Templatic Evidence for the Syllable Nucleus

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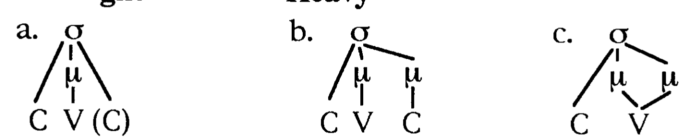
The central hypothesis of the theory of Prosodic Morphology claims that "templates are defined in terms of the authentic units of prosody" (McCarthy & Prince [henceforth McP] 1986, et seq.)*. This hypothesis is complemented by the Prosodic Hierarchy Hypothesis, which defines the actual units of prosody out of which templates must be constructed. The standard version of the Prosodic Hierarchy (cf. Selkirk 1980, Itô 1986, McP 1986, Zec 1988, etc.) recognizes the following units: Prosodic Word (PW) - Foot (F) - Syllable (σ) - Mora (μ). Significantly, this conception of prosodic structure does not recognize the traditional notion of Nucleus as a formal unit of syllable structure. This paper argues that the Nucleus is a necessary unit of the prosodic hierarchy in that the templatic representation of reduplicative morphemes in a number of genetically unrelated languages crucially requires reference to the distinction between a monomoraic vs. a bimoraic Nucleus in their formalization[1].

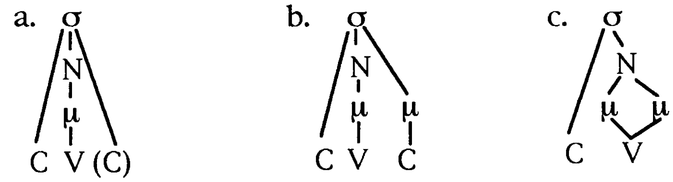
Syllable weight is standardly defined in terms of the mora (Hyman 1985, Hayes 1989, Zec 1988, etc.), this providing a fundamental dichotomy of syllable types into light monomoraic vs. heavy bimoraic syllables. Crucially, this conception of syllable structure, here termed the Non-nuclear Moraic Model, groups together the two types of bimoraic syllables in (1.b) and (1.c).

(1) **Non-nuclear Moraic Model: Light** **Heavy**



Although this claim has considerable empirical support from the behaviour of certain stress systems, compensatory lengthening processes, etc., the present paper provides evidence that morphological templates must also be able to distinguish between the two types of bimoraic syllables, the crucial factor being whether the Nucleus is monomoraic (a short vowel) or bimoraic (a long vowel), as illustrated by the proposed model in (2):

(2) **Nuclear Moraic Model:** **Light** **Heavy**



Central to the argumentation to be developed here is the phenomenon of quantitative transfer in templatic morphology, i.e. the transfer or copying of quantitative length/weight from a base to a prosodic template. Significant research on this issue, following from Clements (1985), has led to two empirically well-documented observations: (i) quantitative transfer is found only in languages with lexically distinctive quantity; and (ii) quantitative transfer is always secondary to the requirements of template size. On the basis of these observed restrictions, McP (1988) propose that quantitative transfer is constrained as in (3):

(3) **Quantitative Transfer**: All and only the lexically specified properties of the input are available for association.

In essence, their claim is that, in a language where vowel length is distinctive, it will always be transferred in the process of mapping from a base to a morphological template, so long as the template is large enough to accommodate the specified quantity.

The Mokilese forms in (4) exemplify a typical case of quantitative transfer:

(4) **Mokilese** (data from Harrison & Albert 1976; cf. McP 1986: 21-23):

a.	pɔdok	pɔd-pɔdok	'plant'
	dɔpʷɔ	dɔpʷ-dɔpʷɔ	'pull'
b.	ko:kɔ	ko:-ko:kɔ	'grind coconut'
	ca:k	ca:-ca:k	'bend'
	sɔ:rɔk	sɔ:-sɔ:rɔk	'tear'
c.	pa	pa:-pa	'weave'

Here the reduplicative prefix is a monosyllabic bimoraic template: [μμ]σ . In the forms in (4.a), the first syllable of the base has a short vowel and consequently, in order to satisfy the bimoraic condition of the template, the following consonant of the copied melody of the base is mapped into the second mora of the template. In the data of (4.b), however, the base has a long vowel; this lexically specified vowel length is "transferred" in the copy process and mapped to the prefix, filling both moras of the template. Note that if length were not transferred here, one would expect that a form such as [sɔ:rɔk] would reduplicate as *[sɔr-sɔ:rɔk] rather than the attested [sɔ:-sɔ:rɔk]. Finally, in (4.c), the fact that the underlying short vowel of the base lengthens in the prefix confirms that the reduplicative template is indeed invariantly bimoraic: if there is not enough copied material to satisfy the template, then some other process will ensure that the template is filled. In this case, the short vowel spreads rightward to fill the second mora of the template.

Of course, quantitative transfer is always subject to the restrictions of template size, i.e. length cannot transfer if the templatic affix is too small to accommodate it, as illustrated by the Tagalog data in (5):

(5) **Tagalog** (McP 1986, cited from Bowen 1969):

a.	galit	ga-galit	'get mad'
b.	ʔa:ral	ʔa-ʔa:ral	'to read'

Although Tagalog is a language with distinctive vowel length, the prosodic template for the particular reduplicative pattern shown here is a monomoraic syllable. Consequently, in (5.b), the underlying vowel length of the base cannot be mapped, as transfer would require at least a bimoraic template.

