The Stipulation of Extraprosodicity in Syllabic Phonology*

Gregory K. Iverson

1. Introduction.

Since first suggested by Liberman and Prince (1977) in their pioneering study on English stress, the role of extraprosodicity has been integrated prominently into metrical theory. As developed particularly in the subsequent work of Hayes (1981, 1982), Hammond (1984), and Halle and Vergnaud(1987), the basic idea remains that a peripheral, usually final element (consonant, rhyme, syllable, morpheme) is transparent to the operations which build metrical structure even though that element too ultimately must be made a part of it. The final rhyme of nouns in English, to raise a familiar example, is characterized as extrametrical not just because primary stress typically does not fall on finals(except when the vowel is long, as in *ballóon*), but because it regularly does fall on the penultimate syllable if it is heavy (*ellípsis*), otherwise on the antepenultimate (*énema*). Were it not for the stipulation of word-final rhyme extrametricality, however, the quantity-sensitive, maximally binary foot construction procedure defined by Hayes (1981) would regularly result in the appearance of stress one syllable too far to the right (**ellipsís*,

* An oral version of this paper was read before the Annual Meeting of the Linguistic Society of Korea held in Seoul in June, 1990 ; versions were presented as well before the 64th Annual Meeting of the Linguistic Society of America, Washington, D.C. (1989), and in linguistics colloquia held at the University of Wisconsin—Milwaukee and the University of Minnesota. I am grateful for the many useful comments and criticisms raised as a result of these presentations, and wish to thank especially my fine colleagues in the Language Research Institute, Seoul National University and the Linguistic Society of Korea for their warm and professional reception in Seoul.

(**enéma*).[1]

But extraprosodicity has also played a part, though a decidedly less pervasive one, in the proper functioning of the rules of syllabic phonology. Thus, the term 'extrasyllabic' has often been applied in reference to segments which fail to satisfy a language's standard word-internal syllabic template but which nonetheless are tolerated at the word's edge as an 'adjunct' or 'appendix' to the syllable. This is commonly supposed for English with respect to the accumulation of word-final coronal obstruents in words like *fifths*, *sixths*, etc., because syllable-final clusters of this complexity may occur only at the end of the word. Segments also have been labeled extrasyllabic, moreover, which cannot be prosodically parsed at all without the support of some further phonological process, usually epenthesis. For example, the sibilant marking the plural in *dishes*(<dish+/z/) must be organized into an epenthetically vocalized syllable apart from that of the stem because clusters of sibilants internal to the same syllable are not permitted in English. The first of these usages can be distinguished from the second as 'licensed' versus 'contingent' extrasyllabicity (Goldsmith 1990), but neither of them equates with the particular sense of extraprosodicity to be taken under consideration here, namely, the stipulated exclusion of syllabic structures which in general do meet a language's prosodic configurational requirements. Contingent extraprosodicity, by contrast, identifies segments which initially fail to satisfy the fundamental structural requirements for syllabification, causing syllabic 'fix-up' rules like epenthesis to apply; and licensed extrasyllabicity sanctions as an appendix the incorporation of specific peripheral segments which extend beyond the range of ordinary syllabification. Under conventional metrical assumptions, however, the extraprosodicity status accorded to word-final, 'extrametrical' rhymes in English nouns is a stipulation which conflicts with rather than augments the language's general scheme of syllabification, because, despite the fact that they ultimately do incorporate into syllable structure, these sequences must be systematically disregarded by the rules of stress assignment. The specific

[1] In a recent dissertation, Spitzer(1989) develops a comprehensive alternative account of English stress, and outlines for the stress patterns of many other languages, in which extrametricality plays no general role at all, although this requires recognition of other (e.g. ternary) footing possibilities.

question to be investigated here then is whether the negative extraprosodicity stipulations properly characteristic of metrical systems play any necessary role among the representations and rules of skeletal or segmental modification.

Though limited, putatively strong support for the existence of this kind of extraprosodicity in the nonmetrical syllabic phonology resides in representative analyses of vowel quantity (Icelandic), epenthesis (Ponapean), consonant elision (Diola Fogny), and place of articulation limitations on consonant clusters (English). It will be shown in turn that each of these submits to alternative, more general analysis made possible on the one hand by melodically empty skeletal representation, and on the other by general constraints on place of articulation deriving from the principles of syllabic licensing. This result, it is concluded, considerably undermines any motivation for the extension of stipulated segmental extraprosodicity beyond its stress-regularizing function in the metrical component of phonological theory.[2]

2. The vowel quantity pattern in Icelandic.

The distribution of vowel length in Modern Icelandic, which is predictable on the basis of syllable structure and stress, would appear to be governed by two separate principles, depending on the number of syllables in the word. In polysyllabic words, where stress is regularly word-initial, the stressed vowel is long if it is in an open syllable, all other vowels are short. The orthographic representations in (1), taken from Kiparsky (1984) and modified to show syllable division and vowel length, bear this distribution out. In monosyllables, however, a stressed vowel is short only when its syllable is closed by a consonant cluster, i. e. the vowel in a stressed monosyllable is long not only when the syllable is open, but also when it is closed by a single consonant, as exemplified in (2).

[2] Whether stipulated extraprosodicity plays an indispensible role in tonal systems as well (Pulleyblank 1986, Goldsmith 1990) is beyond the scope of the present inquiry.

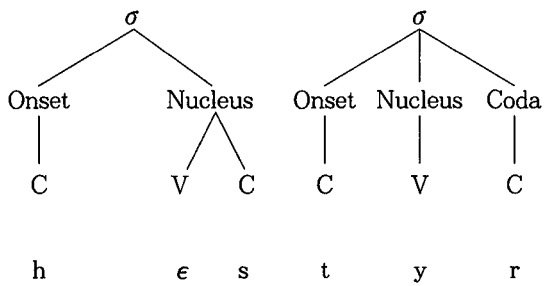
(1)	a.	a[:]-kur	'field'	(2)	a.	á[:]	'river'
		fa[:]-ra	'ride'			skó[:]	'shoe'
		hö[:]-fuð	'head'			bú[:]	'homestead'
	b.	har-ður	'hard'		b.	hó[:]s	'hoarse'
		el-ska	'love'			ljó[:]s	'light'
		kal-la	'call'			ski[:]p	'ship'
					c.	björn	'bear'
						skips	'ship'(gen. sg.)
						mjolk	'milk'

2.1. The bimoraic nucleus.

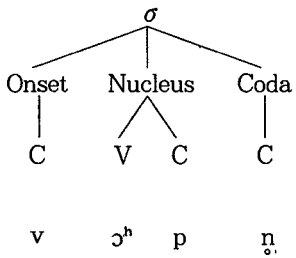
Efforts to include forms like those in (2b) in a general rule of vowel lengthening have typically focused on reanalysis to that purpose of the language's syllable structure. For example, Anderson (1984) proposes that a postvocalic consonant joins with the vowel in forming a syllabic nucleus just in case that vowel-consonant sequence is followed by another consonant, as it is in the words of (1b) and (2c). The syllabification of a polysyllabic word like *hestur* 'horse' would then be as in (3a), with no coda consonant in the first syllable, and a monosyllabic word like *vopn* 'weapon' would structure as in (3b).

These forms already satisfy the requirement Anderson attributes to Icelandic that the stressed nucleus (first syllable) must be bimoraic, or doubly filled, because a postvocalic consonant accrues to the nucleus rather than to the coda when it is preconsonantal. But underlying words on the pattern of (1a) and (2a), as well as (2b), do not satisfy this condition. In order for an open

(3) a.

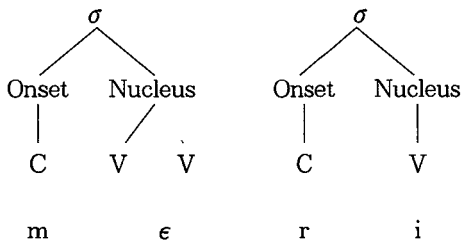


b.

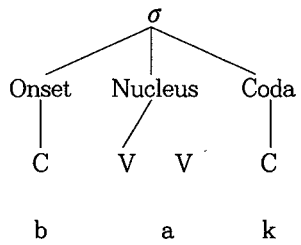


syllable like the initial in *meri* 'mare' or a singly closed monosyllable like *bak* 'back' to meet the bimoraic requirement, their stressed vowels must be provided with one additional mora, i. e. they must undergo lengthening. The two disparate syllable types are thus united by ascribing to them both an underlying monomoraic nucleus subject to lengthening because the syllabic affiliation of the following consonant, being itself not preconsonantal, lies outside the nucleus :

(4) a.



b.



This proposal makes for some unusual claims about syllable structure in Icelandic, however, in particular that there are no coda consonants to close the initial syllables of words like *hestur*. Indeed, these unusual configurations appear to serve no function in the phonology other than to enable, for purposes of vowel lengthening, the joint classification of the categories open syllable and monosyllable closed by a single consonant.

2.2. Coda maximization.

Systematic independent motivation is similarly absent from the syllable structure reanalysis advanced separately by Árnason (1980, 1984) and Macken(1988). Their idea is to syllabify medial consonants in Icelandic such that they affiliate with a preceding vowel even in polysyllabic words, i. e. *meri* would parse as *mer-i* rather than *me-ri*, *hestur* as *hest-ur* rather than *hes-tur*, etc. Under this 'coda maximizing' scheme of syllabification, the rule for vowel lengthening would affect both monosyllables closed by one consonant and the initial syllable of words like *meri* because both would be analyzed as closed; the rule itself, as in (5a), then would lengthen a stressed vowel either in an open syllable or in one closed by a single consonant.

