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Icelandic vowel lengthening and prosodic phonology

1. Introduction: some basic tenets of prosodic phonology

It is an important insight of prosodic phonology that sequences of sound segments are structured according to two hierarchies: the morphosyntactic hierarchy and the prosodic hierarchy. These hierarchies may provisionally be stated as follows:[1]

(1)a *morphosyntactic hierarchy:*
morpheme (M)
grammatical word (W)
phrase
.
.
.

b *prosodic hierarchy:*[2]
syllable (σ)
phonological word (ω)
phonological phrase (φ)
.
.
.

These two hierarchies are not isomorphic, as a simple example from Dutch may illustrate: the derived word *rodig* [rodəx] 'reddish', derived from *rood* 'red' by means of the suffix *-ig* has the following two structures:

(2)a *morphosyntactic structure:* $[[rod]_M[ig_M]_W]$

prosodic structure: $((ro)_\sigma(dəx)_\sigma)_\omega$

An adequate description of a language must contain rules for the mapping of morphosyntactic structure onto prosodic structure.
Both the syllable and the phonological word function as domains of application of phonological rules and as domains of phonotactic restrictions. Since Hooper(1976) it has been accepted in generative phonology that the basic domain of phonotactic restrictions is not the morpheme but rather the syllable: a sequence of segments is wellformed if it can be parsed into one or more wellformed syllables, with no segment left over. The fact that the morpheme cannot be the basic domain of phonotactic restrictions is very clear in Semitic languages, whose lexical morphemes may consist of consonants only, the so-called consonant skeletons like /ktb/ 'to write'. It is also immediately evident for a language like Quechua, which has morphemes with unpronounceable clusters such as the plural suffix *-rga/-rka* (cf. Adelaar 1977: 128). This suffix does not cause any problem for phonotactics because Quechua stems always end in a vowel; hence, the first consonant of this suffix, /r/, syllabifies with the preceding stem-final vowel, and thus there is no phonotactically illformed cluster anymore.

However, it has repeatedly been observed that a language may exhibit phonotactic restrictions that apply word-initially, but not to word-internal onsets.
The same holds for word-final codas compared to word-internal codas (cf. Booij 1983: 252-53). For instance, several languages do not allow for word-final consonants although word-internal syllables may end in a consonant. Another example is English that has no word-initial /ž/, although this consonant occurs as word-internal onset. This shows that, besides the syllable, the phonological word is also a domain for phonotactic restrictions. Therefore, the so-called distributional approach to syllable structure, in which the class of possible onsets of language L is equated with the class of possible word-initial consonant-(cluster)s, and the class of possible codas of L with the class of possible word-final consonant(cluster)s is not tenable, a point that has also been stressed by Bell(1976).

In this paper I will assume that syllabification takes place according to the following principles:
(a) The domain of syllabification is the phonological word.
(b) For each language the set of possible onsets and codas is defined. This set is partly determined by the universal sonority constraint which requires that the sonority of segments increases in onsets and decreases in codas (cf. Kiparsky 1979).[3]
(c) Syllabification applies according to the Maximal Onset Principle, i.e. of a given consonantcluster we assign a maximal number of consonants to the onset of the syllable whose nucleus is the following vowel.

The notion 'phonological word' in (1) deserves some further motivation. The distinction between grammatical words and phonological words is necessary, because for certain types of complex words these two notions do not coincide. In many languages compounds consist of more than one phonological word. This is clear from the fact that the boundary between the two parts of a compound always coincides with a syllable boundary, even if this violates the Maximal Onset Principle. Also, very often the constituent parts of compounds function as independent domains for the application of phonological rules like the assignment of stress. That is, a compound is an example of the non-isomorphy of morpho-syntactic and prosodic structure.