The behaviour of both the Mokilese and the Tagalog data is typical: there is a broad cross-linguistic base of strong empirical support for McP's claim in (3). Nonetheless, there is a set of cases which constitute apparent counter-examples to this hypothesis. The present paper investigates two such cases (Afar, Nisgha), but concludes that their behaviour does not in fact undermine the validity of the Quantitative Transfer Hypothesis in (3). On the contrary, these cases can be interpreted as providing an independent body of evidence in support of this hypothesis if prosodic theory is extended to re-introduce the traditional notion of syllable Nucleus into the prosodic structural organization of the syllable.

In section 4 of this paper, three other languages (Nootka, Nitinaht, Ojibwa) are shown to have reduplication processes which systematically violate another property assumed to constrain templatic morphology, namely Steriade's (1988:80) claim that "the prosodic weight of templates is always fixed". Significantly, in stark contrast to the hypothesis that cases of this type should not exist, the proposed Nuclear Moraic Model of (2) predicts that they should exist. Given that attributing formal prosodic status to the Nucleus provides a principled account of this independent type of seemingly anomalous templatic behaviour, the present paper concludes that there is compelling empirical evidence for enriching prosodic theory to include the syllable Nucleus.

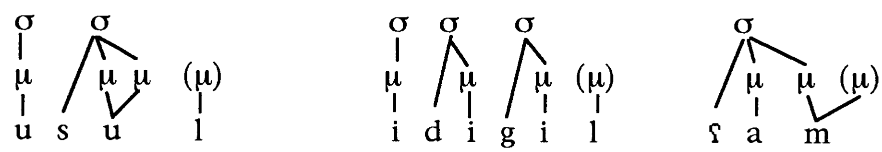
1. Afar reduplication

As an initial case of data which appear not to obey the Quantitative Transfer Hypothesis of (3), consider the Afar (Lowland East Cushitic) intensive reduplication process illustrated in (6) (Bliese 1981:127; cited from McP 1986:55). Note that a sequence of identical vowels represents a monosyllabic long vowel. The reduplicative morpheme is in boldface.

(6) a.	usuul	u-**sus**-suul	'laugh'
b.	biyaak	bi-**yay**-yaak	'hurt'
c.	idigil	idi-**gig**-gil	'break'
d.	ʕamm	**ʕam**-ʕamm	'throw'
e.	ess	**ess**-ess	'take out'

The first issue considered in the present analysis is the prosodic status of syllable-final and word-final consonants. Several facts support two principal conclusions claimed here: (i) that a consonant is moraic in post-vocalic (coda) position, and (ii) that a word-final moraic consonant is extraprosodic. Note first that the syllable-final consonant of the reduplicative prefix in each of the forms in (6.a-c) is derived through leftward gemination of the onset C of the following syllable. This gemination process is *prima facie* evidence that syllable-final consonants are moraic. Secondly, as exemplified in forms (6.a) and (6.b), it is evident that the language has superheavy syllables of the form [V:C] , but only in word-final position. On the assumption that syllables are maximally bimoraic, the limited distribution of these apparently trimoraic superheavy syllables would be explained by the third mora being licensed by word-final extraprosodicity. Thirdly, as exemplified by the form in (6.c), note that even when the final syllable of a word is not a superheavy syllable, the final consonant of that syllable does not get copied in the reduplication process; that is, (6.c) does not reduplicate as *[idi-gil-gil]. This could only be explained by treating the final moraic segment as extraprosodic, and therefore outside of the domain of the copy function of reduplication. Finally, consider the word-final geminate of (6.d) [ʕamm] . Assuming a bimoraic representation of geminates[2], we see that the prosodic structure and behaviour of (6.d) [ʕamm] is directly parallel to that of the other superheavy, trimoraic syllables in (6.a,b). To summarize the above argumentation, the prosodic representations motivated thus far in the present analysis are diagrammed in (7) below, with extraprosodicity of the word-final mora being indicated by parentheses:

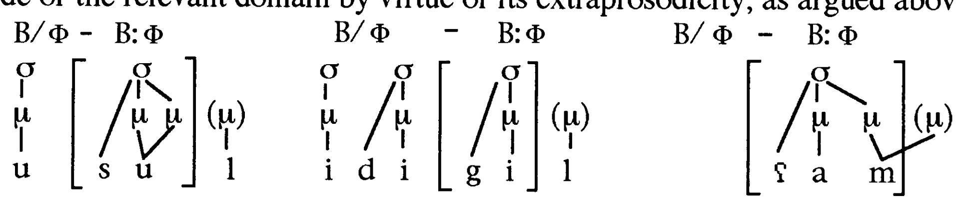
(7)



(6.a) [usuul] (6.c) [idigil] (6.d) [ʕamm]

We are now in a position to consider the Afar intensive reduplication process itself. The first question is to define the locus of affixation, for in the data in (6), the reduplicative morpheme variously appears as "infixed" after the first syllable in (6.a, b), as "infixed" after the second syllable in (6.c), and as prefixed to a monosyllabic base in (6.d, e). The consistent factor here is that the reduplicative affix is always inserted before the final syllable of the base. Consequently, if the base is defined in terms of prosodic circumscription (McP 1990a), where this identifies the rightmost syllable of the word, then reduplication can be straightforwardly analyzed as a prefix to this prosodic base. Adapting the formalism of McP (1990a), the diagrams in (8) indicate this prosodic parsing of the input stems into the circumscribed base (B:Φ) and the residue (B/Φ). Note that in a case such as (6.d), where the input is monosyllabic, the residue (B/Φ) is null. Note further that the final μ is already outside of the relevant domain by virtue of its extraprosodicity, as argued above.