(5) a. $V \rightarrow VV / \_\_ (C)]\sigma$

b.

mer-i	→	me[ː]ri
bak	→	ba[ː]k
bū	→	bū[ː]
hest-ur	=	hestur

Such a strategy of coda-preferred syllabification clearly conflicts with the broadly based principle of onset formation, however, the universal first step in imposing syllable structure onto linear sequences of consonants and vowels. Among its other properties, this principle is strongly supported typologically by the fact that all languages have syllables with onsets, but many do not have codas (Clements and Keyser 1983). Under coda maximization in Icelandic, though, only word-initial syllables generally would have onsets since clusters of two consonants otherwise syllabify as codas, "…unless the first consonant is one of the set /p, t, k, s/and the second of the set /j, v, r/, [in which] case the syllable boundary is to be set between the two consonants." (Árnason 1980 : 38). (The reason for this deviation is that stressed vowels lengthen also before these particular combinations of consonants, e.g. *pu[ː]kra* 'conceal', *tvi[ː]svar* 'twice' ; under onset-preferred syllabification, such clusters would be considered to group with the following syllable rather than to be split between the two.) Like the bimoraic nucleus approach, to be sure, coda maximization in Modern Icelandic does allow for a single—albeit conflated—generalization to hold over the vowel lengthening environments, but the resulting radical

revision of its syllable structure serves no other clear purpose in the language.

2.3. Final consonant extraprosodicity.

Kiparsky's (1984) approach to these vowel quantity phenomena (cf. also Itô 1986 and Goldsmith 1990) is to retain universal, onset-preferred principles of syllabification for Icelandic, but then to stipulate that all word-final consonants fall outside the domain of syllabification, i. e. they are to be marked as extraprosodic. This too permits monosyllables closed by a single consonant to group with open syllables in longer words, and it allows for the simpler, more natural rule of open syllable lengthening given in (6a).

(6) a. $V \rightarrow VV / \_\_]\sigma$

b.			
	me-ri	→	me[:]ri
	ba<k>	→	ba[:]k
	bū	→	bū[:]
	hes-tu<r>	=	hestur

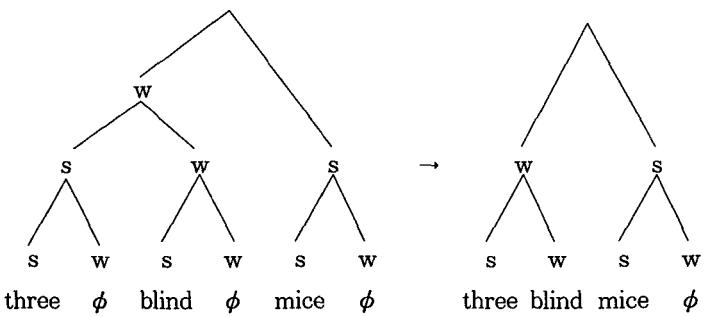
Extraprosodicity of a final consonant would thus seem to be considerably more appealing than the accounts proposing unique, counterintuitive analyses of syllabic structure, yet it too lacks any motivation in Icelandic other than to subsume singly closed monosyllables under the category of open syllable. In particular, extraprosodicity plays no role in the language's stress system, which is altogether insensitive to quantity since stress regularly falls on the word-initial syllable, whatever its composition. Nor does it appear that there is any other aspect of Icelandic phonology in which the proposed extraprosodicity would play a useful role. Final consonant extraprosodicity is of no value even in determining quantity relations in this highly inflecting language except in the rather small class of monosyllables, for it serves no purpose to disregard finals in polysyllabic words (*hestu<r>*, *aku<r>*, etc.) inasmuch as only stressed vowels lengthen and stress is word-initial. It is actually crucial that final consonant extraprosodicity not be involved in the postlexical phonology (cf. Itô 1986 : 186-189), where, for example, a rule of *u*-epenthesis must apply to break up word-final clusters of consonant plus *r* (/hest+r/>*hestur* nom. sg., /dag+r/>*dagur* 'day' nom. sg.) : if still extraprosodic, *r* presumably

would be invisible to epenthesis, and so not induce its application.

2.4. The 'empty vowel' analysis.

There is yet another alternative to modifying the internal syllabification scheme of Icelandic while still maintaining the open syllable lengthening generalization, however, and that is to consider a structurally richer representation to underlie the language's monosyllables. In his characterization of the metrical configuration of monosyllables in other Germanic languages, specifically English and German, Giegerich (1985) notes that stressed monosyllables and disyllabic words tend to occupy equivalent temporal space within phrasal contexts (the stress-timed phenomenon). In order to parallel more closely the temporal pattern of disyllabic words, he suggests that monosyllables also be given a binary-branching metrical representation, one whose weak right constituent is null. Accordingly, CVC monosyllables will structure as CVCϕ, which, as Hogg and McCully (1987 : 228ff) illustrate, also accommodates an appropriate docking site for encliticization. The phrase *three blind mice*, for example, contains monosyllables which, when spoken in isolation or surrounded by pause, are of a duration essentially equivalent to that of disyllabic words. But in phrasal context, the words *three* and *blind* together form a trochaic foot of about the same temporal prominence as *mice*.

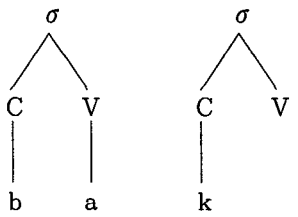
(7)



Incorporating this timing-based idea of metrical nulls into the melodic component of skeletally based syllable structure will have the direct effect, as Iverson and Kesterson (1989) elaborate, of parsing stressed monosyllables in Icelandic as disyllabic. The initial of CVCϕ metrical configurations then becomes an ordinary open CV syllable, the final a

'degenerate' CV syllable whose vocalic nucleus is empty. Specifically, the skeleton underlying a monosyllable like *bak* syllabifies as in (8a), with a V slot at the timing tier not attached to any segmental melody.

(8) a.



b. V→VV/__]σ

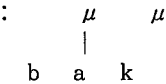
c.

me-ri	→	me[:]ri
ba-kφ	→	ba[:]k
bú	→	bú[:]
hes-tur	=	hestur

On the empty vowel analysis, *bak* and other lexical monosyllables superficially closed by one consonant undergo open syllable lengthening because their segmental vowels prosodically are in open syllables.[3] Rather than stipulate final consonants as extraprosodic, then, this characterization provides monosyllabic stems with a melodically empty final skeletal vowel. Though the results of this account and final consonant extraprosodicity are equivalent with respect to the distribution of long and short vowels, the two approaches are not simply notational variants.

First, the occurrence of the empty final vowel in Icelandic is restricted to lexcal monosyllables closed by a single consonant (i.e. XVC), whereas the alternative of final consonant extraprosodicity affects all words that end in

[3] The empty skeletal V of course must be distinguished from the melodically least specified one as per the theory of radical feature underspecification (Archangeli 1984 and elsewhere). A natural distinction between the two types of featureless structures can be drawn in geometric terms (Clements 1985) such that, while an empty V or C dominates nothing at all, a maximally underspecified V or C contains an empty root node. In moraic representation (Hayes 1988), where the question of skeletal underspecification does not arise because there is no CV skeleton, the lexical equivalent of (8a) before syllabification would be:



a consonant—though in principle it too could be restricted to monosyllables since extraprosodicity has no effect elsewhere. The word-final appearance of the empty vowel suffices to organize words like *bak* and *dag* 'day' acc. sg. into open syllable structures to which lengthening can apply (*ba-kϕ*, *da-gϕ*), and the extraprosodicity account achieves a similar result through its general disregard for word-final consonants (*ba*<*k*>, *da*<*g*>). But the approaches differ with respect to morphologically composite words subject to *u*-epenthesis in the environment before a postconsonantal word-final *r*, as in *dag* + *r*>*dagur* nom.sg. Under the degenerate syllable account, *dag* + *r* is not provided with an empty final vowel since it does not constitute a monosyllable closed by a single consonant, and inasmuch as /gr/ sequences may not syllabify together in the Icelandic coda, epenthesis comes into play to syllabify them separately. Under final consonant extraprosodicity, however, the *r* would be phonologically invisible, and without further adjustments (i. e. removal of extraprosodicity) could not induce the necessary application of epenthesis.

Second, the representation of the CV skeleton apart from melodic or segmental structure implies the autosegmental independence of the two, with the expectation then already built into the theory that a skeletal position might not affiliate with any segmental material at all. Indeed, this is the basis of the several empty consonant accounts offered in the first expository work on CV phonology by Clements and Keyser (1983), viz. their descriptions of *h*-aspiré in French, consonant gemination in Finnish, and irregular suffix allomorphy in Turkish (cf. also Marlett and Stemberger 1983 on Seri and Goldsmith 1990 on Selayarese, among others). The positing of a melodically empty timing slot, though more frequently of a C than a V, is thus an expected if not commonplace feature of CV skeletal analysis. The alternative of extraprosodicity stipulation, by contrast, is a quite separate dimension of the theory unrelated to the fundamentals of autosegmental representation.