In many languages some affixes also behave as independent domains of syllabification and stress assignment. An example is the Dutch suffix *-achtig* '-like'. *Roodachtig* 'reddish', for instance, has the syllabification pattern $(\text{rod})_{\sigma}(\text{ax})_{\sigma}(\text{tax})_{\sigma}$, not $(\text{ro})_{\sigma}(\text{dax})_{\sigma}(\text{tax})_{\sigma}$, as would be expected if this word were one phonological word.[4]

It will be clear then that the domain of the phonological word is determined by morpho-syntactic considerations, whereas the division into syllables within the phonological word is a purely phonological matter. Thus, the following algorithm for the assignment of prosodic structure to words is assumed:

(3)i Divide the segmental string of the grammatical word into one or more phonological words.
ii Divide the phonological word into one or more wellformed syllables, in accordance with the Maximal Onset Principle.

In the next section it will be shown that this set of assumptions relating to prosodic structure is of crucial importance for an insightful account of the phenomenon of vowel lengthening in Icelandic.

2. A prosodic analysis of Icelandic vowel length

2.1. Vowel lengthening in underived words

The facts of Icelandic vowel lengthening in underived words can be summarized in the following, informally stated rule (cf. Einarsson 1945: 4, Árnason 1980, Gussmann 1985):

(4) $\begin{bmatrix} +\text{ syll} \\ +\text{ stress} \end{bmatrix} \rightarrow [+\text{ long}] \; / \; \text{—} \; \begin{Bmatrix} \text{p,t,k,s + j,v,r} \\ C_1^0 \end{Bmatrix} \begin{Bmatrix} V \\ \# \end{Bmatrix}$

That is, a stressed vowel is lengthened if it is followed by at most one consonant or by one of the consonantclusters /p,t,k,s/ + /j,v,r/. The following data illustrate this:

(5)i hatur /hat^{h}yr/ 'hatred' [ha:t^{h}yr]
hattur /hat^{h}t^{h}yr/ 'hat' [ha^{h}tyr]
ofsi /ɔfsI/ 'violence' [ɔfsI]
titra /t^{h}It^{h}ra/ 'shiver' [t^{h}I:t^{h}ra]

ii baδ /paδ/ 'bath' [pa:δ]
mein /mɛin/ 'damage' [mɛi:n]
sem /sɛm/ 'as, like' [sɛ:m]
ut /ut^{h}/ 'out' [u:t^{h}]

Rule (4) presupposes that orthographically geminate consonants are also geminates at the underlying phonological level. Hence, the first vowel of *hattur* is not lengthened, because it is followed by a consonantcluster not consisting of one of the combinations mentioned in (4). Phonetically, these geminate consonants surface as long consonants, but as preaspirated consonants in the case of /p^{h}, t^{h}, k^{h}/ (cf. Hermans 1985).

Vennemann(1972: 5) proposed to interpret the Icelandic vowel lengthening as a rule conditioned by syllable structure:

(6) $V_{[+\text{ stress}]} \rightarrow [+\text{ long}] / \text{——} \$$ ($ = syllable boundary)

This rule presupposes the following syllabification principle for Icelandic: if a vowel is followed by two consonants, the syllable boundary falls in between these consonants, unless the cluster consists of one of the following combinations:

(7) p,t,k,s + j,v,r

That is, it is assumed that Icelandic onsets consist of one consonant, or one of the clusters specified in (7).

However, rule (6) only accounts for vowel lengthening in non-wordfinal syllables. In word-final syllables – not discussed by Vennemann – we get vowel lengthening even though the syllable is closed by a consonant, as the data in (5ii) show. This led Árnason(1980) to propose a different rule, which says that a vowel is long when followed by at most one consonant in the same syllable (Árnason 1980: 51):

(8) $\begin{bmatrix}+\text{ syll}\\+\text{ stress}\end{bmatrix} \rightarrow [+\text{ long}] / \text{——} \; C_0^1 \;)_\sigma$

This rule accounts for the lengthening in (5ii), but presumes syllabification patterns like the following:

(9) $(ofs)_\sigma(i)_\sigma$, $(hatt)_\sigma(ur)_\sigma$, $(hest)_\sigma(ur)_\sigma$, $(vak)_\sigma(ra)_\sigma$

This kind of syllabification violates the Maximal Onset Principle. Moreover, the codas created by this syllabification sometimes violate the sonority constraint. Therefore, another solution seems to be called for.[5]

The relevant notion to solve these problems is that of 'extrametricality', as is convincingly argued by Kiparsky(1984):

> "Studies of stress (...) and syllable structure show that units at the periphery of constituents are often systematically ignored in prosodic systems. (...) For Icelandic, then, we can say that word-final consonants are extrametrical." (Kiparsky 1984: 153)

Below, I will argue that the notion 'word-final' used here by Kiparsky has to be interpreted as 'at the end of a *phonological* word'.

On the assumption that Icelandic word-final consonants are extrametrical, the vowels in the words in (5ii) are in syllable-final position, and hence rule (6) will correctly lengthen these vowels. Consequently, algorithm (3) has to be modified slightly for Icelandic. In particular, the final consonant, if present, has to be skipped when we divide a word into syllables.

The assumption of a word-final extrametrical consonant for Icelandic is supported by the fact that word-final codas seem to be permitted to violate the sonority constraint, as in the words in (10):

(10) vopn 'weapon'
kukl 'witchcraft'
maðk 'worm'
vatn 'water'

This violation is only apparent, since at the phonological level the final consonant does not belong to the final syllable, and hence it is not affected by the sonority constraint on syllables.

A more specific consequence of the sonority constraint is that geminate consonants cannot be tautosyllabic, because they do not differ in degree of sonority. Nevertheless, geminate, i.e. phonetically long consonants do occur in Icelandic, but only in word-final position. This follows from the extrametricality of the word-final consonant, since one of the two identical consonants will be located outside the coda of the last syllable; hence, the sonority constraint will not be violated.

This analysis of geminate consonants is confirmed by the fact that, word-internally, geminate consonants are simplified before a following consonant (Árnason 1980: 23): [6]

(11) kyss-a 'kiss' [kys:a] kyss-ti 'kiss, past 1/3p.sg.' [kyst^{h}i]
viss 'certain' [vis:] viss-t 'certain, neut.' [vist^{h}]

For instance, when we prosodify *kyss-ti*, we get the following prosodic structure:

(12) $((\text{kys})_{\sigma}\ \text{s}\ (\text{t}^{\text{h}}\text{i})_{\sigma})_{\omega}$

In (12), the second /s/ cannot be made part of a syllable, i.e. remains extrasyllabic. This extrasyllabic /s/ will be automatically deleted by the Stray Erasure Convention (Steriade 1982: 89) which says that stray (i.e. extrasyllabic) consonants are erased at the end of the phonological derivation.

Anderson(1982: 6), who opposes a prosodic analysis of Icelandic vowel lengthening, mentions certain data which seem to contradict the analysis given above. Árnason (1980: 52) also mentions these problematic forms:

(13) sötr 'the act of sipping' < sötr-a 'to sip'
kjökr 'the act of wailing' < kjökr-a 'to wail'
pukr 'the act of being secretive < pukr-a 'to be secretive'
sifr 'the act of lamenting' < sifr-a 'to lament'

These deverbal nouns have long vowels, although they are followed by two consonants, and hence stand in closed syllables. Anderson therefore concludes that a segmental approach to Icelandic vowel lengthening is more adequate than the prosodic analysis. However, Kiparsky(1984: 156) argues that these deverbal nouns can be derived by a rule of post-lexical /a/-deletion that applies after Syllabification and Vowel Lengthening. This solution for these marginal forms is supported by the observation that these nouns do not function as inputs for other word formation processes.