(8)

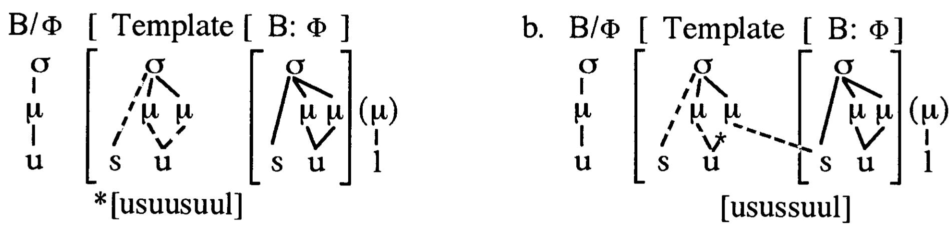


(6.a) [usuul] (6.c) [idigil] (6.d) [ʕamm]

Prosodic circumscription performs two functions: not only does it identify the affixation site (prefixation to the left edge of the base, B:Φ), but it also identifies the content to be copied. That is, following hypothesis (3), what is to be copied in the reduplication process is delimited to the lexically distinctive content of B:Φ.

The next issue is to define the prosodic template for the reduplicative prefix. From the data in (6), it is evident, especially from forms such as (6.a-c) which trigger leftward gemination of the onset C of the following syllable, that the templatic prefix is consistently a single bimoraic syllable. However, given the Quantitative Transfer Hypothesis in (3) which claims that lexically distinctive properties are always transferred in reduplication so long as they can be accommodated by the template, what is entirely unexpected here is the failure of the distinctive vowel length of bases like (6.a-b) to copy into the template. That is, the bimoraic Afar template should accommodate this vowel length, giving the (incorrect) derivation diagrammed in (9.a). Clearly the ubiquitous condition of Template Satisfaction is operative, as the second mora of the template is filled, as shown in (9.b), by backwards gemination of the following consonant.

(9) a. b.



The question therefore is: is there, without abandoning the Quantitative Transfer Hypothesis in (3), a principled account for the failure of the lexically distinctive vowel length to transfer here?

The root of the problem, I submit, lies in the failure of standard moraic theory to prosodically differentiate the two distinct types of bimoraic (heavy) syllables in (1.b/1.c). Standard moraic theory predicts that these two types of bimoraic syllables will always behave as a class. Whereas the templatic behaviour of the Mokilese reduplication data of (4) shows that they sometimes do class together (for the requisite template unifying (4.a) and (4.b) is a simple, undifferentiated bimoraic syllable), the templatic morphology of Afar (and other cases to be discussed below) shows that these two types of heavy syllables sometimes do not pattern alike. In the present analysis, it is claimed that the fundamental distinction between the two is the weight of the Nucleus. Thus, as represented in (2) above, I claim that prosodically-sensitive phonological or morphological processes in languages can differentiate between bimoraic (heavy) syllables which have a monomoraic (non-branching) Nucleus (2.b) or a bimoraic (branching) Nucleus (2.c). Before discussing the broader theoretical implications of this, consider first the application of this hypothesis to the Afar case.

The claim here advanced is that the appropriate form of the Afar template is the prosodic representation in (2.b): a single bimoraic syllable, crucially with a non-branching N. As illustrated in (10.a) below, the templatically specified constraint against a branching N prevents the lexically distinctive vowel length of the copied syllable of (6.a) [suu] from mapping into the second mora of the template; the principle of Template Satisfaction is nonetheless still operative, triggering leftward spreading of the following onset segment to fill the second mora. The representation

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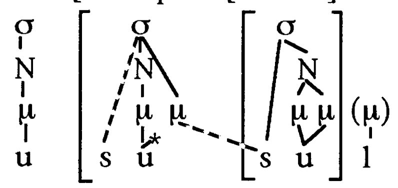
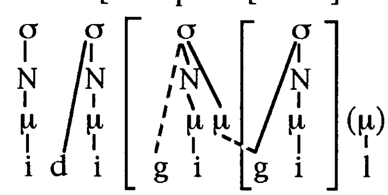
in (10.b) shows how backwards gemination from the following onset is similarly required in order to fill the second, non-nuclear mora in cases where the copied root vowel is short. In contrast, the form in (10.c) illustrates the case where the prosodically circumscribed base includes post-nuclear segmental content which copies and maps directly into the template. Interestingly, the final representation (10.d) shows what happens with a monosyllabic vowel-initial root. The root [ess] 'take out' reduplicates not as *[esess], but rather as [essess], illustrating in this case *rightward* gemination of the final [s] of the prefix in order to provide an onset for the following onsetless syllable, while still maintaining the bimoraic status of the reduplicative template.

