Prosodic Edge-in Association

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To account for association of melody units with skeletal slots, two proposals were made originally, first that association is universally left-to-right (e.g. Goldsmith 1976 on tone and McCarthy 1981 on template morphology), and second that association is 'outside-in' (e.g. Marantz 1982 on reduplication). Yip 1988 argues that these proposals can be unified under a single generalization, namely that association may (or must) work from the edges inward, in both stems and affixes. In the case of a root or stem, association is first to both edges of the domain, with subsequent association of medial units. In this paper, I argue that Icelandic template association and syllabification provide striking support for edge-in association and, further, resolve an indeterminacy in the Yip 1988 theory by showing that edges require directional association. First, I present evidence that Icelandic syllabification is coda-maximal and governed by a trimoraic template. Next, I show that template association is edge-in, with left-right association of edges. Concluding evidence for both edge-in and left-right edge association will come from syncope.

Coda-maximalization and the trimoraic template

If a CVCV string is syllabified with the medial consonant in the second syllable (via the obligatory onset rule) and the maximum syllable weight is bimoraic (e.g. Hyman 1985, McCarthy and Prince 1986), quantity languages with long vowels in both monosyllabic words closed with a final consonant and in the first syllable of disyllabic CVCV words may provide evidence for extrametricality, or extraprosodicity: if the final consonant of monosyllabic words is extrametrical, the parallel behavior of the vowel in both types of words can be captured by a rule of "open syllable lengthening", as in Kiparsky's 1984 analysis of Icelandic. However, under a *constrained* theory of extrametricality (EM) and with consideration of additional evidence, we can establish that final consonants are not extrametrical in Icelandic. Rather, Icelandic syllabification is coda-maximal, and final consonants are obligatorily associated with the syllable. Taking the mora to represent, in this case, an obligatory weight unit of

the rhyme, as opposed to an independent pitch-bearing unit, we may represent the constraint governing the stressed, initial syllable of Icelandic as a trimoraic template that licenses two types of heavy rhymes, VVC and VCC rhymes. Thus, the necessary lengthening rule applies in light syllables, both V syllables and also VC syllables. Syllable theory must be accordingly parameterized.

In a restrictive theory, extrametricality must be a property of representations and not a diacritic property of individual rules. If EM is a diacritic unique to individual rules, then nothing prevents its use in the statement of vowel lengthening (other than minimal criteria, such as periperality, single prosodic unit, etc.); however, the cost is high, an unconstrained, seriously weakened theory. If, rather, EM is a property of representations, then independent evidence for its use can come from other rules that operate on the same representations. Two leading approaches to syllable extrametricality take the strong, and desirable, position that EM is a property of representations. The first and widely supported theory assumes that extrametrical elements are unincorporated into the prosodic structure. This is the analysis presented in Kiparsky 1984. In the standard view, extrametrical and other unassociated elements are the unmarked candidates for stray erasure. The second theory also recognizes unassociated elements as deletion targets, but in contrast takes extrametrical elements to be prosodically "licensed" and therefore not targets for stray erasure. This is the theory of Itô 1986.

Yet, neither interpretation of extrametricality can be properly applied to Icelandic. The deletion and coalescence facts rule out a Kiparsky-type analysis, since word final "extrametrical" consonants, though unassociated in such an analysis, are not the consonants that are deleted or melodically incorporated through coalescence. Icelandic compensatory lengthening facts rule out an Itô 1986 type analysis wherein extrametrical consonants, though licensed, are not moraic and thus cannot serve as melody sources for compensatory lengthening, which however they must do. The compensatory lengthening facts are also problematic for a Kiparsky-type EM analysis.

Under (1) are the basic vowel quantity facts. In Icelandic, long vowels are found in monosyllabic words closed by at most a single consonant and in the first syllable of disyllabic CVCV words. In monosyllabic words closed by two or more consonants and in disyllabic words with two or more medial consonants, the vowels in question are always short. This vowel length contrast occurs only in the first syllable, the syllable that receives stress.[1]

(1)	a. *bók* 'book'	/bouk/	[bou:k]
	b. *bú* 'household'	/bu/	[bu:]
	c. *koma* 'come'	/kom-a/	[ko:ma]
	d. *aska* 'ash'	/ask-a/	[aska]
	e. *land* 'land'	/land/	[land]

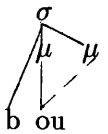
[1]Phonetic and underlying forms minimize irrelevant issues, such as the complex details of sonorant devoicing, the distribution of aspiration and the nature of the voicing contrast (the text symbols /b, d, g/ are underlyingly voiceless, unaspirated (sometimes represented b̥, d̥, g̥) and /p, t, ,k/ are underlyingly voiceless, aspirated). [o] is used for lax, open-o.

For a number of reasons both phonological and morphological, the preferred analysis of Icelandic quantity is one where length is distinctive in consonants and where vowel length is derived (cf. Benediktsson 1963, who also presents historical arguments; and Venneman 1972). Briefly, we find sets like those under (2).