A final objection to the Vennemann/Kiparsky analysis of Icelandic vowel lengthening, made by Árnason(1980: 29) is the following: Árnason compares *hestur* [hɛstʰyr] with *dysja* [tI:sja] 'to bury'. In order to predict the contrast in vowel length, the following syllabifications are called for: $(hɛs)_\sigma (t^hyr)_\sigma$ versus $(tI)_\sigma (sja)_\sigma$. He then points out that both *st-* and *sj-* occur as word-initial onsets; hence, according to the Maximal Onset Principle we would expect a different syllabification for *hestur*: $(hɛ)_\sigma (st^hyr)_\sigma$, with concomitant -but incorrect- lengthening of the first vowel. Árnason raises the same point with respect to clusters like *nj-*, *mj-*, *lj-* and *rj-*. These clusters do occur word-initially (e.g. *njota* 'to enjoy', *ljotur* 'ugly', *rjomi* 'cream'), and yet the prosodic analysis of vowel lengthening forces them to be interpreted hetero-syllabically in word-internal position, as the following data show:

(14)

venja	[vɛnja]	'habit'
temja	[tʰɛmja]	'to domesticate'
velja	[vɛlja]	'to choose'
berja	[pɛrja]	'to hit'

The shortness of the stressed vowels in the first syllables of these words is only predicted if the word-internal consonantclusters are divided between the two syllables.

It will be clear by now that this problem is solely caused by the distributional approach to syllable structure discussed in section 1. It is this distributional theory that Árnason takes here as his point of departure. However, since the phonological word is a prosodic constituent in its own right, it may have independent properties, apart from being a concatenation of wellformed syllables. Apparently, Icelandic not only allows for extra consonants at the end of a phonological word, as we saw above, but also at the beginning, for instance an extra /s/, as in word-initial /st-/, or an extra liquid or nasal before /j/, as in the other examples. Note that /st-/ also violates the sonority constraint. In sum, the distributional facts mentioned by Árnason do not constitute a problem for the prosodic analysis of vowel lengthening.

2.2. Vowel lengthening in complex words

The prosodic analysis of vowel lengthening deserves some further discussion with respect to compounds and derived words. As pointed out in section 1, compounds may be assumed to consist of two (or more) phonological words. Consider the following compounds (examples taken from Gussmann 1985: 89):

(15)

[hlut][taka]	'articipation'
[auk][nefni]	'nickname'
[haus][kúpa]	'skull'
[djúp][skyggn]	'profound'

In these words the first vowel is long, although these vowels are followed by consonantclusters that do not belong to the class of clusters before which lengthening takes place. This is predicted if we assume that the constituents of these compounds are independent phonological words. For instance, *hluttaka* will be prosodified as follows:

(16)

input:	[lutʰ][tʰakʰa]
mapping onto phonological words:	$(lut^h)_\omega (t^hak^ha)_\omega$
syllabification:	$((lu)_\sigma t^h)_\omega ((t^ha)_\sigma (k^ha)_\sigma)_\omega$

Thus, the /u/ of *hlut* is in syllable-final position, and will be lengthened, since this syllable is stressed. The second vowel is not lengthened: it has no stress due to the rule of stress deletion that disallows adjacent stresses and applies

after the rule of main stress that assigns primary stress to the first syllable of each phonological word (cf. Gussmann 1985: 83-84). The claim that *hluttaka* consists of two separate phonological words is confirmed by the fact that the word-internal sequence /t^ht^h/ does not surface as a preaspirated [^ht], as is normally the case within words (Einarsson 1945, Hermans 1985). Apparently, the domain of the rule of preaspiration is the phonological word.

The analysis of compounds like *hluttaka* also shows that the property of being extrametrical must be assigned to consonants at the end of phonological words: the extrametrical /t^h/ of *hlut* does not occur at the end of a grammatical word. This interpretation of extrametricality is the most natural one, since, after all, the notion refers to prosodic structure, not to grammatical structure.