To recapitulate, then, the theory does predict empty V positions as well as empty C's. This possibility was realized in early work by Selkirk (1981), who proposed a degenerate syllable or empty vowel interpretation of the 'superheavy' finals in Arabic. The familiar metrical pattern in Classical Arabic is to stress the penultimate syllable if it is heavy (CVV or CVC), otherwise the antepenult—except that the ultimate syllable is stressed

instead if it is superheavy (CVVC or CVCC, i. e. heavy syllable plus C). Analyzed as CVVCV and CVCCV, however, where the final vowel is empty, all of the instances of superheavy ultimate stress automatically reduce to the ordinary heavy penultimate pattern (i.e. CVV-Cϕ, CVC-Cϕ). More recently, McCarthy and Prince (1989) have also suggested that final consonants in Arabic form onsets to a nonmoraic or vowel-less syllable (which they term 'extrametrical' because it has no segmental vowel). Generalizing beyond the stress distribution, they observe that all stems in Arabic must end in a consonant, a restriction that can be directly expressed by analyzing stem-final syllables as a sequence of any possible medial syllable (CV, CVC, CVV) followed by an obligatory consonant, i.e. the template licensing stems is of the form $[\cdots\sigma\ C]_{stem}$. This stem-final consonant syllabifies as onset to an actual syllable when a suffix follows, but to a degenerate syllable which has no segmental vowel when nothing follows. Simply to characterize stem-final consonants as extraprosodic in Arabic would not suffice to account for both the superficially ultimate stress pattern of words with superheavy finals and the mandatory appearance of stem-final consonants.

Third, Icelandic gives further persuasive evidence for existence of the empty vowel in its derivational morphology, where certain 'action nouns' derive from verbs through truncation of the infinitival ending *-a*. As Kiparsky (1984) points out, the results of this operation often stand in violation of otherwise general phonological rules in the language. For example, the derivation of *klifr* 'climbing' from *klif-ra* 'to climb', or of *hamr* 'hammering' from *ham-ra* 'to hammer', produces apparent exceptions to *u*-epenthesis, the rule which normally interrupts word-final consonant plus *r* clusters. In the case of verbs whose consonant clusters syllabify together rather than split between coda and onset, e. g. *so[:]-tra* 'to sip', *pu[:]-kra* 'to conceal', the otherwise transparent open syllable lengthening rule is made opaque in that the stressed vowels of the verbs remain long in their corresponding derived nouns despite the fact that their syllables are now closed by two consonants; *so[:]tr* 'sipping, *pu[:]kr* 'concealing'. Kiparsky suggests that this anomaly calls for fixing the place of deverbal *a*-truncation—a clearly morphological operation—in the postlexical phonology, where it would have to be ordered extrinsically after the similarly postlexical rules of *u*-epenthesis and open syllable lengthening. In

this way, the long vowels of the verbs would be retained even though, as monosyllables closed by a consonant cluster, the nouns which derive from them no longer satisfy the structural requirements of open syllable lengthening.

The introduction of morphological operations into the postlexical component is very suspect, however, for it confounds the overall program of lexical phonology wherein word formation processes are tied to phonological rules in (and only in) the lexicon. This naturally limiting feature of the theory can be maintained under present assumptions by considering that deverbal *a*-truncation, now properly lexical, deletes only the vowel's segmental melody, not its skeletal element too. The CVCCV skeleta of verbs like *sötra* and *pukra* are then unaffected by *a*-truncation, and the nouns *sotr* (*sö-trϕ>sö[:]tr*) and *pukr* (*pu-krϕ>pu[:]kr*) accordingly retain eligibility for open syllable lengthening in the same way as do lexical monosyllables closed by a single consonant, like *bak* (*ba-kϕ> ba[:]k*). The empty final vowel then also serves to block *u*-epenthesis without any special ordering restriction since at the skeletal level these C*r* clusters are not actually final, i.e. they syllablify as onsets to syllables whose derived vocalic nucleus is null. As Kiparsky further observes, deverbal action nouns also form doublets with words which do follow the expected pattern of epenthesis, viz. *sö[:]-tur*, *pu[:]-kur*, etc. These are naturally accounted for in the present framework by the optional generalization of lexical *a*-truncation to deletion of the vowel's skeletal position as well ; on Kiparsky's analysis, the rule must vacillate between lexical (*pu[:]-kur*) and postlexical (*pu[:]-kr*) applicability.

The peculiarities of these action nouns constitute strong empirical support for existence of the empty vowel in Icelandic phonology. Its derived rather than basic character as observed in this aspect of the sound system complements its occurrence among lexical monosyllables, and forms part of an overall account which makes possible the essential restriction of morphological and word formation operations to the lexical component of the grammar. Multiple motivation behind the null nucleus analysis in turn allows for a unified account of the distribution of vowel quantity in Icelandic, and does so apart from any stipulations of final consonant extraprosodicity.[4]

[4] The experimental work of Garnes (1974) lends a suggestive measure of phonetic support to the empty vowel idea in Icelandic inasmuch as she found that

3. Coda filter versus cluster condition in Ponapean.

Word-final consonant extraprosodicity has also been reported to play a crucial role in the establishment of place of articulation limitations on consonant clusters in the Micronesian language, Ponapean, which represents a type of phenomenon for which there is no alternative of independently motivated empty vowel analysis. The distribution of segments in this language is generally restricted to open syllables with at most one consonant in the onset. But clusters of two consonants are permitted medially in polysyllabic words and finally in monosyllabic words provided they are either geminate or homorganic (Itô, 1989 : 226) :

(9)	a.arewalla	'to return to the wild'
	kemmad	'to change into dry clothing'
	nappa	'Chinese cabbage' (loanword)
	b. nampar	'trade wind season'
	nankep	'inlet'
	c. mand	'tame'
	emp	'coconut crab'
	kull	'roach'

Itô's (1989) rather ingenious account of this distribution imposes extraprosodicity on word-final consonants along with a constraint on coda membership to the effect that syllable-final consonants may not be uniquely specified for place of articulation features, i. e. if they are to occur at all, they must share their place features with another consonant. Basing herself

[4] continued
the timing of a coda consonant in a superficial monosyllable varies in about the same way as does that of an onset consonant in the second syllable of a disyllabic word. For example, the *k*-after long vowel in both *vak* [va:k] 'be awake' imp. and *vaka* [va:ka] inf. reduces by about 75 ms or 50% in phrasal context when compared to citation pronunciation. Similarly, after short vowels, both coda *k* (vakk [va^{h}k] 'walk around' imp.) and onset *k* (*vakka* [va^{h}ka] inf.) reduce by around 50ms, but the vowels in all cases remain essentially stable. By representing the coda of superficial monosyllables as onset to a vocalically empty syllable, the otherwise unexpected common temporal behavior of these consonant types follows automatically from their common syllable-initial structural configuration.

on the earlier place of articulation studies of Steriade (1982) and Prince (1984), Itô expresses this restriction in terms of the coda filter in (10), which is considered to be subject to the 'linking constraint' of Hayes (1986) with the interpretation that association lines in structural descriptions must be exhaustive.

(10) $*C]_{\sigma}$
|
[PLACE]

Under the Obligatory Contour Principle (OCP ; cf. McCarthy 1986), geminates and homorganic clusters in the same morpheme share their place of articulation, and so, even when heterosyllabic, do not violate the filter against place specification in codas. That is, (10) prohibits the occurrence of a syllable-final consonant only when its place of articulation specification is unique to that consonant. Since a single consonant at the end of the word does not share its place features with any other consonant, therefore, it would be in violation of (10) were it not for the stipulation of final consonant extraprosodicity. Alongside the examples in (9a) and (9b) with word-final consonants, accordingly, these in (11) taken from Rehg and Sohl (1981 : 60) will still conform to the coda constraint against unique place specification because (10) assumes that final consonants are systematically disregarded.

(11) mem 'sweet'
nenek 'commit adultery'
lal 'make a sound'
rer 'tremble'
ŋoŋ 'bark'
sinom 'sink in'
tenek 'hung up'
kaŋ 'eat'

The words in (9c), which end in consonant clusters, also conform to (10) despite word-final consonant extraprosodicity inasmuch as the coda consonant visible to the filter is the penultimate one, which does share its place features with another, albeit extraprosodic consonant. While the stipulation of extraprosodicity thus has no exclusionary effect on word-

final consonant clusters, without it the coda filter would not allow for the occurrence of any single word-final consonants.[5]

But (10) is not the only or even most direct way to accomodate the homorganicity restriction on Ponapean clusters. Following Prince (1984), the constraint instead can be that contiguous consonants are prohibited in which each member is specified for place of articulation :

(12) * C C
| |
[PLACE] [PLACE]

As the OCP rules out adjacent identical specifications, (12) has the effect of filtering out just heterorganic clusters, thus permitting homorganic ones whether split between two syllables as in (9a) and (9b) or integral to the same syllable as in (9c). Word-final single consonants as in (11) obviously are not affected at all, which means that final extraprosodicity is not needed, either, Open (CV) and singly closed (CVC) syllables are sanctioned throughout the word, but in replacement for extraprosodicity a separate template will also permit consonant clusters to occur word-finally—a possibility it would appear is realized only in monosyllables and in words derived from them through reduplication. Parallel to the McCarthy and Prince (1989) account of Arabic, then, the possible occurrence of an additional consonant just in word-final environments can be directly expressed through consideration of it to be an adjunct or appendix to syllable types found elsewhere, i. e. [$\cdots\sigma$ (C)] word.[6] In contrast to the extraprosodic approach, which disregards all final consonants, the empirically equivalent appendix account incorporates specifically only those consonants which lie beyond the scope of standard

[5] Actually, under standard proposals for radical feature underspecification, (10) would permit the syllable-final appearance of any consonant which is lexically unspecified for place features, presumably the class of coronals (*t, d, s, n, l, r*) in Ponapean. As this is not at all what is intended under the coda filter analysis (neither coronals nor any other consonant may occur syllable-finally unless homorganic with an immediately following consonant), (10) would seem to presuppose a more complete form of feature representation, such as provided by contrastive specification (Clements 1987).