(10) a. B/Φ [Template [B: Φ]



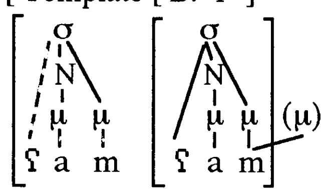
(6.a) [usussuul]

b. B/Φ [Template [B: Φ]



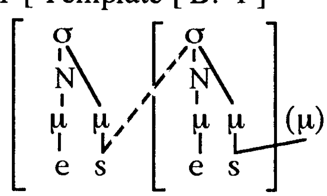
(6.c) [idigiggil]

c. B/Φ [Template [B: Φ]



(6.d) [ʕamʕamm]

d. B/Φ [Template [B: Φ]



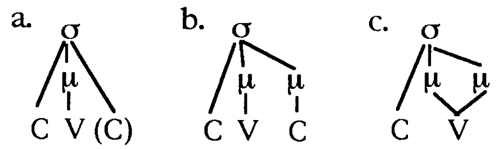
(6.e) [essess] 'take out'
*[esess]

To summarize, it has been argued that the failure of the Afar intensive reduplication to allow quantitative transfer of lexically distinctive vowel length into the bimoraic reduplicative template provides compelling empirical evidence that prosodic theory must be able to differentiate between two types of bimoraic syllables. It is further claimed here that the criterial basis of this distinction is most appropriately captured by recognizing the syllable Nucleus as a formal category in the prosodic hierarchy. As illustrated earlier in (2), bimoraic syllables thus subclassify into those that have a branching (bimoraic) Nucleus node, and those that have a non-branching (monomoraic) Nucleus followed by a non-nuclear mora. The theoretical implications of this hypothesis are explored in the next section.

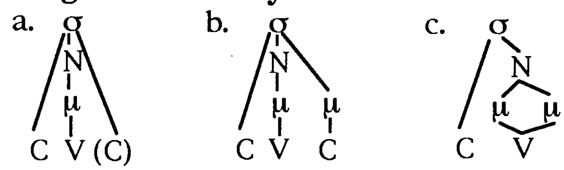
2. Theoretical implications of positing a Nucleus node

The proposal to enrich the number of prime constituents in prosodic theory by adding a syllable Nucleus node into the hierarchy has strong predictive empirical content, in that it expands the class of possible templates available for morphological (and phonological) reference. In order to evaluate the consequences of this proposed enrichment of the theory, compare once again the fundamentally binary typology of syllable structures licensed by standard Non-nuclear Moraic Theory, i.e. those models broadly represented in (1) above [repeated here for reference], with the tripartite classification entailed by the Nuclear Moraic Model of (2).

(1) **Non-nuclear Moraic Model**
Light **Heavy**



(2) **Nuclear Moraic Model**
Light **Heavy**



The Nuclear Moraic Model in (2) makes a number of distinct empirical predictions regarding possible templatic specification. Obviously, these predictions are only testable in languages which have both lexically distinctive vowel length and at least a subset of moraic consonants in the inventory. Four types of predictions are summarized in the table in (11), with reference to the different structures posited for syllable types (a,b,c) in models (1) and (2).

Significantly, each of the four predicted classifications are attested in the templatic morphology of the languages reported on here. The fact that a Non-nuclear (Non-N) Moraic model cannot formally characterize *any* of the attested templatic types in (11), whereas the Nuclear (N) Moraic Model provides a restrictive and systematic account of all these types, is strong motivation in favour of the present claim that the Nucleus node must be formally incorporated into the prosodic hierarchy.

(11) Predicted Templatic Distinctions:

	Non-N Model	**N Model**	**Attested**
I. heavy σ, but only short V (b); but not *(a), *(c)	*	bimoraic σ with monomoraic N	Afar
II. max. σ, but only short V (a), (b); but not *(c)	*	max σ with monomoraic N	Nisgha
III. variable weight: copy V length of base (only open CV or CV:)	*	N	Nootka, Nitinaht, Ojibwa
IV. heavy σ, but only long V (c); but not *(a), *(b)	*	bimoraic N	Standard Arabic

The template characterized in (11.I) is attested in Afar, as documented in Section 1. The other predicted templates are each investigated in turn in the following sections.

3. Templatic Form: max σ with monomoraic N

The Template characterized in (11.II) differs from the Afar type of case in only one respect: because both the syllable types (2.a) and (2.b) share the structural property of having a monomoraic Nucleus, the model predicts that they could function together as a class, in contradistinction to the bimoraic Nucleus structure of (2.c). This is exactly the case in the Nisgha (Tsimshianic) reduplication pattern (Tarpent 1983, 1987; Shaw 1987) documented in (12).

