N}}$	([ɲa.mi])$_{\mathrm{N}}$	([ba.gii])$_{\mathrm{V}}$
	b	Lmw	([H]+L)	([LL]+L)	([LH]+L)
		(N, V)	([mii].mi)$_{\mathrm{N}}$	([ba.gul].wa)$_{\mathrm{V}}$	([ŋa.luuŋ].gir)$_{\mathrm{N}}$
	c	Cpd	([H]+[LL])	([LL]+[LL])	([LH]+[LL])
		(V)	([ɲaa].[gi.li])$_{\mathrm{V}}$	([bi.la].[ga.ra])$_{\mathrm{V}}$	([bu.raa].[ba.di])$_{\mathrm{V}}$

As Wargamay, Gumbayŋgir has a number of unattested compound templates:

(19)	a	*([H]+[H])	c	*([LL]+[H])	e	*([LH]+[H])
	b	*([H]+[LH])	d	*([LL]+[LH])	f	*([LH]+[LH])

Absence of these root shapes can be explained as in Wargamay. No vowel length occurs outside the first two syllables because of converging stress requirements that both outrank PARSE, i.e. (a) a constraint that heavy syllables must be main-stressed, and (b), a constraint that the initial foot must be main-stressed.

The interest of Gumbayŋgir resides in the fact that HLL is avoided in 'derived' nouns. If an inflectional suffix is added to a (vowel-final) HL nominal root, vowel length obligatorily shifts from the first to the second syllable.

(20)		*Base*	*Inflected form*		
	a	waaɲɟi	waɲɟii-gu	'dog-DAT'	(*waaɲɟi-gu)
		guuɽu	guɽuu-la	'black-LOC'	(*guuɽu-la)
	b	niigar	niigar-gu	'man-DAT'	(*nigaar-gu)

This length shift achieves three prosodic goals. First, the derived form is made to conform to canonical noun format, which extends to word level. Recall that Lmw ([LH]+L) is allowed in nominal roots, but Cpd ([H]+[LL]) is not. Here length shift is a word-level strategy to extend the scope of canonical root shape. Simultaneously, the right edge of the root is aligned with the right edge of a foot, cf. ([*waɲɟii*]-*gu*) > *([*waaɲ*]*ɟi*-*gu*). Third, length shift avoids lapse, clash, and final stress in the same way as we saw earlier in Yidiɲ and Wargamay, cf. *[wáaɲ].ɟi.gu, *[wáaɲ].[ɟì.gu], *[wáaɲ].[ɟi.gù]. Relevance of lapse avoidance is shown by optional lengthening, in the same morphological context, of the vowel in the second syllable of an LL base, e.g. /*ɲami*/, *ɲamii-ɲar* ~ *ɲami-ɲar* 'woman-ABL'.

6. Uradhi

Consider the distribution of 1090 roots in Uradi vocabulary (Crowley 1983). For roots with long vowels, root statistics are split into three dialects: Atampaya (At), Angkamuthi (An), Yadhaykenu (Y) (some roots are identical for 2/3 dialects):

(22)

Type	*Number*	*Example*			
LL	413	ama 'man, person', iku 'short-nose bandicoot'			
LLL	380	in̪t̪inu 'story-place of brown snake', ʈuɣuβa 'cigarette'			
LLLL	129	umuɣan̪u 'nose', ukumala 'sweet potato'			
LLLLL	26	ayparumpiwa 'sparrowhawk', uʈalaɣala 'sick'			
L	7	wa 'to cook, burn', ma 'to pick up' (all *irregular*)			
		At	*An*	*Y*	
LHL	58	28	22	26	amaaka 'message stick', untaamu 'wife'
LH	43	-	36	11	aðaa 'hole', muʈaaɲ 'good-looking'
HL	20	13	16	14	maaru 'tired', wiiðaɲ 'greedy'
LLH	5	5	-	-	aðuðaa 'sick', akantii 'wongai plum'
LHLL	5	-	2	4	alɣuumala 'child', mayaakala 'magpie'
HLL	2	-	1	2	aanima 'to do', wuulaða 'father's father'
LLHL	2	1	1	-	yukuʈiina 'cigarette', uriɲaani 'sorry'

First, note that no monosyllabic roots occur except from 7 L roots (4 irregular verb roots, 3 particles). Monosyllabic H roots are unattested. Therefore minimal size of the canonical roots is disyllabic. Second, we find a large number of long roots, most notably LLLLL (which seems to exceed Cpd). Third, roots with vowel length on the antepenult (i.e. HLL, LHLL) are rare and occur in the Angkamuthi and Yadhaykenu dialects only. Most are probably morphologically complex, e.g. *wuulaða* 'father's father', cf. *wuula*(*n*) with identical meaning. Fourth, vowel length in the final root syllable occurs in the Angkamuthi and Yadhaykenu dialects only.