(2) *lög* 'laws' [lö:g], *lögg* 'small quantity of liquid', [lög:], *frami* 'fame' [fra:mɪ], and *frammi* 'out' [fram:ɪ]; *ís* 'ice' [i:s] and *íss* *ís* + s 'ice (gen sg)' [is:].

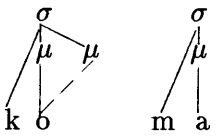
Accordingly, vowels are underlyingly short. To derive the vowel quantity, we could capture the parallel quantity facts in monosyllabic and disyllabic words seen in (1a) and (1c) with an open syllable ; lengthening rule, if word-final consonants are extrametrical, as proposed in Kiparsky 1984 and shown in (3).

(3) a. word final consonants are extrametrical;
b. vowels are lengthened in open syllables (Kiparsky 1984)
c.



(k)^{em} → [bou:k]

d.



→ [ko:ma]

As can be seen in (3), extrametricality is the absence of incorporation into prosodic structure. Such extrasyllabicity, introduced by Clements/Keyser 1983 (cf. also Hyman 1985), has been used, for example, to account for deletion in French where extrametrical consonants that cannot be re-syllabified into a following onset are deleted, as shown under (4). Steriade (1982), among others, has proposed that all consonant deletion is the result of stray erasure of unsyllabified segments.

(4) pe tit gar con pe tit a mi
↓
∅

If extrametricality means unincorporated into prosodic structure, the analysis under (3) predicts that word-final consonants should delete, if there are deletion rules in the language in question, as should medial consonants that cannot be syllabified into a following onset. In Icelandic, deletion of consonants is widespread. Both heteromorphemic and monomorphemic, triconsonantal sequences are reduced to two (except when C2 is /p,t,k,s/ and C3 is /v,j,r/), as shown in (5). Geminates degeminate (i.e. lose a C slot) (5i). For a sequence of three different consonants, generally C2 deletes, but C1 may delete under special circumstances: for example, when C1 is /r/, it deletes before /s, sk, sn, st, nd, nt/; see, for example, 5ic, 5iiic and d. C3 never deletes.

(5) Consonant cluster reduction: $C_1C_2C_3 \rightarrow C_1\ C_3$

(i) Degemination (heteromorphemic)
(a) *sleppa* 'let go' /slɛpp-a/ [slɛhpa] → *slepptu* /slɛpp-tY/ [slɛftY] (imper)
(cf. *lapti* /lapti/ [laftɪ])
(b) *missti* 'lose (pret, 1st, sg)' /mɪss-t-ɪ/ [mɪstɪ]
(cf. *missa* 'to lose' /mɪss-a/ [mɪs:a])
(c) *karlsson* 'son of karl; churl' /karl-s-son/ [kalson]
(d) *allt* 'all (neuter, accus)' /all-t/ [alt]

(ii) Deletion (heteromorphemic)
(a) *kembdi* 'comb (pret, 1st, sg)' /kɛmb-t-ɪ/ [kjɛmdɪ]
(cf. *kemba* 'to comb' [kjɛmba])
(b) *hálfra* 'half (gen, pl)' /haulf-ra/ [haulra]
(c) *lands* 'land (gen)' /land-s/ [lans] (cf. *land* 'land (nom)' [land])

(iii) Deletion (monomorphemic)
(a) *álft* 'swan' /ault/ < /aulft/ [ault]
(b) *olnbogi* 'elbow' /olnbog-ɪ/ [olboijɪ] (*bog-* is a morpheme, *oln* is not)
(c) *fyrst* 'first'; 'since' /fɪrst/ [fɪst]
(d) *stirndur* 'full of stars' /stɪrnd-Yr/ [stɪnd̥Yr̥], *stirnd* [stɪnd̥] nom, fem, sg

Two facts are clear in (5). First the same consonants delete in medial and in final position. These consonants are, with few exceptions, *medial* in the string. Second, the extrametrical *final* consonants *never* delete. This across-the-board absence of any deletion of a final, supposedly extrametrical consonant is the first evidence that this position is obligatorily associated with the syllable. I will be using this evidence to argue that this position is therefore moraic. For the moment, however, we may conclude that the deletion facts eliminate the standard extrametricality analysis. The same conclusion follows from a consideration of the coalescence facts, as well.

In Icelandic, coalescence is the complement of deletion. As shown in (6) where all words but (b) are monosyllabic, we find that in particular $C_1C_2C_3$ strings, C_1 and C_2 coalesce or merge, as for example, the /fnC/ and /gnC/ codas. In underlying two consonant codas, /fn/ is [pn] and /gn/ is [gn]: e.g. *hrafn* [hrapn] and *megn* [mɛgn]. In triconsonantal codas, /f+n/ [pn] coalesce into [m], and /g+n/ [gn] coalesce into the velar nasal [N] (n.b. the final nasal is indeed coronal in a two C coda). The merger of melodies seen here and in other coda sets is one of the more unusual ways the well-formedness condition on the stressed syllable template is met. For the present discussion, the point is that the supposedly extrametrical, unassociated C3 never undergoes coalescence, which apriori would be one way that the melody of an unassociated consonant could be saved.