(12) a.	qá:p	qap-qá:p	'to scratch stg.'
	ɬé:χ̣-k^{w}	ɬaχ̣-ɬé:χ̣-k^{w}	'to have finished eating'

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	ɬó:q	ɬaχ-ɬó:q	'to wake or get up early'	[Spir: q → χ]
	ʔúx	ʔax-ʔúx	'to throw stg.'	
	híx	hax-(h)íx	'to be fat'	
	háw	haw-(h)áw	'to stop, go home'	
b.	ɬáx^{w}	ɬux^{w}-ɬáx^{w}	'to shake stg.'	
	tá:w	tu:-tá:w	'to freeze'	
	t'ák^{w}	t'ux^{w}-t'ák^{w}	'to twist stg.'	[Spir: k^{w} → x^{w}]
c.	wá:x	wix-wá:x	'to paddle'	
	t'á:p	t'ip-t'á:p	'to drive stg. in'	
	t^{s}ám	t^{s}im-t^{s}ám	'to boil, cook stg.'	

Note first that the quality of the vowel in the reduplicative prefix is independent of that in the base, this being predictable on the basis of the adjacent consonants. The specific contexts for this assimilation are stated informally in (13):

(13) **Unstressed short V Colouring:**

(12.a)	[a] / uvular & laryngeal consonants
(12.b)	[u] / before a tautosyllabic rounded velar consonant
(12.c)	[i] / elsewhere

What is significant for our present purposes is not the vowel quality in the prefix, but rather its quantity, for as is evident from the examples isolated in (14), as well as from other forms in (15), it is systematically the case that lexically distinctive vowel length is not transferred into the template in Nisgha. That is, like Afar, Nisgha appears to violate the Quantitative Transfer Hypothesis of (3) above.

(14)	wá:x	wix-wá:x			'to paddle'
	t'á:p	t'ip-t'á:p			'to drive stg. in'
	tá:w	tuw-tá:w	→	[tu:-tá:w]	'to freeze'

It is important to establish, however, that the template could accommodate bimoraic quantity. That this is indeed possible follows from evidence that resonant consonants are moraic in Nisgha, although obstruents are not. Two types of evidence establish this. First, the forms in (15) are from a different, independent reduplication pattern, one defined with a simple monomoraic [μ] template (Walsh 1990; Shaw & Walsh 1991). What is most relevant here is the data in (15.b), which illustrate the fact that a base-initial resonant consonant suffices to satisfy the monomoraic template, with the resonant itself being realized as syllabic.

(15) a.	páʔ	pi-páʔ	'thigh'
	kát	ki-kát	'people'
	hát̓^{s}	ha-hát̓^{s}	'to be biting stg.'
	sú:s	si-sú:s	'to be small'
	ɬínkit	ɬi-ɬínkit	'Tlingit (sg); slaves (pl)'
b.	ní:l̓uk^{w}	n̩-ní:l̓uk^{w}	'to be long (pl)'
	m̓á:l	m̩-m̓á:l	'canoe'
	láy̓	l̩-láy̓	'to be large, big'

Independent evidence for the moraic status of resonants derives from the different behaviour of tautosyllabic [VO] sequences vs. [V:] and [VR] sequences with respect to stress. As illustrated in (16), stress in Nisgha is restricted to the root, and is quantity-sensitive from the right edge (Thompson 1984; Rigsby 1986; Tarpent 1987; Walsh 1990). On roots with two monomoraic syllables (16.b), stress falls on the rightmost one. The forms in (16.c) show that a long vowel attracts stress forward, but only if the final syllable is monomoraic; compare with (16.d). The bisyllabic roots in (16.e) establish that post-vocalic resonants function like the long vowels of (16.c) to attract stress if the syllable at the right edge is light. In contrast (16.f), post-vocalic obstruents do not. This behaviour is straightforwardly explained by an analysis which recognizes only post-vocalic resonants as moraic.

(16) a.	siluxʷlúkʷaˀti:t	'they loaded up'
	[[si-[luxʷ-[lúkʷ]]-aˀ]-ti:t]	[make/do-RedupPl-to move-detrans-3pl]
b.	pil̓íst	'star'
	kʷilá	'blanket'
c.	qɔ́:ta	'to be all gone'
	hí:ɬukʷ	'morning'
d.	t̓ˢu:pé:q	'mushroom'
	ta:ɬé:	'sleet'
e.	qáwsukʷ	'to be quiet'
	ˀálta	'amabilis fir'
	kímxti	'opposite sex sibling'
	háɣtaX̧	'Haida people'
f.	naX̧ńá	'to hear something'

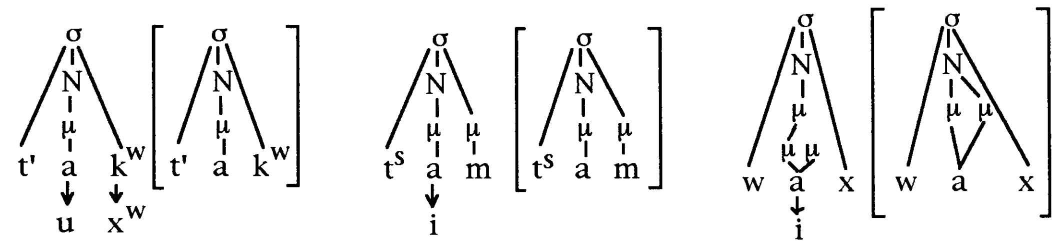
Returning to the question of the appropriate prosodic characterization of the reduplicative template for the Nisgha process exemplified in (12), the different moraic status of resonants and obstruents in Nisgha leads us to conclude that the weight of the prefix is variable. That is, sometimes (17.a) it is a monomoraic closed syllable of the type in (2.a), whereas sometimes (17.b) it is a bimoraic closed syllable of the type in (2.b).