Let us now consider the stress pattern. In words with light syllables only, stress is antepenultimate. In words that have a long vowel, this is stressed. That is, the stress foot is a trochee [**H**], [**L**L], [**H**L] with final light syllables extrametrical.

(23)	a	[á.ma]	‘person’	e	a.[ðáa]	‘hole’
	b	[ʈú.ɣu].⟨βa⟩	‘cigarette’	f	a.[máa].⟨ka⟩	‘message stick’
	c	u.[kú.ma].⟨la⟩	‘sweet potato’	g	[áa.ni].⟨ma⟩	‘to do’
	d	ay.pa.[rúm.pi].⟨wa⟩	‘sparrowhawk’	h	al.[ɣúu.ma].⟨la⟩	‘child’

Accordingly, the template pool is Cpd-Right, modulo σ_μ extrametricality. There are two restrictions. The minimal root is disyllabic. Moreover, no long vowels may appear in the non-head foot (of a Cpd template).

(24)	a	Smw	([**H**]) (**Min 2 σ*)	([**L**L]) ([á.ma])	([**H**L]) (**E.m. parse*)
	b	Lmw	(L+[**H**]) (a.[ðáa])	(L+[**L**L]) (**E.m. parse*)	(L+[**H**L]) (**E.m. parse*)
	c	Cpd	([LL]+[**H**]) ([a.ðu].[ðáa])	([LL]+[**L**L]) (**E.m. parse*)	([LL]+[**H**L]) (**E.m. parse*)

(25) Extrametrical analysis:

a	Smw	([**H**]) ⟨L⟩ ([máa]).⟨ru⟩	([**L**L]) ⟨L⟩ [ʈú.ɣu].⟨βa⟩	([**H**L]) ⟨L⟩ ([áa.ni]).⟨ma⟩
e	Lmw	(L+[**H**]) ⟨L⟩ (a.[máa]).⟨ka⟩	(L+[**L**L]) ⟨L⟩ (u.[kú.ma]).⟨la⟩	(L+[**H**L]) ⟨L⟩ (al.[gúu.ma]).⟨la⟩
f	Cpd	([LL]+[**H**]) ⟨L⟩ ([yu.ku].[ʈíi]).⟨na⟩	([LL]+[**L**L]) ⟨L⟩ ([ay.pa].[rúm.pi]).⟨wa⟩	([LL]+[**H**L]) ⟨L⟩ (*accidental gap?*)

As in Wargamay, minimal discrepancies arise between the templatic analysis of Cpd roots and their reported stress pattern, which is apparently single-stressed.

Note that the root templates HLL and LHLL, which are based on the unbalanced trochee [HL], are in fact marginal. This observation matches the universal tendency to avoid unbalanced trochees, cf. Hayes (1995). (The Atampaya dialect is the most restrictive since it has no HLL nor LHLL roots at all.) Interestingly Uradhi enforces this restriction at the *root level* rather than at the word level. This can be concluded from two pre-lengthening suffixes (genitive -:*namu* and reciprocal -:*niβa*), which derive words ending in HLL. An interesting example is the genitive of the HL root *taara* ‘reef’, *táaráanamu*, a double-stressed HHLL sequence with two long vowels in adjacent syllables. No root in Uradhi contains adjacent long-voweled syllables, while a final sequence HLL in roots is rare.

Let us now turn to the dialectal variation, which this analysis can describe by two minimal differences. First, the fact that HLL and LHLL roots are restricted to the Angkamuthi and Yadhaykenu dialects is captured by strictly bimoraic feet [H], [LL] in this dialect. Second, the fact that final root syllables cannot contain long vowels in the Atampaya dialect. For this dialect, all root-final syllables (light and heavy) are extrametrical, while in Angkamuthi and Yadhaykenu only light syllables are so.

7. Conclusions

We have found that for all languages discussed, canonical root shapes (maximal size and position of length) can be captured by template pools. And for all languages, the foot required in root shape agrees with the stress foot. Prosodic coherence was even enhanced by correspondence (in root shape and stress pattern) of *extrametricality* (Uradhi) and *catalexis* (Mbabaɽam). However, there appears to be no full isomorphy between stress feet and 'templatic' feet in some languages (Wargamay, Uradhi) in which the template pool functions as 'analytic' only.

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