Gussmann(1985: 90) points out that certain compounds do not behave according to the rules and principles outlined so far. For instance, there is an opposition between the compounds *rauðvin* 'red wine' and *hvitvin* 'white wine'. In the first compound the vowel of the first syllable is short, whereas it is long in the first syllable of the second. Within the analysis outlined so far we expect long vowels in both cases. Gussmnan therefore postulated a rule of boundary weakening that changes a word boundary into a morpheme boundary after a stressed vowel followed by a voiced consonant:

$$(17)\ \#\ \rightarrow\ +\ /\ \underset{[+\ \text{stress}]}{V}\ \begin{bmatrix}+\ \text{cons}\\ +\ \text{voice}\end{bmatrix}\ \_\_$$

This particular descriptive mechanism is not available within prosodic phonology because it does not allow for segment-like grammatical boundaries. Hence, we have to reformulate this rule as a prosodic restructuring rule that changes a concatenation of two phonological words into one:

$$(17)'\quad (\ldots\ \underset{[+\ \text{stress}]}{V}\ \begin{bmatrix}+\ \text{cons}\\ +\ \text{voice}\end{bmatrix})_\omega(\ldots)_\omega\ \rightarrow\ (\ldots\ \underset{[+\ \text{stress}]}{V}\begin{bmatrix}+\ \text{cons}\\ +\ \text{voice}\end{bmatrix})_\omega$$

This rule turns *rauðvin* into one phonological word, with the prosodic structure $((\text{rau}\delta)_\sigma(\text{vin})_\sigma)_\omega$. In this structure, the first syllable is closed because the /ð/ is no longer interpretable as extrametrical, since it does not stand at the end of a phonological word.[7]

As pointed out in section 1, bound morphemes may also function as independent phonological words (cf. Booij 1983 for examples from several languages). In Icelandic, this seems to be the case for suffixes like *-legur*, *-laus*, *-samur*, *-leiki*, *-leitur* and *-naemur* (cf. Pétursson 1975 and Gussmann 1985 who designates them as word boundary suffixes). With respect to vowel lengthening words with these suffixes behave exactly like compounds, as the following examples illustrate:

(18)	sp[a:]klegur	'peaceful'
	v[I:]tlegur	'wise'
	s[a:]klaus	'innocent'
	l[I:]tlaus	'colourless'
	gr[y:]nsamur	'suspicious'
	sk[I:]nsamur	'reasonable'
	s[a:]knaemur	'noxious'

Since these derived words consist of two phonological words they are in principle also subject to rule (17)'. For instance, *rauðleitur* 'reddish' has a short vowel in its first syllable, whereas in *hvitleitur* 'whitish' the first vowel is long.

In many languages (e.g. Dutch, English and Polish, cf. Booij and Rubach 1984) prefixes may also function as independent domains of syllabification, i.e. as independent phonological words. This also seems to be the case for Icelandic, as

is illustrated by the negative prefix *ó-* [ou:]. For instance, Gussmann(1985: 91) mentions the following words as being crucial in this respect:

(19) [ou:]skammtadur 'undivided'
[ou:]brjáladur 'not crazy'

In both words, the first vowel is long, although *sk-* and *brj-* do not belong to the class of clusters before which lengthening takes place. That is, if the prefix *ó-* did not form a phonological word of its own, we would expect that the first syllables of the words in (19) are $(\acute{o}s)_\sigma$ and $(\acute{o}b)_\sigma$ respectively, i.e. closed syllables, because *sk-* and *brj-* do not constitute possible word-internal onsets in Icelandic. We are now also able to explain why clusters like *sk-* and *brj-* can occur word-internally: they can now be interpreted as standing at the periphery of a phonological word, a position that - as we saw above - allows for extra consonants before the onset of the first syllable.