(6) $C_1C_2C_3$ coalescence:
(a) *hrafns* 'raven (gen)' /hrafn-s/ [hrams] or [hrafs]
(cf. *hrafn* /hrafn/ [hrapn])
(b) *hefndi* 'avenge (pret)' /hɛfn-t-ɪ/ [hɛmdɪ]
(c) *jafnt* 'even (neuter)' /jafn-t/ [jamt]
(d) *megnt* 'strong' /mɛgn-t/ [mɛNt] (N=velar nasal)
(cf. *megn* /mɛgn/ [mɛgn])

Before turning to an alternative interpretation of EM, we must consider an exceptional set of words. Long vowels are also found preceding two consonant clusters where C1 is /p,t,k,s/ and C2 is /v,j,r/, as shown under (7).

(7)	(a) *dapra* 'sad (gen.pl.masc.)'	/dap-ra/	[da:pra]
	(b) *fúsra* 'eager (gen.pl.)'	/fus-ra/	[fu:sra]
	(c) *lepja* 'to lap up'	/lɛp-j-a/	[lɛ:pja]
	(d) *flysja* 'to peel'	/flɪs-j-a/	[flɪ:sja]
	(e) *vökva* 'to water'	/vök-v-a/	[vö:kva]
	(f) *tvisvar* 'two times'	/tvɪsvar/	[tvɪ:svar]

Kiparsky 1984 assumes that the clusters in (7) "constitute [a subset of] permissible onsets and are syllabified with the following vowel" (153). The words in (8) show that this cannot be a general condition in Icelandic, since the words there have medial clusters that form licit onsets also and yet these words have short vowels in syllable one.[2]

(8)	(a) *tefla* 'to play chess'	/tɛfl-a/	[tɛpla]
	(b) *epli* 'apple'	/ɛpl-ɪ/	[ɛplɪ]
	(c) *haegri* 'right'	/haeg-rɪ/	[haeɣrɪ]
	(d) *velja* 'to choose'	/vɛl-j-a/	[vɛlja]

The above and other data show that medial parsing cannot be restricted to the distinction between possible and impossible onsets. Moreover, unlike in languages like English, Attic Greek and Finnish where longer strings are permitted in medial position (codas+onsets) or languages like English that allow extra segments word-finally (in an appendix) that could not be syllabified into a medial coda, the set of Icelandic medial clusters is nearly identical to the set found in final position (cf. Haugen 1958 tables; and deletion rules). Identity between medial and final string sets would be a remarkable coincidence if they were under the control of different structures, possible codas plus possible onsets medially, versus possible codas (+/- appendix) finally. A striking illustration of this correspondence between medial and final clusters can be seen in the monosyllabic sonority violation words given in (9). The final clusters of (9) also appear medially (cf. 8).

(9) (a) *hefð* 'tradition', *hægð* 'ease', *bragð* 'trick',
(b) *faðm* 'embrace', *lasm* 'friend', *ofn* 'oven', *rausn* 'munificence',
(c) *vopn* 'weapon', *vatn* 'water', *sókn* 'the act of seeking', *sögn* 'story', *megn* 'pungent',

[2]The vowel quantity split in (7) and (8) is duplicated in a special case of deverbal nominals derived by vowel deletion, *pukra* 'to whine' → *pukr* 'whining' [pu:kr] (long Vs as in (7)) versus *klífra* 'to climb' → *klífr* 'climbing' [klivr] (short Vs as in (8)). Neither bimoraic analysis ((3) or (10)) can handle these words without ad hoc measures, e.g. postlexical morphology in Kiparsky 1984, and violating standard conditions on extrametricality (cf. Itô 1986). In contrast, these facts will follow directly from the trimoraic account: the coda condition (22c) blocks coda association of /r/ in *pukr*, and regular vowel lengthening is done; since (22c) only blocks association to the coda, /r/, with its level one association line, can be stray adjoined directly to the syllable node.

(d) *iðn* 'trade', *barn* 'child' [baḍn], *nafn* [naḅn] 'name',
(e) *rupl* 'plundering', *gutl* 'dabbling',*hekl* 'crotcheting' *gafl* 'gable', *afl* 'strength', *rusl* 'rubbish', *uml* 'mumbling', *fugl* 'bird', *tagl* 'tail of a horse', *karl* 'old man' [kaḍl],
(f) *ösp* 'tree', *ást* 'love', *ósk* 'wish'
(g) deverbal nouns, e.g. *grenj* 'wailing, *flífr* 'a climb', *pukr* 'concealing'.

Using the split between the data in (7) and the data in (8), Itô 1986 qualifies the possible onsets constraint with an analysis wherein syllabification satisfies a lexical syllable template that contains no more than one postnuclear moraic position; a restricted onset condition syllabifies /p,t,k,s/ + /v,j,r/; and final consonants are extrametrical. Unlicensed segments that cannot be syllabified into the following onset are stray erased, and vowels are lengthened in open syllables. This part of Itô's analysis is given in (10). The mora structures for (10) are the same as in (3c,d) and are also given in (17b).