[6] Or '[σ (C)] word', if the possible appendix consonant is restricted to underlying monosyllables.

syllabification.

At this point the two characterizations would appear to vary only notationally, except that the appendix mechanism is necessary anyway in order to accomodate consonantal adjuncts to the syllable as described above for Arabic (cf. also Selkirk 1982 and Goldsmith 1990 for motivation of appendices to word-initial and word-final syllables in English and certain other languages). But there are two further ways in which conventional extraprosodicity differs from the appendix account. One, to be taken up in section 5 below, is that the stipulation of extraprosodicity permits place of articulation constraints on heterosyllabic clusters to be defined prosodically, as per (10), within the domain of a single syllable. The other, to be addressed presently, concerns the fact that the long vowels of unsuffixed, monosyllabic nouns in Ponapean alternate with short vowels when suffixed.

3.1. Vowel lengthening in monosyllabic nouns.

That particularly monosyllables should be singled out for special prosodic treatment is reminiscent of the Icelandic situation. In fact, monosyllabic nouns in Ponapean undergo vowel lengthening under essentially the same conditions as in Icelandic, viz. when closed by one consonant. Rehg and Sohl (1981 : 117-118) illustrate with the alternations in (13a) :

(13)	a.	pʷiːl	'gum'	pʷilin	'gum of '
		ŋeːn	'spirit'	ŋenin	'spirit of '
		saːpʷ	'land'	sapʷen	'land of '
		pʷoːŋ	'night'	pʷoŋen	'night of '
		uːs	'net float'	usen	'float of '
	b.	keːp	'yam'	keːpin	'yam of '
		raːn	'day'	raːnin	'day of '
		pʷoːr	'carton'	pʷoːrin	'carton of '
	c.	kent	'urine'		
		keŋk	'coconut, containing no nut'		
		mall	'grassy area'		

The vowels in (13b) are most simply analyzed as long underlyingly ; (13c) gives examples of short vowels before final clusters, where there are no reported instances of long vowels. Following an analysis in unpublished

work by McCarthy, Itô (1989) suggests that this constitutes further support for final consonant extraprosodicity, because coupled with a two-mora minimum requirement on word size, extraprosodicity can explain why lengthening occurs only in monosyllables closed by one consonant : if the final consonant is disregarded, such syllables are monomoraic before application of lengthening(CV<C>), but syllables closed by clusters or those with long vowels underlyingly are multi-moraic to begin with irrespective of the final consonant (CVC<C>, CVV<C>).

The proposed bimoraic minimum word size requirement could hold only for nouns, however, since Rehg and Sohl (1981:103, 118) make clear that verbs and other parts of speech do not observe it (*dik* 'skip', *dil* 'penetrate'). There are even some exceptional nouns, usually but not always borrowings, which also fail to undergo the expected vowel lengthening (*pil* 'bill', *pis* 'pitch', *dip*^{w} 'clan'). Suggestively, Rehg and Sohl account for the monosyllabic noun pattern by pointing out that the Micronesian comparative evidence indicates that lengthening originally took place in the initial open syllable of disyllabic nouns whose final vowels were subsequently lost :

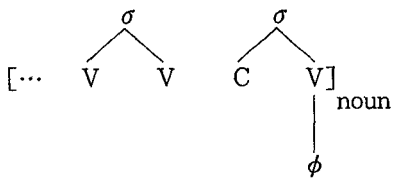
(14)	Reconstructed Form	*p^{w}ili	*ŋeni
	Vowel Lengthening	p^{w}i:li	ŋe:ni
	Vowel Deletion	p^{w}i:l	ŋe:n

The same kind of history is recapitulated in Minkova's (1982) analysis of open syllable lengthening in Middle English, where the phenomenon was almost entirely compensatory as it took place in general only if the following vowel also deleted (both lengthening and loss occurred in *tale*, for example, but neither did in *talent*). A natural way to view developments like these within the context of distinct skeletal and melodic representation is to consider that apocope resulted in loss only of the vowel melody, not of its timing slot or mora too, which then remained to serve as the environment for lengthening of the vowel in the prosodically still open initial syllable (cf. also Hayes 1988). Applying this interpretation to Ponapean yields the diachronic derivations in (15).

(15)	Reconstructed Form	*p^{w}i-li	*ŋe-ni
	Vowel Melody Loss	p^{w}i-lϕ	ŋe-nϕ
	Compensatory Lengthening	p^{w}i:-lϕ	ŋe:-nϕ
	Surface Resyllabification	p^{w}i:l	ŋe:n

The final steps of (15) are just the same as in the null nucleus analysis of Icelandic, and result in an equivalent explanation as to why lengthening takes place in superficial monosyllables closed by one consonant but not by two. If (nonexceptional) Ponapean monosyllabic nouns contain a final empty vowel in synchronic representation too, then the lengthening of segmental vowels in nouns of the form CV-CV but not CVC-CV will derive from a morpholexically restricted rule of open syllable lengthening triggered by an empty vowel :

(16)



Among the legacies of the developments in (15), besides apparent synchronic retention of the rule in (16), are the occurrence of word-final consonant clusters in monosyllables (cf. (13c)) and the systematic absence in such words of long vowels.[7] The first result comes about through vowel melody apocope in CVCCV words, the second through the failure of cluster configurations to satisfy the structural requirements of compensatory open syllable lengthening. As in Icelandic, then, positing a second but empty nucleus to underlie certain monosyllables in Ponapean offers a coherent account of vowel lengthening in nouns without recourse to final consonant extraprosodicity.[8]

3.2. The predictability of insert vowels.

Irrespective of vowel lengthening, however, extraprosodicity has been

[7] Rehg and Sohl (1981) list no surface monosyllabic nouns of the shape CV (monomoraic) or CVV (bimoraic), a gap which is consistent with, though not determined by, rule (16). Since long vowels regularly shorten in word-final environments, however, an apparent reflex of apocope's affecting the second element of VV (e.g. *pa* 'to weave', reduplicated *pa:pa* durat ; *nta* 'blood', suffixed *nta:niki* poss. verb), it would seem quite unlikely that open monosyllable nouns could ever terminate in a long vowel. (But this would nonetheless be required of them under the minimum bimoraic word analysis.)

[8] As shown in (17b) below, alternations may support retention of the vowel melody too in the underlying representations of some words, which then is subject to a synchronically still active form of apocope.

claimed to play a crucial role in accounting for the particular site of epenthesis in Ponapean. As the coda filter rules out syllable-final consonants with independent place of articulation specifications (except word-finally, where extraprosodicity removes them from its domain), possible violations of (10) easily emerge through morphological operations such as reduplication and affixation. When this occurs, the potential violations are typically removed through the appearance of an intermediating vowel, which is usually either a copy of the first vowel in the following morpheme (17a) or an instance of an underlying vowel that otherwise deletes in word-final position (17b).

(17) a.

Base Word		Demonstrative (Prefixed) Form	
dey	'throwing contest'	akedey	/ak+dey/
$p^{w}uŋ$	'petty'	$akup^{w}uŋ$	/ak+$p^{w}uŋ$/
tantat	'to abour'	akatantat	/ak+tantat/

b.

Base Word		Durative (Reduplicated) Form	
tep	'to begin'	tepitep	/tepi+tep/
tep	'to kick'	tepetep	/tepe+tep/

Thus, no clusters emerge in the derivation of the forms in (17b) because an underlying stem-final vowel surfaces when it is not in word-final position. But in (17a), a vowel copy operation takes place to interrupt the heterorganic clusters that result from the prefixation of *ak-*. Vowel copy comes about, in Itô's analysis, because a consonant with its own place of articulation specifications cannot be syllabified as a coda under (10). This effectively strands the *k* in *ak-* as a syllable in its own right since it cannot form the onset of the following syllable, either, which already has an onset (only one is allowed). Hence, /ak+dey/ cannot syllabify as [ak]σ [dey]σ (violates (10)) or as [a]σ [kdey]σ (violates single conosonant onset), it can only be parsed with *k* as a member of neither syllable, as [a]σ [k]σ [dey]σ.

But [k]σ, with no nucleus, is still not a possible syllable in Ponapean. In order to make it one, a vowel is copied from the following morpheme. The reason the copy vowel is introduced after rather than before the *k* on this analysis is that the latter choice would still result in a violation of (10), namely, [ek]σ, whereas insertion after *k* results in [ke]σ, which is a well-formed syllable in Ponapean. Importantly, the selection of the insertion site

is not a specific property of vowel copy itself, but rather follows from the impossibility of one of the choices' ([ek]σ) satisfying the coda filter. The interplay of these factors is illustrated in (18), the last step of which is the syllablic incorporation of the word-final extraprosodic consonant.