3. Vowel lengthening, Lexical Phonology and clitics

Within the framework of Lexical Phonology (Kiparsky 1982, 1984) a basic distinction is made between two types of rule: lexical rules and postlexical rules. Lexical rules apply cyclically, are structure-preserving and allow for exceptions, whereas postlexical rules do not (necessarily) have these properties. Structure-preservingness is the property that a rule does not create new types of segments, which do not occur underlyingly. In other words, lexical rules only manipulate features that are distinctive on the underlying level. By this latter criterion, vowel lengthening is a postlexical rule, since it introduces a non-distinctive feature, [+ long]. This is confirmed by the observation that vowel lengthening cannot apply cyclically, as the following data (from Gussmann 1985) illustrate:

(20)	br[ɔ:]t	'breaking'	br[ɔ]tna	'break'
	r[i:]ta	'write'	r[i]tna	'Holy Scripture'
	v[ɛi:]kur	'weak'	v[ɛi]kla	'weaken'

The addition of the suffix *-na* or *-la* turns the syllable of the stem into a closed one, and thus the vowel is short. Clearly, the length of a stressed vowel can only be determined after all morphology has been executed.

Einarsson(1945: 28) observes that the 2nd pers. sg. clitic pronoun *ðu* has the same effect on vowel length as suffixes when it follows the inflected form of the verb, in this case the imperative:

(21)	g[ɛ:]fa	'give'	g[ɛ]vðu
	k[ɔ:]ma	'come'	k[ɔ]mdu
	l[ɛ:]sa	'read'	l[ɛ]stu
	v[ɛ:]ra	'be'	v[ɛ]rtu

Kiparsky(1984: 154) points out that certain forms of the cliticised definite article have the same effect on vowel length: [8]

(22)	st[a]ld-num	'place, dat. sg. definite'
	[a]-nni	'river, dat. sg. definite'
	sk[ɔ]-nna	'shoe, gen. pl definite'

These clitics are attached on the right hand side of the noun that functions as host word. The interesting thing to be noted here is that these clitics behave like suffixes: they must be attached to the preceding verb or noun in the lexicon, by a lexical rule of cliticisation, before the postlexical (or at least postcyclic) rule of vowel lengthening applies. Thus, Icelandic provides supporting evidence for the claim made by Klavans(1983), Booij(1985b) and Booij and Rubach(to appear) -based on analyses of Ngiyambaa, Dutch and Polish- that

clitics must be divided into two classes: lexical clitics, which are attached in the lexicon, and syntactic clitics which are adjoined to their hosts post-syntactically, in the syntax.

4. Conclusions

The facts of vowel lengthening in Icelandic can be accounted for in a rather straightforward way within the theoretical framework of prosodic phonology. The apparent complications concerning vowel lengthening can be explained away by making use of independently motivated theoretical notions like 'extrametricality' and 'phonological word'. Finally, it has been shown that Icelandic is another language with lexical, i.e. pre-syntactic clitics, which supports the hypothesis that clitics must be divided into two classes, lexical and postlexical clitics.

Notes

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1. Cf. Booij(1983, 1985a), Nespor and Vogel(1982, to appear).
2. I leave out of discussion here whether the foot is also a prosodic category in between the syllable and the phonological word.
3. The sonority hierarchy that I assume here is the following:

   vowels glides liquids nasals fricatives plosives
   $\longrightarrow$
   decreasing sonority
4. Cf. the literature mentioned in note 1 for a further motivation of these assumptions. The non-isomorphy between the two hierarchies above the level of the word is discussed in Nespor and Vogel(1982, to appear) and in Klavans(1985).
5. Cf. Gussmann(1982) for similar critical remarks.
6. According to Árnason(1980: 36) consonants in syllable-final position after a stressed short vowel surface as half-long consonants, whereas geminate consonants are phonetically long.
7. Other examples can be found in Einarsson(1945: 49) and Árnason(1980: 48ff.) According to the former, the rule only applies if the first constituent is monosyllabic. All the examles that I came across in the literature indeed obey this constraint.
8. Einarsson(1945: 49) gives a full survey of the paradigm of the definite article clitic. Kiparsky(1984: 154) provides these clitics with a #. However, I think this is incorrect, since in that case we would not expect the clitic to influence the length of the preceding vowel.

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