(10) (a) final consonants are extrametrical;
(b) a lexical syllable template that contains no more than one postnuclear moraic position;
(c) a special onset condition for /p,t,k,s/ + /v,j,r/;
(d) stray erasure of unlicensed segments that cannot be syllabified into the following onset;
(e) vowel lengthening in open syllables (Itô 1986).

A crucial difference between (3) and (10) is the use of prosodic licensing in (10). In Itô's theory, segments can be licensed in two ways, by syllabification and by extraprosodicity (e.g. 1986.62), and licensed segments are not deletion targets. Thus, Itô's analysis can in principle handle many of the deletion facts given in (5), as illustrated below in (11a), where [bd] is not a possible onset and /b/ is deleted. But there are also many cases where deletion occurs even though the medial C could in principle be syllabified with the second syllable, as shown in (11b), where /st/ and /kv/ are possible onsets, and yet /s/ and /k/ are still deleted. The deletion illustrated in (11b) is not related to a specific prohibition against geminates, because Icelandic geminates regularly occur in both final and medial positions, and degemination only occurs in triconsonantal contexts where the third consonant is other than /v,j,r/ (11b).

(11) (a) OK: *kembdi* kem.bdi → [kɛmdɪ]
(b) but: *missti* mis.sti → not [mɪs.stɪ] but [mɪstɪ]; cf. *stigi* 'stairs'
(n.b. *missa* 'to lose' /mɪs:-a/ [mɪs:a]) *hvass* 'piercing' /hvas:/ [hvas:])

Note also in (11b) that the geminate is a linked structure. The homorganic clusters /st/ (11b) and /mb/ (11a), as partial geminates, could also be analyzed as linked structures, as can the cluster [bd], where /t/ has assimilated in laryngeal features to the preceding /b/.[3] Segmental linking has been shown to play an important role

[3]The Icelandic past tense morpheme can be analyzed as either underlying /t/ or /ð/. In either case, it would undergo assimilation in forms like [kemb-d-i], laryngeal assimilation in both and, in addition, closure assimilation in the later case (recall that /b/ is voiceless, unaspirated).

in the syllable structure systems of several languages (Steriade 1982; cf. also Itô 1986, Borowski 1989). For example, linking saves unsyllabified consonants that would otherwise be deleted in Attic Greek. Yet, in Icelandic, unlike in Attic Greek and many other languages, linking does not save a consonant from deletion.

Returning now to the analysis in (10)[4], I will show the crucial problem it encounters with Icelandic compensatory lengthening, which is illustrated under (12).

(12) Compensatory lengthening
- (a) *barns* 'child (gen)' /barn-s/ [bas:],
- (b) *vatns* 'water (gen)' /vatn-s/ [vas:],
- (c) *fljóts* 'big river (gen)' /fljout-s/ [fljouts] or [fljous:]
- (d) *lágt* 'low (neuter)' /laug-t/ (→ [lautt] →) [lau^{h}t] (or [lauxt])
- (e) *vers* 'verse' /vɛrs/ [vɛr̥s] or [vɛs:]
- (f) *farsi* 'farce' /farsɪ/ [farsɪ] or [fas:ɪ]

Under (13) is a vowel-triggered deletion rule that affects postvocalic *f* =[v] and *g* [q], where, for example, *g* optionally deletes after *á, ó, ú* [au, ou, u]. Forms like (13b) and (13d) illustrate compensatory lengthening of the following consonant once the preceding /f/ or /g/ is deleted.

(13) Vowel-triggered consonant deletion
- (a) *bágur* 'pitiful (masc)' /baug-ur/ [bau:Yr] or [bau:ɣYr]
- (b) *bágt* 'pitiful (neuter)' /baug-t/ [bau^{h}t] (or [bauxt])
- (c) *lág* 'low (feminine)' /laug/ [lau:] or [lau:ɣ]
- (d) *lágt* 'low (neuter)' /laug-t/ [lau^{h}t] (or [lauxt])

The preaspiration in (13b) and (13d) shows the [t] to be a derived geminate, as shown by the data and derivation given in (14). (14a) and (14b) show that both underlying and morphologically derived voiceless stop geminates are preaspirated, as is a geminate phonologically derived through compensatory lengthening (14c).

(14) (a) *hitta* 'to meet' /hɪtt-a/ [hɪ^{h}ta]
átt 'direction' /autt/ [au^{h}t]

(b) *feit* 'fat (fem, sg)' /feit/ [fei:t]
feitt 'fat (neuter, sg)' /feit-t/ [fei^{h}t]

(c) *lágt* 'low (neuter)'
/laug-t/
[lau t] deletion
[lautt] compensatory lengthening
[lau^{h}t] preaspiration

[4]There are several additional problems with the analysis in (10) that cannot be covered here. For example, while many of the heteromorphemic deletion facts can be given a plausible analysis, the lexical phonology analysis of deletion in Itô 1986 cannot handle any of the monomorphemic cases; and, further, the constraint that extrametricality goes away at the postlexical ("word") level conflicts with postlexical assignment of vowel lengthening (cf. Kiparsky 1984).