(18)	Underlying	/ak+dey/	
	Extraprosodicity	/ak+de<y>/	
	(Syllabification)	[ak]σ [de]σ<y>	(Violates Coda Filter)
	(Syllabification)	[a]σ [kde]σ<y>	(Violates Onset Template)
	Default Syllabif.[9]	[a]σ [k]σ [de]σ<y>	([k] has no nucleus)
	(Vowel Copy)	[a]σ [ek]σ [de]σ<y>	(Violates Coda Filter)
	Vowel Copy	[a]σ [ke]σ [de]σ<y>	(Satisfies All Templates)
	Incorporation	[a]σ [ke]σ [dey]σ	(Extraprosodicity off)
	Surface	**akedey**	

This account of the positioning of the copy vowel would not be possible were it not for final consonant extraprosodicity, because that is what allows the filter against independent specification for place of articulation features in coda consonants to be maintained ; this filter, in turn, forces the copy vowel to appear after rather than before a consonant syllabified without a nucleus.

An alternative to the coda filter approach, however, is the general constraint against heterorganic clusters expressed in (12). It turns out that this also gives a unique determination of the site to be occupied by the copy vowel, because (12) rules against clusters of consonants with multiple place of articulation specifications whether within or between syllables. Since it does not presuppose final consonant extraprosodicity, and therefore does away with the coda filter as well, syllabification of /ak+dey/ can proceed directly to [ak]σ [dey]σ; (12) will then trigger vowel copy to break up the heterorganic cluster. The copy vowel itself has to appear between the two members of the cluster rather than after or before them because that is the only choice which removes the violation, as summarized in (19).

[9] The placement of *k* into its own syllable of course does not conform to the templates of Ponapean, either, which always require a sonorant nucleus. The syllabification of *k* and the introduction of the copy vowel are therefore perhaps best interpreted as simultaneous occurrences in the derivation of *akedey*, but the impossibility of alternative syllabic affiliation for the consonant or of a different site for the insert vowel remains.

(19)	Underlying	/ak+dey/	
	Syllabification	[ak]σ [dey]σ	(Violates Constraint (12))
	(Vowel Copy)	[aek]σ [dey]σ	(Still violates (12))
	(Vowe Copy)	[ak]σ [deey]σ	(Still violates (12))
	Vowel Copy[10]	[ak]σ [e]σ [dey]σ	(Violates Onset Formation)
	Syllabification	[a]σ [ke]σ [dey]σ	(Satisfies All Templates)
	Surface	akedey	

There is other evidence in Ponapean that shows that a simple constraint like (12) (or even (10)) does not tell the whole story, however. The prohibition of heterorganic clusters is actually just against those whose second member initiates a syllable which is itself either closed or, if containing a nonhigh vowel, followed by a word-final closed syllable whose own vowel is also nonhigh. Rehg and Sohl (1981:92-94) exemplify realization of the following closed syllable condition with the forms in (17a), but then show that heterorganic clusters are freely tolerated when the following syllable is open, as in the prefixed words in the right column of (20).

(20)	lapalap	'high ranking'	aklapalap	/ak+lapalap/
	manaman	'spiritual power'	akmanaman	/ak+manaman/
	tikitik	'small'	aktikitik	/ak+tikitik/

Similarly, vowel copy takes place before following mid or low vowels, but not when either of the two final vowels is high :

(21)	With Vowel Copy		Without Vowel Copy	
	tamataman	/tam+taman/	*ŋ*al(i)*ŋ*alis	ŋal+ŋalis/
	tepetepek	/tep+tepek/	pir(i)pirap	/pir+pirap/
	padapada:k	/pad+pada:k/	kil(i)kiles	/kil+kiles/
	kakakadall	/kak+kadall/	sop(u)sopuk	/sop+sopuk/

There would appear to be other conditions on vowel copy (relating, for example, to cliticization) which are "…by no means well understood", but it

[10] Though the only site consistent with (12) for the appearance of the insert vowel lies between the two consonants, whether syllabic structure accompanies its introduction en passant, as depicted here, or is provided subsequently in the derivation through (re)-syllabification does not bear on the issue. As in derivation (18), these events are perhaps best construed as simultaneous.

is quite clear that copy vowels are not introduced to break up all heterorganic clusters. Instead, as the parenthetical vowels in (21) indicate, heterorganic clusters not subject to vowel copy either remain intact or, optionally, acquire a different sort of inserted vowel, which Rehg and Sohl term epenthetic.

Epenthetic vowels differ from copy vowels both in quality and in optionality. Copy vowels are obligatory under conditions (a) and (b), whereas the occurrence of epenthetic vowels depends at least in part on the rate of speech, i. e. "…in slow, careful speech they are less likely to be employed than in rapid, less careful speech" (p. 94). Unlike copy vowels, the epenthetic vowel is always either *i* or, before rounded segments in the next syllable, *u*. Hence, pronunciations vary according to style and rate of speech between *kilkiles* and *kilikiles*, *sopsopuk* and *sopusopuk*, etc. Epenthesis can also affect the clusters in (20), giving variations between *akmanaman* and *akimanaman*, *aktikik* and *akitikik*, etc. Itô's (1989) illustration of epenthesis in the derivation of *kitikimen* 'rat' (indef.) from /kitik+men/, therefore, must be complemented by the grammaticality of the nonepenthesized variant, *kitikmen*.

In order to integrate these facts into an overall account of Ponapean insert vowels, it can hardly be the case that the avoidance of heterorganic clusters constitutes an obligatory constraint in the language. Rather, there appears to be only a stylistically governed tendency to avoid them. The composite picture of insert vowels and cluster modification will then have to contain specific conditions on the rule for vowel copy, in addition to certain other largely arbitrary morphophonemic rules. For example, despite the fact that geminate obstruents are phonotactically consistent with the homorganicity constraint, their occurrence morpheme-internally is highly exceptional, limited to borrowings and exclamations. And when they arise through reduplication or prefixation, the first member becomes a nasal :

(22)	a.	nappa	'Chinese cabbage' (Japanese)	
		kiassi	'catcher' (English)	
		akka	'exclamation of surprise'	
	b.	pampap	/pap+pap/	'swimming'
		sansas	/sas+sas/	'staggering'
		anke:lail	/ak+ke:lail/	'demonstrative of bravery'

The impermissability of heteromorphemic geminate obstruents would seem to be unrelated to the existence of other clusters in Ponapean, as would the fact that they are removed through nasalization rather than deletion, epenthesis, or some other logical possibility. By the same token, the interruption of certain consonant sequences under special conditions by copy vowels cannot be due to a general constraint against the existence of heterorganic clusters, because their occurrence clearly is permitted.[11] Like geminate nasalization, in other words, vowel copy must be an actual rule of Ponapean, and it cannot be fully determined by an optional constraint such as in (12).

But as a stylistic option, (12) can determine the specific properties of vowel epenthesis. The phonetic quality of the vowel will follow from independent underspecification principles establishing the least marked features in a given context, as per Archangeli (1984), or just from general redundancy rules governing the internal structure of segments (Clements 1987). When option (12) is not selected, heterorganic clusters are free to appear, when (12) is brought into play, epenthesis breaks them up :

(23) a. Underlying /kitik+men/ (Option (12) not chosen)
Syllabification [ki]σ [tik]σ [men]σ
Surface kitikmen
b. Underlying /kitik+men/ (Option (12) selected)
Syllabification [ki]σ[tik]σ[men]σ
Epenthesis [ki]σ[tik]σ[i]σ[men]σ
Syllabification [ki]σ[ti]σ[ki]σ[men]σ
Surface kit:men

Other than the fact that it occurs at all, then, no specific properties of epenthesis need be stipulated in Ponapean. Epenthesis is merely the

[11] In order to prevent them being interrupted by epenthesis as a consequence of the coda filter (10), Itô (1986:136ff.) proposes that 'fake' heteromorphemic geminates (with their own place of articulation specifications) first fuse into 'true' geminates (which share all their melodic features) before undergoing the nasalization process exemplified in (22b). This also permits heteromorphemic sonorant geminates, which undergo no apparent phonological modification, to escape epenthesis because under fusion they would become true geminates, too : *memmem* 'sweet' (</mem+mem/, **memimem*), *lallal* 'to make a sound' (</lal +lal, **lalilal*), *rerrer* 'to tremble/(</rer+rer>, **rerirer*), etc.

realization of an optional constraint against clusters with multiple place of articulation specifications, and the precise placement of the epenthetic vowel follows from the inability of alternative sites to achieve conformity with phonological principles of the language. As (23b) illustrates, when one of these principles is (12), syllable structure reconfigures so as to accommodate the vowel that results from epenthesis.

If the coda filter in (10) were maintained instead of (12), now also necessarily made optional, the corresponding derivations of *kitikmen* and *kitikimen* would be as in (24).