(17) a. sometimes (2.a):	$[[\mu]_N\ ]\sigma$	t'ákʷ	t'uxʷ-t'ákʷ	'to twist stg.'
b. sometimes (2.b):	$[[\mu]_N\ \mu]\sigma$	tˢám	tˢim-tˢám	'to boil/cook stg'
c. never (2.c):	$[[\mu\ \mu]_N\ ]\sigma$	wá:x	*wa:-wá:x wix-wá:x	'to paddle'

Although this kind of behaviour constitutes one type of counterexample to Steriade's (1988: 80) claim that "the prosodic weight of templates is always fixed", one might hypothesize that the template here be specified simply as a *maximal* syllable (McP 1986), incorporating a second mora if available from the copied portion of the base. But, as already seen (14, 17.c), the critical problem here is that lexically distinctive vowel length transferred from the base is *never* mapped into the template. Given that a bimoraic realization of the template is systematically attested (17.b), if the heuristic were simply to map a second mora if available, then one would expect the vowel length in cases like (17.c) to map. Clearly there is a criterial functional difference between the second moras in syllables like (17.b/2.b) vs. (17.c/2.c).

The appropriate generalization for Nisgha, like Afar, is that the template must be restricted to a monomoraic Nucleus. The parametric difference between the Nisgha case and the Afar case is that the Nisgha maximal syllable allows post-nuclear content to map whether it is moraic or not, whereas the Afar bimoraic template requires that a second post-nuclear mora be filled. Diagrams illustrating the templatic structure and mapping of representative Nisgha forms are presented in (18):

(18) Template [Base] Template [Base] Template [Base]



(17.a) [t'ux^w-t'ák^w] (17.b) [t^{s}im-t^{s}ám] (17.c) [wix-wá:x]

4. Nuclear Templates of Variable Weight

With reference back to the table in (11), consider now the third prediction made by the Nuclear Moraic Model, specifically that a template could be defined in terms of a Nucleus node alone, allowing for variable weight to be mapped into it, subject to the constraints of Quantitative Transfer as already stipulated in (3). This prediction is particularly significant because it conflicts directly with previous claims in the literature. If such cases were indeed unattested and their absence not otherwise explicable, then this would seriously undermine the empirical substance of the present proposal. If, however, such cases are attested, then their predicted existence must offer considerable support for the Nuclear Moraic Model.

Steriade (1988) focusses this issue nicely. In support of her hypothesis that "the prosodic weight of templates is always fixed" (1988: 80), she observes: "If a monosyllabic template consists of an open syllable, its vowel length is always fixed....I haven't yet encountered a reduplicative template consisting of an open syllable with variable weight, yielding forms like *ba-bana, baa-baana*." In contrast, the prosodic model proposed here in (2) claims that precisely such a template should occur if the Nucleus node is an independent category of the prosodic hierarchy. That is, the Prosodic Morphology Hypothesis (McP 1986 ff.) entails the claim that any prosodic category is a possible morphological template. Thus, the Nuclear Moraic Model of (2) predicts that a template could be defined in terms of N alone, i.e. an N of unspecified weight. Consider the consequences of this applied across syllable types (a,b,c): if the template is an unspecified N, then a base with a monomoraic nucleus will copy and map that short vowel into the template N, but a base with a distinctively long vowel, will copy and map the vowel length. If syllable structure markedness constraints were to independently require the obligatory mapping of an onset consonant, this would constitute exactly the "open syllable with variable weight" type of case characterized by Steriade. The traditional moraic model in (1) has no way of defining open syllables as opposed to closed syllables in a language with both; on the assumption that this is not a relevant distinction, independent of syllable weight, the model is designed only to differentiate light vs. heavy syllables, both of which may be either open or closed.

Not one, but three languages of the type unattested by Steriade are documented here. The fact that the analysis of the variable vowel length of the templatic affix in each of these cases receives a principled explanation under the assumptions of the Nuclear Moraic Model constitutes striking empirical support for the model.

Consider first Nootka, a Wakashan language, as documented in Stonham (1990; based on Swadesh 1937, Sapir & Swadesh 1939, 1955). Data such as that in (19) establish that Nootka has contrastive vowel length:

(19) a.	mas-	'healed up'	b.	-uk	'durative, transitive'
	ma:s-	'baking on an open fire'		-u:k	'all over'

Forms illustrative of the Reduplication pattern of particular relevance to the present discussion are given in (20) (Stonham 1990:19, 131):

(20) a.	/c̓awa/	c̓a-c̓awa-čiɬ	'naming one'
	/ʔu/	ʔu-ʔu-'i:h	'hunting it'
b.	/wa:s/	wa:-wa:s-čiɬ	'naming where...'
	/ta:kʷa/	ta:-ta:kʷa-'i:h	'hunting only that'
c.	/čims/	či-čims-'i:h	'hunting bear'
	/čims/	či-čims-čiɬ	'naming a bear'