As an alternative to the deletion with compensatory lengthening analysis that I have just proposed, we might consider that the forms in (12), (13) and (14c) show, not deletion of the target, but complete assimilation of the target to the following consonant. While the two analyses are formally equivalent in moraic theory, there is empirical evidence in Icelandic that allows us to choose between them. Consider the data in (15): if the apparent compensatory lengthening in (14c) were actually the result of the total assimilation of /g/ to the following consonant, we would expect to see such assimilation across-the-board, but as (15) illustrates, /g/ never assimilates totally to a following consonant. In [saxt], we find voicing assimilation; if the relevant rule involved total assimilation, the predicted output would be [sa^{h}t] (via an intermediate form [satt]), which is incorrect. The feeding rule is, indeed, the vowel-triggered deletion rule given in (13). Once the /g/ is deleted, the following consonant compensatorily lengthens into the vacated C slot.

(15) *sagt* 'say (pret)' /sag-t/ [saxt], *[sa^{h}t]

In the compensatory lengthening cases illustrated above, segment-specific deletion rules delete certain melody units before particular consonants, and a compensatory lengthening, spreading rule then applies to fill the necessary two coda C slots. However, compensatory lengthening is never triggered by single consonant deletion in tri-consonantal clusters but rather only when a two consonant cluster is reduced to one as shown in (16). Thus, compensatory lengthening cannot be triggered simply by freed associations lines as in Attic Greek (Steriade 1982).

(16) (a) *fyrst* 'first' /fʏrst/ [fʏst], *[fʏs:t]; (b) *vers* 'vers' /vɛrs/ [vɛs:]

The Itô analysis of continuous syllabification and at most a single postnuclear, moraic consonant incorrectly predicts [vɛ:s] as shown in (17). The EM consonant is not moraic: it could conceivably move into the vacated mora (via deletion and relinking, producing *[vɛs]), but without being moraic, it cannot be the melody source for compensatory lengthening.

(17) (a) bó(k)^{em} [bou:k]; ver(s)^{em}

(b)

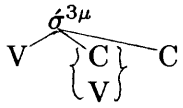
(s)^{em} → *[vɛ:s]

Thus, in constrast to the non-templatic weight language where lengthening is triggered by freed association lines (Attic) and to the bimoraic templatic languages (cf. (17b)), Icelandic compensatory lengthening shows that each of two coda *consonant* slots is obligatory. With these results, we may eliminate the second EM analysis.

Trimoraic syllable template

The deletion, coalescence, compensatory lengthening and distributional facts (and other data including historical arguments) show that, contra the extrametricality analyses in (3) and (10), syllabification in Icelandic is coda maximal and the stressed syllable is under the constraint of a trimoraic template. This template is given under (18).[5] This analysis directly captures the identity between the medial consonant strings in disyllabic words and the final strings monosyllabic words.

(18) Trimoraic $\acute{\sigma}$ template:



Under this analysis, as listed in (19), (a) word final consonants are obligatorily incorporated into prosodic structure, (b) the lexical template is trimoraic, (c) a coda condition blocks coda syllabification of /v,j,r/ following /p,t,k,s/, (d) unassociated consonants are stray-erased, and (e) vowels are lengthened in light syllables.

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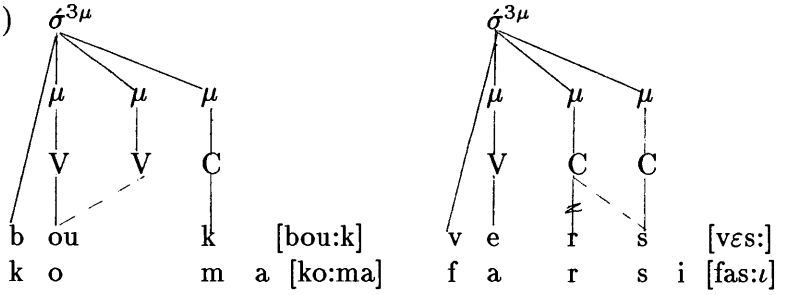
(b) the lexical template is trimoraic,
(c) a coda condition blocks coda syllabification of /v,j,r/ following /p,t,k,s/,
(d) unassociated consonants are stray-erased,
(e) vowels are lengthened in light syllables, V and VC.