(24) a. Underlying /kitik+men/ (Option (10) not chosen)
Extraprosodicity /kitik+me<n>/
Syllabification [ki]σ [tik]σ [me]σ <n>
Incorporation [ki]σ [tik]σ [men]σ
Surface kitikimen

b. Underlying /kitik+men/ (Option (10) selected)
Extraprosodicity /kitik+me<n>/
Syllabification [ki]σ[ti]σ[k]σ[me]σ <n>
Epenthesis [ki]σ[ti]σ[ki]σ[me]σ <n>
Incorporation [ki]σ[ti]σ[ki]σ[men]σ
Surface kitikimen

It is thus also possible to account for the nonapplication of epenthesis by ascribing optionality to the proposed coda filter. As (10) requires final consonant extraprosodicity in order that word-final consonants may occur without having to share place of articulation specifications, however, there is no value in assigning extraprosodicity when the coda filter is not even in force. While there is no particular harm in it either beyond unnecessary complication of the derivation, removal of extraprosodicity from cases like (24a), where it serves no function since the coda filter option has not been selected, would amount to a revealing but otherwise unmotivated complication of the phonology, for turning off extraprosodicity would always be coincident with the coda filter's nonselection. More importantly, the characterization of the coda filter as optional in order to accommodate consonant clusters in words like *kitikmen* has the consequence that heterorganic clusters are predicted also to occur at the end of the word, since it is only the coda filter against unique place specification that rules

these out in the first place. All evidence is that, as exemplified in (9c), final clusters must always be homorganic : *emp*, not **enp*, etc. Because it explicitly refers to a sequence of two consonants, the appropriate constraint on applicability of the cluster condition in (12) is relatively straightforward, viz. 'optional when heterosyllabic'. The coda filter in (10), however, refers only to a single consonant at the end of the syllable—hence there is no apparent way to express that it is optional just when another consonant follows in the next syllable.

A coherent, empirically adequate alternative resides in elimination of Ponapean extraprosodicity altogether and results in the analysis outlined in (23), where clusters multiply specified for place of articulation are stylistically permissable when heterosyllabic, otherwise subjected to the epenthesis process induced by the invocation of (12). Language specific rules also exist to insert copy vowels under cerain conditions into heterorganic clusters and to nasalize the first element of most heteromorphemic geminate obstruents. Unlike epenthesis, though, these operations are obligatory and highly restricted in scope. Epenthesis per se, as Itô (1989) correctly hypothesized, is fully determined by independent phonological principles of Ponapean—but with (12) serving in lieu of (10), these do not entail the stipulation of word-final consonant extraprosodicity.

4. Extraprosodicity and the analysis of consonant clusters in English

Competition between the cluster condition and coda filter approaches to place of articulation restrictions obtains also in the description of English, though here the results overlap only partially. Pursuing a coda filter interpretation, Borowsky (1989) argues that in the level 1 and underlying phonology English permits a coda with two skeletal positions just in case the second is a consonant whose feature matrix is place-linked to another. Accordingly, a consonant may syllabify with a preceding long vowel (which produces a VC coda) only if it is homorganic with the onset of the next syllable, and tautosyllabic clusters (CC coda) are sanctioned only if their final consonant shares place features either with the other consonant in the cluster or with the following onset. These possibilities are illustrated

in (25), and are taken to be subject to the English coda filter in (26).[12]

(25) a. an-cient, boun-teous, cam-bric, caul-dron, coun-cil, dain-ty, laun-dry, poul-try, ries-ling, sol-dier, wain-scot

b. acupunc-ture, ant-ler, chand-ler, gump-tion, instinc-tive, part-ner, sanc-tion, symp-tom, tex-ture, vint-ner

(26) * V X X]σ
|
[PLACE]

Construing (26) to be governed too by the constraint that association lines are interpreted as exhaustive, the VVC rhymes in the initial syllables of (25a) are phonotactically permissable since their consonants share place of articulation with following onsets. But words such as **caul-pron*, **daim-ty*, **laun-kry*, **chaim-ker*, etc., whose clusters are heterorganic, would be filtered out, Similarly, the VCC rhymes in (25b) are allowed through since in each case the final C shares place of articulation with a neighboring consonant, but this would not be the case in nonoccurring words such as * *synp-tom*, **tex-pure*, **park-ner*, etc.

Borowsky observes that proper nouns are often in violation of the two-place maximum coda restriction (*Augs-burg*, *Carls-bad*, *Blooms-bury*) apparently at play in the level 1 phonology,[13] and that the coda filter is systematically suspended upon entrance to the level 2 phonology (*child-hood*, *field-hand*, *keep-sake*). But even in nonderived contexts in the common vocabulary, violations of the coda filter abound in word-final position, where there is no following consonant for the final C in VVC to share place features with (*node*, *tape*, *keep*, *fake*; *balloon*, *isotope*, *hurricane*).

[12] Borowsky's formulation is as follows : * X X]σ
|
[+cons]

The changes reflected in (26) are intended to clarify that the filter operates only on place features, not just any structural linkage (such as laryngeal features), and that its exclusionary effects are in fact restricted to codas, i. e. to VC or CC configurations following a (nuclear) V. Borowsky also considers that her version of the filter has the effect of ruling out two-place (*elk*, *melt*) and larger (*corpse*, *world*) codas in word-final position irrespective of homorganicity, words which she ultimately sanctions through final consonant extraprosodi-city ; cf. below.

[13] Hence vowel shortening before irregular inflections, as in *mean+t*.

In order to maintain conformity with the coda filter in these cases, it is necessary to stipulate that word-final consonants are extraprosodic. Though at first it might seem so, this extraprosodicity requirement in fact cannot be equated with the extrametricality stipulations presumed to operate in the English stress system (Hayes 1982), first because it does not affect monosyllables anyway and second because among nouns extrametricality is defined on the entire rhyme, though among verbs on just the final consonant. All the same, it would be necessary to stipulate special extraprosodicity for the entire cluster in monomorphemic verbs which have heterorganic VVCC rhymes (*coax*, *hoax*, *traipse*), because the occurrence of even one tautosyllabic consonant after a long vowel constitutes a violation of the coda place filter.[14] Despite its relevance only to underlying and level 1 phonology, therefore, (26) still requires the otherwise unmotivated stipulation of just word-final consonant extraprosodicity in nouns like *node* and *balloon* which terminate in VVC, and of word-final consonant cluster extraprosodicity in verbs like *traipse* which end in heterorganic VVCC.

By contrast, Yip (1990) proposes an account in which place of articulation constraints on English consonant clusters are due to operation of the condition given in (12), or, in her words, to the restriction that "Adjacent consonants are limited to a single Place specification." The success of this constraint depends on the representation of coronal place as radically underspecified, so that while one member of the cluster may be either labial or velar (specified), the other has to be either the same, sharing that place specification, or else coronal (unspecified). Yip amply illustrates with respect to two member heterosyllabic clusters following short vowel (about which, since it is defined on three member rhymes, the coda place filter in (26) is silent) : *chapter*, *capsule*, *whimper*, *prism*, *atlas*, *signify*, etc. There are certain exceptions, viz. the *gm* cluster in Greek-derived words (*sigma*), clusters with no coronal in some proper names (*Kafka*) and a few native words (*napkin*). But the cluster condition turns

[14] Borowsky maintains that two consonants would always have to be marked as extraprosodic in words with VVCC rhyme structure, even when the cluster is homorganic, as in *child*, *field*, *beast*, *paint*, *flounce*. But multiple stipulation wouldn't really be necessary here under the proposal of single-consonant extraprosodicity since the visible C in VVC<C> does share place of articulation with the final, albeit extraprosodic C.

out also to accommodate the presumably exhaustive list of three member medial clusters cited by Borowsky, including all of the 85 items with VCC codas like *symptom* which conform to the coda filter as well as the 15 words presented as exceptions to it, e.g. *arctic, sculptor*. The cluster condition still excludes coda filter violations like **chaimker*, but it generally does not rule out three member clusters unless a labial is adjacent to a velar (**fipkture, * arcpic*). It thus asserts that many possible words excluded under the coda filter account, like **texpure* (cf. *expert*) or **parkner* (cf. *Orkney*, albeit a proper name) are accidental rather than systematic gaps. According to Yip's cluster condition account, then, the overriding generalization in both two and three member medial clusters in English is that at most one noncoronal place of articulation is permitted in neighboring consonants, a restriction which she notes also characterizes word-initial as well as word-final clusters and so quite escapes the effects of a coda-specific Place filter. Of course, implementation of the cluster condition in (12) rather than the coda filter in (26) means that no particular extraprosodicity is needed in order to account for heterorganic finals like *elk* and *help*, or even *traipse* and *coax*, yet **efk, *henp, *traipf*, and **coakp* are all properly ruled out along with **chaimker, *arcpic*, etc.

5. Coda licensing and intersyllabic place of articulation constraints.

Apart from its crucial reliance on extraprosodicity, moreover, the coda filter approach differs from a simple constraint against clusters with multiple place of articulation specifications in that it is defined in terms of a strictly local prosodic domain, i.e. within rather than between individual syllables : because association lines in structural descriptions are interpreted as exhaustive, no reference need be made to structure outside the syllable that the coda filter is defined on. As Yip points out with respect to English, the fact that at most one overt Place specification is permitted in onset clusters as well as in codas shows that in this language the restriction is not a property of codas alone, but rather of consonant clusters in general, which in turn necessitates positing the cluster condition. To the extent in other languages that the exclusion of clusters multiply specified for place of articulation features can be construed purely as an aspect of

syllable composition rather than as a consequence of any specific constraint against them, on the other hand, which Itô's (1986) comprehensive theory of the syllable requires, the advantage in this regard of the coda filter analysis might seem to make the price of special extraprosodicity worth paying. But under the rather more direct approach to syllabic licensing developed by Goldsmith (1990), the effects of the cluster constraint in most cases do in fact derive exclusively from conditions on syllable composition. Though perhaps otherwise a notational equivalent of the system of negative filters presented by Itô, this proposal for syllabic organization contrasts with it sharply with respect to the role of extraprosodicity stipulations.