The data in (20.a) show that a short vowel nucleus in the base copies as short in the Reduplicative affix, whereas the data in (20.b) show that a long vowel nucleus in the base copies as long in the Reduplicative affix. Clearly these data are not analyzable in terms of a single template of invariant weight. Moreover, it is evident that the variable weight in the templatic prefix is directly dependent on transfer of the distinctive vowel length of the root. A further fact of considerable interest is seen in (20.c): these forms are derived from bases with a third type of canonical syllable, specifically a short vowel followed by a moraic nasal consonant. Significantly, the Reduplicative prefix on such roots maps only the vocalic nucleus and not the post-vocalic nasal, even though nasals are demonstrably (see below) moraic and even though the Reduplicative template must allow that a second mora sometimes be mapped in order to account for the data of (20.b). In short, these data show once again that nuclear and non-nuclear mora behave differently, and that templatic specification must be able to reference this distinction.

From the considerable breadth of evidence which Stonham (1990: 134, 144) provides, the stress facts alone will suffice to establish the moraic status of post-vocalic (tautosyllabic) nasals in Nootka. Stress in Nootka is determined from the left edge and falls on the first heavy syllable, the data in (21.a) illustrating cases where heaviness is instantiated by vowel length. As seen in (21.b) however, a short vowel plus nasal sequence functions as heavy to attract stress, even when in competition with an immediately following long vowel. Consequently, nasals must be considered moraic.

(21) a.	nú:taswe'ʔin	'they are going to play the hoop game, it is said'
	n̓á:csa:ƛ̓weʔin	'they looked at her, it is said'

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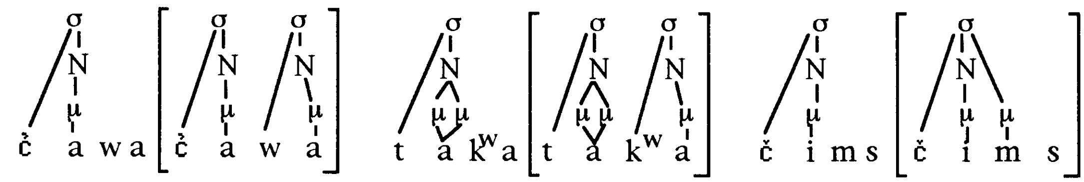
hawá:taƛweʔin	'after eating, it is said'
b. čímsm̓i:t	'Son of Bear'
X̣ačímsiqsakʔi	'her brothers'

The derivations in (22) of Nootka reduplicated forms illustrate the effect of mapping copied material from the base into a template defined as a N node of unspecified weight. The hypothesis of Quantitative Transfer in (3) ensures that the distinctive moraic specification of the base vowel will be copied such that it will then be mapped intact into the unspecified N. Note particularly in the derivation of (20.c) that it is, once again, crucial to prevent the mapping of a post-nuclear mora, even though it is clear from cases like (20.b) that the prefix can be bimoraic. What is consistently necessary is the recognition that nuclear mora play an independent role from non-nuclear mora.

(22) Template [Base] Template [Base] Template [Base]



(20.a) [č̓a-č̓awa-] (20.b) [ta:-ta:kʷa-] (20.c) [či-čims-]

Two other cases are presented below which exhibit an essentially identical open syllable template where variable vowel length in the reduplicative prefix is directly dependent on the vowel length of the base. The first is Nitinaht (Wakashan):

(23) **Nitinaht** (Stonham 1990):

a.	ƛ'ic-ak	'whiteness' [white-DUR]
	ƛ'i-ƛ'ic-akuk	'flour' [REDUP-white-resembles]
b.	tu:ɬ-apt	'spruce tree' [scare-plant]
	tu:-tu:ɬ-ubq-akuk	'juniper-leaved hair moss' (lit. resembles a spruce)

The second case is Ojibwe, from the Algonquian language family:

(24) **Ojibwe** (Blain 1991; data cited from Nichols 1980):

a.	ma-miskwa:tte:	'there is a flashing red light'
	wa-waniššin	'he gets lost here and there'
	ka-koškosi	'he gets up off and on'
b.	ka:-ki:škikwe:pina:t	'he broke their necks off sequentially'
	sa:-sa:ka'am	'he goes out from time to time'
	na:- no:tin	'there is wind from time to time'

Although the three languages discussed in this section exemplify reduplication patterns which constitute incontrovertible counter-examples to Steriade's (1988) claim that "the prosodic *weight* [emphasis mine/PAS] of templates is always fixed", all the analyses presented here sustain the hypothesis that the prosodic *form* of templates is invariant, provided that the syllable Nucleus node is accorded formal status within the prosodic hierarchy.