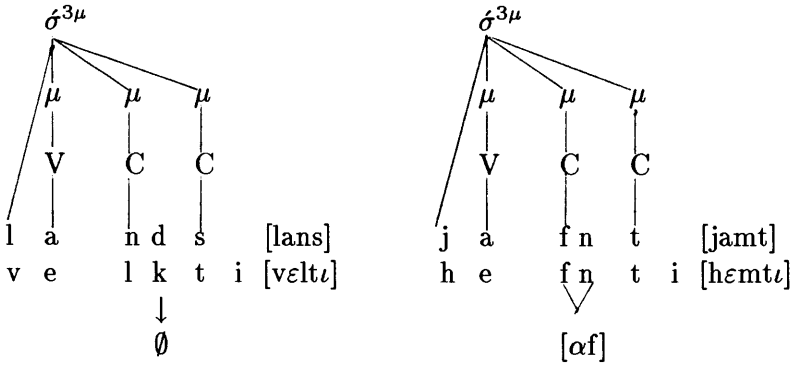
Summary. With respect to the template, deletion and coalescence resolve cases of excess melodic material, and vowel lengthening and compensatory lengthening (and syncope, next section) resolve cases of excess skeletal slots. C_2 of CCC codas deletes, *land* but [lans] from *land-s*. Coalescence merges C_1 and C_2 of a CCC, *jafn* but [jamt] from *jafn-s*. Vowel lengthening is triggered in underweight rhymes like *bŏk* and *kŏm.a*. Compensatory lengthening obligatorily maintains both C slots in CC codas where one C has been deleted under segmental constraints, e.g. *vers* [ves:] (after r-deletion). These rules are given in (20). They apply in identical fashion in both medial and final position .

(20)



(i) vowel lengthening (ii) compensatory lengthening

[5]The template correctly distinguishes C from V positions: there are no overlong, trimoraic vowels in Icelandic, *[bu::] (as there are in some dialects of German). This fact, and others, argue against the purely moraic theory (McCarthy and Prince 1986, Hayes 1989, etc.) that eliminates the C-V distinction of skeletal template theories (Clements and Keyser 1983, etc.).

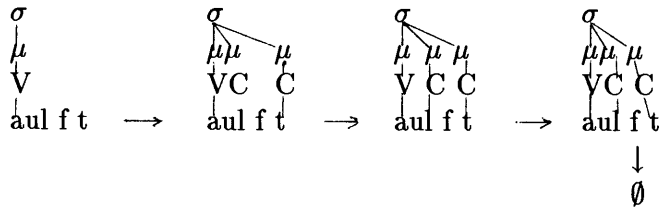


(iii) deletion (iv) coalescence

Edge-in template association.

The trimoraic template combined with coda-maximal syllabification establishes that association is edge-in (Yip 1988). In terms of theory, only edge-in association meets the locality condition. With respect to data, as we have seen, key evidence has been the cases of excess melodic material, where *medial* melodies are deleted in both monomorphemic and heteromorphemic cases, just as predicted by the edge-in theory (Yip 1988). This occurs both with template association, where the medial consonant in a triconsonantal cluster is deleted (*lands* and monomorphemic *álft*), as we have already seen, and with syllable projection, where the medial vowel in a trisyllabic word may be syncopated (*hamar-i* next section). Template association is illustrated in (21) for the monomorphemic word *álft* 'swan'.

(21) Trimoraic template association, *álft* /aulft/ 'swan' → [ault]
(short diphthong, single V slot):



The edges of the template, the vowel and the final consonant, are associated; left-right association follows from the requirement that projection of syllable nodes precedes further construction of the rhyme. The next, inner span of the domain is not so constrained and thus provides crucial evidence on the order of association of edges. For the inner -CC- span, -lf- in *alft*, association must be left-right: *only* the left C is associated by general convention; the right C is unassociated and stray erased. This accounts for the ATB deletion of medial C_2 in CCC codas.

Syncope and edge-in syllable projection.

An adequate prosodic theory should account for not only standard lengthening and deletion cases, but other syllable-building processes, as well. The trimoraic analysis

just presented easily handles Icelandic epenthesis and, more importantly, provides a direct account of syncope in Icelandic. Under any analysis of Icelandic syllable structure, epenthesis (under (22)) will be simply a further consequence of the special stipulation controlling /r/: however the /r/ is stranded (either by assignment to syllable 2 onset as in (10c) or by being blocked from syllable 1 by a coda condition in (19c)), vowel insertion must be a specific rule that creates the second syllable. The epenthesis rule itself does not directly choose between the proposals concerning the structure of the first syllable. Note, however, that coda maximalization sets the directionality parameter and provides a direct account for the insertion of a vowel before the stray C, rather than after it. (22) gives data and a representative derivation.

(22)

/a k r/		*akur* 'field'
$\acute{\sigma}^{3\mu}$ σ		
aV k r		core syllabification
$\acute{\sigma}^{3\mu}$ σ		
a: k Vr		epenthesis
a: k u r		default fill-in
[a: k u r]		

Syncope raises trickier problems.[6] The first interesting property of syncope is that only the second vowel in a word is syncopated. This vowel is deleted only under particular conditions: syncope deletes a postconsonantal vowel before a singleton [l r n s] or [δ] that is in turn followed by a vowel. Compare *hamar*, with syncope in the dative singular, and *kerling*, where syncope is blocked by the stem final cluster (23).

(23)

	/hamar/ 'hammer (masc)'	/kerling/ 'old woman (fem)'
dat sg	hamr-i	kerling-u
gen sing	hamar-s	kerling-ar

Morphological conditions. This rule does not apply in nonderived environments (Kiparsky 1984.148), nor in verbs[7], but does apply essentially wherever its phonological structural description is met in level two nouns and adjectives (cf. the analysis below), and thus does not need to be described by a list of the relevant nominal and adjectival morphological environments, contra Orešnick 1972.