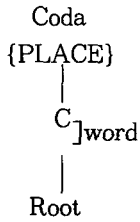
Goldsmith's idea is that specific syllable positions license rather than block the occurrence of various segmental substructures and features. For example, all languages permit (and some require) consonantal segments to appear in the onset of the syllable, and all license them to have their own place of articulation features. But while some languages allow nothing at all in the coda, requiring open syllables throughout (Maori), and some permit any consonant in their inventory to appear in this position (Yokuts), others restrict the composition of the coda in various ways. In particular, many languages require coda consonants to be homorganic with following onset consonants, and may impose further specific limitations on the coda. The Austronesian language Selayarese falls into this category as analyzed by Goldsmith, because the only consonant it permits to appear in the coda is a nasal homorganic with the following consonant if there is one, otherwise, i.e. word-finally, the nasal is velar. This circumstance calls for the coda to license a consonant only for the feature [+nasal] ; its place of articulation features (for which it is not licensed) will then always derive from the following onset consonant (which is licensed universally for place features), except in word-final position where special licensing for velar articulation is required.[15]

Applying this concept to Ponapean results in a similar analysis : the coda is licensed for just one set of place of articulation features in word-final position, whether for a single consonant (e.g. *mem*) or a consonant cluster

[15] This is much the same situation as in Japanese, where a word-final nasal assimilates in place to the following consonant if there is one, otherwise is articulated either with velar/uvular closure or without closure at all, i. e. as a nasal glide (cf. Trigo 1988).

(*emp*). Elsewhere, i. e. when another syllable follows, such licensing is optional—if the option is selected, heterorganic clusters are permitted ; if it is not selected, presumably the unmarked case, heterorganic clusters are interrupted by epenthesis.

(27)



The coda license in (27) thus authorizes one instance of a Place node to occur under domination of a word-final consonant ; among consonants elsewhere, except universally in the onset, no Place node is licensed at all, with the result that all medial clusters will be homorganic since in the coda Place is parasitic on the onset. In Ponapean, however, the word-final restriction of (27) optionally can be relaxed so as to license independent place features among word-internal coda consonants as well, which results in the observed variation between epenthetically interrupted and uninterrupted heterosyllabic clusters. In other languages, such as Yokuts, removal of the word-final restriction altogether results in the syllable-final appearance of any one of its consonants, whether homorganic with a following consonant or not. In still others, e.g. Axininca Campa (Payne 1981, Goldsmith 1990), the complete absence of a coda license for place of articulation anywhere correlates with the absolute restriction of coda consonants to homorganic medial clusters, so that no consonants are word-final. The pattern that results from retention of (27) without optional relaxation of the word-final restriction then is that while medial clusters must be homorganic, word-final consonants are free to assume any place of articulation the language has, which is the distribution of Diola Fogny (Sapir 1965).[16]

[16] Another variant of (27) would be one which licenses only certain place of articulation features in word-final consonants, e.g. velar as in Selayarese, or, more commonly, coronal as in Greek, Finnish, or Spanish (cf. Yip 1989). The assumption that coronal is unspecified necessitates in the latter group of languages either that redundant nodes and feature values are automatically supplied as soon as rules of derivation make explicit reference to them

5.1. Stray erasure in Diola Fogny.

As analyzed by Itô (1986), this language in most relevant respects seems to be governed by the same syllabic considerations as Ponapean. The major difference is that Ponapean 'rescues' phonotactically aberrant consonants by syllabifying them with insert vowels, whereas Diola deletes them. As in Ponapean, but with apparently obligatory force, consonant clusters are not allowed unless they share place of articulation features, and these, moreover, are restricted to sequences of nasal or liquid plus obstruent or to geminate nasals (so that nonfinal coda consonants are licensed only for the feature [+sonorant]). Otherwise, syllables are uniformly open, except word-finally, where they may be closed by up to two consonants meeting the preceding restrictions. Showing syllable division, some of the examples Itô (1986:58ff) cites from Sapir (1965) are given in (28).

(28)	a.	kaŋ-kan	'made'	
		jen-su	'undershirt'	
		kun-don	'large rat'	
		sal-te	'be dirty'	
	b.	famb	'annoy'	
		ka-band	'shoulder'	
		bunt	'lie'	
	c.	u-ju-ja	'if you see'	/ujuk+ja/
		le-ku-jaw	'they won't go'	/let+ku+jaw/
		ko-ko-ben	'yearn, long for'	/kob+kob+en/

The forms with medial clusters in (28a) and with final clusters in (28b) will all conform to the same coda filter as proposed in (10) for Ponapean if final consonant extraprosodicity is assumed, but the underlying forms in (28c) will not ; in these cases, the first consonant in the cluster must be deleted, which can be attributed to stray erasure since (10) would block its incorporation as a coda. The resulting degenerate syllable is then removed because it has no nucleus and because epenthesis has not been selected for.[17]

[16] continued
(Archangeli 1984), or that a class node like Place can be constrained to null reference in order to exclude all but the unmarked form.

[17] As Itô points out, whether stray erasure or epenthesis is brought into play

As in Ponapean, the cluster condition in (12) will account for this same range of facts without resorting to extraprosodicity, but so will the coda licensing approach : with no license for coda place features except word-finally, syllabification of the underlying forms in (28c) also strands morpheme-final consonants which do not share place features. The two intrasyllabically restricted ways of deriving *kokoben* are illustrated in (29).

(29)	a.	Underlying	/kob+kob+en/	(Assumes (10))
		Extraprosodicity	/kob+kob+e<n>/	
		Syllabification	[ko]σ [b]σ [ko]σ [be]σ <n>	
		Stary Erasure	[ko]σ [ko]σ [be]σ <n>	
		Incorporation	[ko]σ [ko]σ [ben]σ	
		Surface	kokoben	
	b.	Underlying	/kob+kob+en/	(Assumes (27))
		Syllabification	[ko]σ [b]σ [ko]σ [ben]σ	
		Stray Erasure	[ko]σ [ko]σ [ben]σ	
		Surface	kokoben	

Not all instances of cluster reduction can be accounted for under the analysis assuming (10) just by the stray erasure of partially syllabified segments, however, because stray erasure itself must be fed by a desyllabification process when derivationally intermediate clusters of three consonants are taken into account, which do arise when CVCC monosyllables are reduplicated. As illustrated in (30a), Itô's (1986:77-82) derivation of *ererent* 'it is light' from/e+rent+rent/ (cf. also Steriade 1982) passes through a stage in which the first member of the homorganic morpheme-final cluster properly syllabifies as a coda (it shares its place features with the second member, which cannot also form part of the coda since the Diola syllable template allows at most one consonant in that position). Thus stranded without a nucleus, the second consonant is stray-erased ; but this places the previously syllabified coda consonant in

[17] continued
would seem to be a language-specific property, i.e. a matter of parametric variation. However, optional epenthesis plays a significant role in Diola, too, especially in careful speech, where it then obviates stray erasure : for example, /ujuk+ja/ is realized either as *ujukuja*, with an epenthetic *u* in slow speech, or as *ujuja*, with a reduced consonant cluster in rapid speech (Sapir 1965:17-19).

violation of (10) since the consonant it shared its place features with is no longer present. This circumstance, finally, triggers desyllabification and the stray erasure of the offending consonant.

(30)	a.	Underlying	/e+rent+rent/ (Assumes (10))
		Extraprosodicity	/e+rent+ren<t>/
		Syllabification	[e]σ [ren]σ [t]σ [ren]σ <t>
		Stray Erasure	[e]σ [ren]σ [ren]σ <t>
		Desyllabification	[e]σ [re]σ n [ren]σ <t>
		Stray Erasure	[e]σ [re]σ [ren]σ <t>
		Incorporation	[e]σ [re]σ [rent]σ
		Surface	ererent
	b.	Underlying	/e+rent+rent/ (Assumes (27))
		Syllabification	[e]σ [re]σ [n]σ [t]σ [rent]σ
		Stray Erasure	[e]σ [re]σ [rent]σ
		Surface	**ererent**

The corresponding derivation under a system assuming (27) is much less complex, as illustrated in (30b).[18] The only coda consonant licensed for place of articulation features, whether shared or not, is in the word-final syllable. Since the *nt* cluster of the reduplicated morpheme is not word-final, neither may it or its members be incorporated into a syllable coda without giving up all inherent place features and deriving them instead from the following syllable's onset, which in Diola must be an obstruent in

[18] As discussed above with reference to heteromorphemic geminates in Ponapean, a special rule is necessary under the coda filter or cluster condition analyses to fuse fake geminates into true ones in order to prevent them from being interrupted by epenthesis. A significant advantage of the coda license approach in (27) is that this special fusion would appear to be unnecessary, or at least determined independently given the conditions on syllabification : since place of articulation features are not licensed in the coda to begin with except word-finally, any nonfinal coda consonant will automatically sacrifice its inherent place features if they can be derived instead from the following onset consonant, which is always possible with accidental geminates and other systematically homorganic clusters. (As it is not possible for consonants in heterorganic clusters to share place features, obviously, their syllabification will depend on epenthetic support.) A specific prediction of this interpretation is then that any language which prohibits heterorganic consonant clusters (and thus avoids them by epenthesis, stray erasure, or assimilation) will, if it has geminates at all, permit them to remain intact when heteromorphemic.

order to serve as the source of assimilative spreading. As the following *r* does not satisfy this condition (irrespective of whether the *t* in *nt* is eliminated first), the maximum syllabification that can result is with [n]σ as coda of one degenerate syllable sharing its place features with [t]σ as onset of another. In the absence of a parameter setting for epenthesis, the vocalically unsupported [n]σ and [t]σ are stray-erased.