5. Templatic Specification of a Bimoraic Nucleus

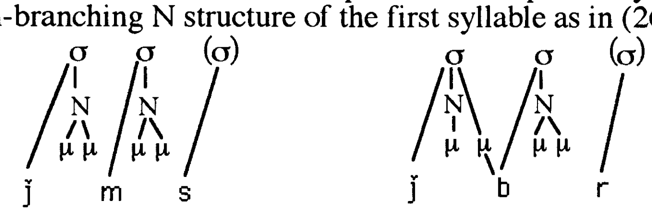
The final issue to be considered is the fourth type of predicted templatic form identified in the table in (11), specifically a heavy syllable template restricted to a bimoraic Nucleus. Such a case entails a language with both long vowels and moraic consonants, i.e. with syllables of both types (2.b) and (2.c), but where the template itself requires that the second mora can be filled only by vowel length. Although I know of no reduplication data which exemplify this restriction, consider what such a case would involve. The Mokilese data in (4) above exemplify a case of a simple bimoraic syllable template. If these data were subject instead to the bimoraic nucleus template defined in (11.IV), the output would be as in the Hypothetical Mokilese forms in (25):

(25)	pɔdok	*pɔd-pɔdok	pɔ:-pɔdok	'plant'
	dɔp^{w}ɔ	*dɔp^{w}-dɔp^{w}ɔ	dɔ:-dɔp^{w}ɔ	'pull'

What is necessary here is that an eligible moraic consonant in the copied portion of the base *not* map to the template; instead, the copied short vowel must become long by spreading into the second mora of the template. The apparent absence of a natural language case like this within reduplicative morphology may be a fortuitous gap or it may be systematic. At present, I leave this issue open[3].

Nonetheless, other types of templatic morphology might entail a bimoraic N template. Consider, for example, the situation within the nonconcatenative morphological system of Arabic (McP 1990b) where there are long vowel vs. medial geminate contrasts between certain templatically defined morphological subclasses. Noting (1990b:41) that "moraic theory...is unable to distinguish between the two types of heavy syllables Cvv and CvC", McP argue that all such contrasts can be dealt with in terms of lexical marking or grammatically controlled applications of gemination or vowel lengthening. The present proposal provides an alternative possibility: namely, differentiating such forms directly in terms of templatic structure. Thus, consider the contrast in underived triliteral noun forms like [ǰaamuus] and [ǰabbaar] discussed in McP (1990b:32, 43ff)[4]; both patterns are analyzed as a sequence of two heavy syllables followed by an extraprosodic "incomplete syllable" dominating the final C: [μμ][μμ] (σ). Whereas McP treat the [ǰabbaar] pattern as derived by a lexically governed application of medial gemination, the present framework allows the contrast to be represented templatically in terms of the branching vs. non-branching N structure of the first syllable as in (26):

(26)



To ensure medial gemination, the mode of association of the second pattern entails first, Edge-Linking of the rightmost C to the final (σ) templatic position, and then, regular Left-to-Right association, with spreading of the medial C to fill the following onset position in accordance with the obligatory Onset Rule (McP 1990b: 48). The first pattern simply entails regular Left-to-Right association.

6. Conclusions

To summarize, I have documented several cases of templatic morphology which cannot be accounted for within the current body of hypotheses which collectively function to constrain and characterize templatic behaviour. I have argued, however, that extending the Prosodic Hierarchy to include a Nucleus constituent, thus allowing the two functionally distinct types of bimoraic syllables in (2.b) and (2.c) to be formally differentiated, provides a principled and constrained account of these otherwise problematic data, while maintaining the Prosodic Morphology Hypothesis and the Quantitative Transfer Hypothesis (3) in their strongest form.

Endnotes:

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[1] Steriade (1991) also argues that a distinction between nuclear and non-nuclear moraic segments must be recognized, her evidence pertaining to minimal weight conditions and to various phonological properties of tone assignment, accentuation, diphthongization in Early and Classical Greek and in Lithuanian. Contrary to my conclusions here, Steriade decides against giving a structural interpretation to the Nucleus, opting instead for identifying such segments by reference to selected feature content (e.g. sonorancy) in combination with their prosodic (moraic) status.

[2] The fact that heterosyllabic geminate consonants do not surface as bimoraic is due, of course, to the second half of the geminate functioning as onset to the following syllable and, following a central tenet of moraic theory, onsets are not moraic. Whether this is effected by demorification (cf. Hyman 1985) or simply pre-empting morification (cf. Hayes 1989) is immaterial to the present argumentation.

[3] If a natural language case of reduplication like this is not attested, then one would question whether there is not some general principle which excludes it. Steriade insightfully notes that "[p]rosodic templates frequently eliminate certain marked options from their syllabic structures" (1988: 80). Given that a bimoraic Nucleus is more marked than a monomoraic one, the effect of a template like (2.c) would be to systematically eliminate the lexically distinctive property of V length from the base, in the direction of the more marked option in the affix. The lack of such cases might therefore follow from an independent markedness constraint such as:

Syllable Structure Markedness Constraint on Templatic Form:

> The prosodic form of a morphological template can only override lexically distinctive properties of a language if the syllabic adjustment is less marked.

[4] Other possible examples could be drawn from the verb system: (i) Form 2 [faʕʕal] vs. Form 3 [faaʕal], where McP (1990b:48) attribute the medial gemination in Form 2 to a grammatically-conditioned rule of association; or (ii) Forms 4 vs. 10 with

biliteral roots, [ʔasmam] and [stasmam], where McP (1990b:49) cannot in general account for the fact that the first syllable in these stems is closed.

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