There are many exceptions that could in principle counter an analysis of syncope as related to general syllabification.[8] Apart from some apparent idiosyncratic lexical items, the exceptions systematically partition into particular morphological categories. Syncope does not apply to forms with the suffixed definite article (Kiparsky

[6]Both the Kiparsky- and the Itô-type analyses can handle the basic epenthesis, but both must treat Icelandic syncope as an idiosyncratic phenomenon, outside the basic syllabification system.

[7]In some verbs historically formed from nouns, part of the derivational process deleted the stem final vowel of the noun. This is not the synchronic syncope rule found in the nouns and adjectives: morphological vowel deletion is not under phonological constraints, and the deleted vowel never appears in any verb form. The synchronic status of the morphological rule is unclear, since verbs cannot be formed from many nouns that can undergo syncope themselves, e.g. *bítil-l* 'Beatle', *bítla* 'Beatle (acc pl), **bítla* 'to (act like a) Beatle'.

[8]Anderson (1974.142) says there is a set of recently borrowed words that are exceptions to the syncope rule, but Thráinsson 1978.19 shows that syncope does apply in recent loans, e.g. *bítil-l* → /bítil + i/ → *bítli* 'Beatle (dat sg)'.

1984), nor to full compounds or deverbal nouns (e.g. agentive deverbal masculine nouns ending in *-ari*, deverbal feminine nouns in *-un*, and derived masculine nouns in *-uður*). Thus, for example, the words in (24) are exempt from syncope. (The root vowel of the verb in (24d) was changed from *ó* by the historical i-umlaut shift.)

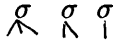
(24) (a) *safnað-ar* 'congregation (gen)' (← *safn* 'collection');
(b) *pöntun-ar* 'order (gen)' (← *panta* 'to order');
(c) *verslun-ar* 'trade (gen)' (← *versla* 'to carry on business');
(d) *dómar-a* 'judge (dat sg)' ← *daema* 'to judge'.

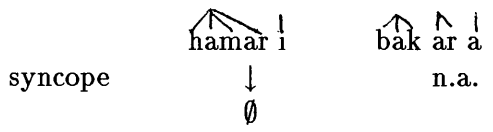
In a level-ordered lexicon (e.g. Kiparsky 1982), the morphological categories of the exceptions undergo morphological and phonological rules in different levels in the grammar. Thus, the exceptions can be handled in such a level-ordered grammar, if syllabification applies at each level and is structure-preserving. Since syncope does not apply to the compound-like definite article, these presumably are added postlexically (Kiparsky 1984.147). While syncope regularly applies to inflected simple nouns and adjectives, inflected nouns formed from verbs do not undergo syncope, nor do inflected adjectives formed from adverbs. For example, syncope applies in (25a), but does not in phonologically similar forms like those in (25b).

(25) (a) *akur-i* 'field (dat sg) → *akri*
mikil-um 'large (dat pl)' → *miklum*
(b) *bakar-a* 'baker (dat sg)' → *bakara*
(*bakar* 'baker' is formed from *baka* 'to bake')
heimil-um 'at free disposal (adj, dat pl)' → *heimilum*
(*heimil-l* 'at free disposal' is formed from *heim* 'home (adv)').

Consider the derivations in (26). Derivational morphology takes place at level one. All forms go through level one; however, syllabification applies only in cyclic domains. If we assume that bound roots are not cyclic domains (Kiparsky 1982), nouns like *hamar-i* are not syllabified until affixed at level 2. In contrast, the deverbal nouns like *bak-ar* are syllabified at level one and then submitted to level two, where inflectional affixation takes place. If we assume that syllabification applies at level two only to unsyllabified material, the structural description of syncope will not be met in *bakara* but will be met in *hamari*. Newly syllabified segments and newly formed syllables are adjoined to the level one syllable structure (cf. Steriade 1982). Thus, the exceptionality of these forms with respect to syncope is a straightforward result of the the grammar and a syllabification that is cyclic and structure-building.

(26)

	hamari	*bakara*
Level one		
syllabification	n.a.	
syncope		n.a.
Level two		
syllabification		



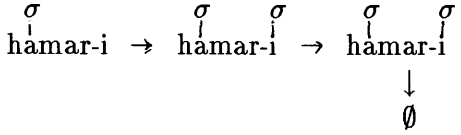
Phonological conditions. Returning to the phonological factors, recall that syncope deletes a postconsonant vowel if it is followed by a singleton /l,r,n,s,δ/ that in turn is followed by a vowel. If we consider [l, n] to be continuants, the consonants mentioned are the only coronal continuants that may occur in this position: [j] does not appear to occur in this position, and the rule is said to be blocked if the following consonant is a noncontinuant [t, d] (which are extremely rare in this position, Orešnick 1972.20). The rule only syncopates the second vowel in a trisyllabic or longer word (27). There is usually a morpheme boundary between the second and third syllables, but such a boundary between the third and fourth syllables cannot trigger the rule. Syncope is fundamentally a foot-based rule: the syncopated vowel may only be in the second syllable and must be followed by at least one other syllable; this condition insures that the output is at least a two-syllable foot.