6. Conclusion.

The extraprosodicity effects in syllabic phonology reviewed here reduce to two kinds. In one type, a peripheral consonant functions as if it were onset to another syllable. Considering it actually to be such creates an otherwise unavailable environment to condition rules like open syllable lengthening (Icelandic, Ponapean monosyllabic nouns) or to cause a superficially ultimate syllable to be analyzed as penultimate (Arabic superheavy finals). On comparison, the degenerate syllable or empty vowel account emerges as empirically superior to the alternative of stipulating word-final consonants as extraprosodic, and follows as a natural consequence of the autosegmentalization of skeletal versus melodic representation. In the other type, consonantal extraprosodicity figures crucially in expressing the generalization holding over several languages that coda consonants must derive their place of articulation features from a following onset consonant, except, of course, at the end of the word where there is no following consonant. Substituting a negative condition on heterorganic clusters for the coda place filter, however, as Yip (1990) argues is independently necessary for English, removes any requirement for the stipulation of extraprosodicity and results in the ability to distinguish between tautosyllabic and heterosyllabic applicability of the condition. In Ponapean, this is a necessary distinction inasmuch as heterorganic clusters optionally are permissable in intersyllabic contexts, but are prohibited entirely when within the syllable.

This distinction can also be drawn in the context of a theory which, like that of Itô (1986), seeks to characterize as many phonotactic restrictions as possible, even intersyllabic ones, strictly within the domain of the syllable. But no stipulations of extraprosodicity are required on this

assumption either if the positive approach to syllabic licensing outlined by Goldsmith (1990) is adopted, wherein place of articulation features accrue to a coda consonant only when specifically licensed to do so or when derived from a following onset. In further view of independently supported principles of syllabification which allow for the incorporation of specific additional segments at the periphery of the word or stem, i.e. appendices, there is no remaining reason to extend the stipulation of segmental extraprosodicity beyond its stress-regularizing role in the metrical component of phonological theory.

References

Anderson, Stephen R. (1984) 'A metrical interpretation of some traditional claims about quantity and stress', In Aronoff and Oehrli (1984) 83-106.

Archangeli, Diana (1984) *Underspecification in Yawelmani phonology and morphology*, PhD dissertation, MIT. Published 1988, New York : Garland.

Árnason, Kristjan (1980) *Quantity in historical phonology : Icelandic and related cases*, Cambridge : Cambridge University Press.

Árnason, Kristjan (1984) 'Toward a model of Modern Icelandic syllable types', *Islenkst Mal 6*. 136-153

Aronoff, Mark and Richard T. Oehrle (eds.) (1984) *Language sound structure : studies in phonology presented to Morris Halle by his teacher and students*, Cambridge, Mass : MIT Press.

Borowsky, Toni (1989) 'Structure preservation and the syllable coda in English', *NLLT 7*. 145-166.

Clements, George N. (1985) 'The geometry of phonological features', *Phonology Yearbook 2*. 223-252.

Clements, George N. (1987) 'Toward a substantive theory of feature specification', *NELS 18*. 79-93. Amherst : The University of Massachusetts Department of Linguistics.

Clements, George N. and Samuel J. Keyser (1983) *CV phonology : a generative theory of the syllable*, Cambridge, Mass : MITPress.

Garnes, Sarah (1974) 'Quantity in Icelandic : production and perception',

Hamburger phonetische Beiträge 18.

Giegerich, Hans (1985) *Metrical phonology and phonological structure*, Cambridge : Cambridge University Press.

Goldsmith, John (1990) *Autosegmental and metrical phonology*, London : Basil Blackwell.

Halle, Morris and Jean-Roger Vergnaud (1987) *An essay on stress*, Cambridge, Mass : MIT Press.

Hammond, Michael (1984) *Constraining metrical theory : a modular theory of rhythm and destressing*, PhD dissertation, UCLA. Published 1988, New York : Garland.

Hayes, Bruce (1981) *A metrical theory of stress rules.* PhD dissertation, MIT. Published 1985, New York : Garland.

Hayes, Bruce (1982) 'Extrametricality and English stress', *LI 13.* 227-276.

Hayes, Bruce (1986) 'Inalterability in CV phonology', *Lg 62.* 321-351.

Hayes, Bruce (1988) 'Compensatory lengthening in moraic phonology', *LI 30.* 253-306.

Hogg, Richard and C. B. McCully (1987) *Metrical phonology : a coursebook*, Cambridge : Cambridge University Press.

Itô, Junko (1986) *Syllable therory in prosodic phonology*, PhD dissertation, University of Massachusetts. Published 1988, New York : Garland.

Itô, Junko (1990) 'A prosodic theory of epenthesis', *NLLT 7.* 217-259.

Iverson, Gregory K. and Courtenay Kesterson (1989) 'Foot and syllable structure in Modern Icelandic', *Nordic Journal of Linguistics 12.* 13-45.

Kiparsky, Paul (1984) 'On the lexical phonology of Icelandic', In C.-C. Elert et al. (eds.) *Nordic Prosody* III. Stockholm : Almqvist and Wiksell. 135-164.

Liberman, Mark and Alan Prince (1977) 'On stress and lingusitic rhythm', *LI 8.* 249-336.

Macken, Marlys (1988) 'Preaspiration and class node delinking', *Proceedings of the Eastern States Conference on Linguistics 5.* 313-325. Columbus : The Ohio State University Department of Linguistics.

Marlett, Stephen and Joseph Stemberger (1983) 'Empty consonants in Seri', *LI 14.* 617-639.

McCarthy, John (1986) 'OCP effects : gemination and antigemination', *LI 17.* 207-263.

McCarthy, John and Alan Prince (1989) 'Prosodic morphology and

templatic morphology', To appear in M. Eid and J. McCarthy (eds.) *Proceedings of the second annual symposium on Arabic lingusistics.* Amsterdam : John Benjamins.

McCarthy, John and Alan Prince (1990) 'Foot and word in prosodic morphology : the Arabic broken plural', To appear in *NLLT 8.*

Minkova, Donka (1982) 'The environment for open syllable lengthening in Middle English', *Folia Linguistica Historica 3.* 29-58.

Payne, David L. (1981) *The phonology and morphology of Axininca Campa,* Dallas : Summer Institute of Linguistics.

Prince, Alan (1984) 'Phonology with tiers', In Aronoff and Oehrle (1984). 234-244.

Pulleyblank, Douglas (1986) *Tone in lexical Phonology,* Dordrecht : D. Reidel.

Rehg, Kenneth L. and Damian G. Sohl (1981) *Ponapenan reference grammar,* Honolulu : The University Press of Hawaii.

Sapir, J. D. (1965). *A grammar of Diola-Fogny,* (West African Language Monographs 3.) London : Cambridge University Press.

Selkirk, Elizabeth O. (1981) 'Epenthesis and degenerate syllables in Cairene Arabic', In Hagit Borer and Youssef Aoun (eds.) *Theoretical Issues in the Grammar of Semitic Languages.* (MIT Working Papers in Linguistics, vol. 3.) 209-232.

Selkirk, Elizabeth O. (1982) 'The syllable', In Harry van der Hulst and Norval Smith (eds.) *The structure of phonological representations, Part* II. Dordrecht : Foris. 337-383.

Spitzer, Mary (1989) *Constrainsts on extrametricality,* PhD dissertation, University of Iowa.

Steriade, Donca (1982) *Greek prosodies and the nature of syllabification,* PhD dissertation, MIT.

Trigo, R. Lorenzo (1988) *On the phonological derivation and behavior of nasal glides,* PhD dissertation, MIT.

Yip, Moira (1990) 'Coronals, consonant clusters and the coda condition', To appear in C. Paradis and J.-F. Prunet (eds.) *The Special Status of Coronals.* Dordrecht : Foris.

ABSTRACT

The Stipulation of Extraprosodicity in Syllabic Phonology

Gregory K. Iverson

Though the role of extraprosodicity has been thoroughly integrated into metrical theory, it has played a decidedly less pervasive part among the rules of syllabic phonology. Under Itô's(1986, 1989) 'codafilter' account of syllable formation in certain types of languages, however, extraprosodicity of a word-final consonant is crucial both for maintaining the generalization that consonants in clusters must be homorganic and, when they are not, for determining the site of epenthesis. But in lieu of the coda filter and its extraprosodicity requirement, syllabification can be subject to a well-formedness condition which rules against consonant clusters in which each member is specified for Place, with epenthesis then applying precisely where it does because that is the only site which serves to remove violations. In further view of CV phonology's prediction of melodically empty skeletal representation and certain general principles of syllabic licensing, it is concluded that the role of stipulated segmental extraprosodicity is properly restricted to the metrical component of phonological theory.

Department of Linguistics
University of Wisconsin－Milwaukee
P.O.Box 413
Milwaukee, Wisconsin 53201
U. S. A.