(27) (a) *amerískur* 'American (adj)' → *amríska*;
(b) *ameríkani* 'American (n)' → *amríkani*, **amerkani.*

Why the vowel in only the second syllable? Why the coronal continuants? Notice that the effect of the syncope rule is to add an additional consonant to the coda of the stressed syllable. Furthermore, the coronals that figure in this rule are precisely the coronals that appear frequently as C2 in word final CC codas (cf. data in (9)).[9] If we assume that syncope is an outcome of foot construction and the basic syllabification mechanism, we automatically account for the once more, parallel behavior of monosyllabic words and (in this case, syncope-derived) disyllabic words. The bimoraic account (10) (and (3)), in contrast, must treat syncope as a rule that is unrelated to basic bimoraic quantity and, moreover, that arbitrarily selects out the second (as opposed to the third or fourth) vowel.

The challenge of Icelandic syncope is that left-right syllabification violates the locality principle: V_2 is deleted only in 3+ syllable words; thus, 'left-right only' evaluation of V_2 requires a nonlocal look ahead mechanism. By combining the trimoraic template with directional edge-in syllabification at the foot level (28, below), we account for the uniform targeting of the second syllable after the projection of its right hand syllable context and thus avoid a nonlocal look ahead mechanism.

(28) Syllable projection and association, *hamar-i* 'hammer (masc, dat sg)' → [hamri]:



[9]It is not clear how significant the constraint on coronal continuants is, given the rarity of other consonant types in the relevant positions in Icelandic words.

Edge vowels are projected to syllable nodes, first the left vowel (the first), then the rightmost (the third or fourth). The string-wise long distance context of syncope–i.e., a syllable node to the right of the syncope target vowel–is now a local context for the evaluation of V_2. For a 4 σ word, the inner domain will be both V_2 and V_3. The *left*most vowel is again evaluated first (cf. also the discussion of template association (21)); this will, then, always be the second vowel. Thus, in a 4 σ word, left-right association of edges on the inner span is crucial for identifying the *second* vowel as the syncope target and not the third vowel.

The association mechanism now evaluates V_2. Coda maximalization automatically parses all consonants to the right of V_2 into an interim coda. Locality requires that the association mechanism inspect a branching node in cluster words like *kerlingum*, rather than checking the string, first C_1, then C_2 and back-tracking. This branching node is an interim structure that correctly indicates constituency of the rhyme. If the interim coda branches, V_2 is associated to a syllable node, and the rhyme is completed. If the interim coda does not branch, the daughter melody is evaluated; if that is [+cor, +cont], no syllable node is projected, and the coda C is adjoined to the coda of the first syllable. The unassociated vowel is stray erased at the end of the derivation.

Consider now the problem posed by four-syllable words, like *dóttirina* 'daughter (accus sg, def) [douttrina], where -in-, the third syllable, string-wise meets the structural description of an additional application of syncope, *[dottrna] (syncope) → *[dotna] (medial C deletion). With syllable building rules, blocking syncope for -in- requires record of the "degenerate syllable", an "x" at the syllable level, on the left (i.e. a trace of the prior evaluation of -ir-, where projection of a proper syllable node was blocked); otherwise the syllable projection for dott- can fulfill the left-hand environment for -in- and syncope would apply again, incorrectly. However, taking the approach that the template is a condition on syllable representation, as has been done here, we need no further mechanisms: syncope does not iterate across the string, since syncope is in part motivated and controlled by the template governing the first syllable, and, after one application of syncope, the template is satisfied. Thus, the trimoraic template directly accounts for syncope, and, as we have seen, only edge-in association assures that locality is met.

Conclusions

In conclusion, a constrained theory of extrametricality, wherein extrametrical consonants are either unincorporated in the prosodic structure or licensed but not obligatorily distinct from a separate postnuclear position, provides diagnostics for the non-diactric use of syllable extrametricality. But neither can handle the Icelandic facts. Thus, we are led to reject EM analyses, and, accordingly, syllable theory must be parameterized to permit trimoraic syllable weight and lenghthening in light syllables that may include VC syllables as well as open V syllables.[10]

With coda-maximalization and the trimoraic template governing the syllabification, association must be edge-in. The obligatory edges here are the nucleus of the

[10]This grouping of syllable types is also found in Lardil, where several rules treat both CV and CVC syllables as light, see Hale 1973 and Wilkinson 1988.

prosodic template and the affix that selects for the stem. Thus, edge-in association unifies a left-headed, prosodic constituent and a right-headed, morphological constituent. Left-right edge-in association produces the correct affects in all cases of medial melody loss and in the coalescence cases. The trimoraic template association is a straightforward use of edge-in association, as originally proposed for morphological templates. The edge-in syllabification mechanism for syncope is the first proposal for nontemplate edge-in syllabification. For both template association and syncope, edge-in association provides a uniform account solving outstanding puzzles in Icelandic syllabification.

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