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On the representation of diphthongs in Frisian¹

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1. INTRODUCTION

Frisian is well known for the fact that it has a very rich inventory of vowels and diphthongs. In addition to nine short vowels and their long counterparts, it also has schwa, five falling diphthongs which end in a high vowel, and six centralizing diphthongs, some of which alternate with what traditionally are called rising diphthongs (cf. Zantema, 1984), the so-called breaking. In (1) I give a list of the vowels and diphthongs, and in (2) the phenomenon of breaking is illustrated by some examples taken from Cohen *et al* (1966: 119):

- (1) *short vowels*: i, y, u, ɪ, ø, ɛ, o, ɔ, a
long vowels: i:, y:, u:, ɛ:, ø:, ɛ:, o:, ɔ:, a:
falling diphthongs: eɪ, ʌy, ɔy, oɪ, ai²
 iə, yə, uə, ɪə, oə,
rising diphthongs: iu, iɛ, uo, ua
- (2) iə/iɪ stien [stiən] 'stone' stiennen [stiɛnən] 'stones'
 ɪə/iɛ beam [biəm] 'tree' beamke [biɛmkə] 'little tree'
 uə/uo foet [fuət] 'foot' fuotten [fuotən] 'feet'
 oə/ua doas [doəs] 'box' doaske [duaskə] 'little box'³

As Cohen *et al* (1966) point out, the two kinds of diphthongs mentioned in (2) not only occur in pairs of related forms, but also in words with only one of the variants, either the falling or the rising diphthong. Some of these words form minimal pairs, like the following taken from Cohen *et al* (1966: 119):

- (3) ier [iər] 'vein' hjir [iɪr] 'here'
 earn [ɪən] 'eagle' jern [iɛn] 'yarn'
 boeren [buərən] 'farmers' buorren [buɔrən] 'village centre'
 poaten [poətən] 'legs' poarten [puətən] 'gates'

[1] The research for this paper was carried out as part of research programme Lett 88/9, Vrije Universiteit Amsterdam. I would like to thank Tony Feitsma, Jarich Hoekstra, Geert van der Meer and Willem Visser for their assistance with the Frisian data, and for their comments on a previous version of this paper. I also thank the editor of this journal and two anonymous referees for their very useful remarks.

[2] In some varieties of Frisian we find [ɔi] instead of [ai] (W. Visser, pers. communication).

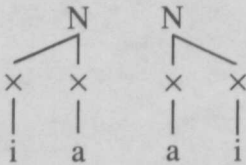
[3] Besides the alternations listed in (2) there is also one case of an alternation between [yə] and [iə]: *sluere* [slyərə] 'to meander' – *slurkje* [sljɔrkjə] 'to meander softly'.

In this paper I will argue that what have been called rising diphthongs can be shown to be glide-vowel sequences of which the glide forms part of the syllable onset rather than being part of the syllable nucleus. That is, only falling diphthongs are 'real diphthongs' in Frisian. This analysis of the Frisian 'rising diphthongs' will be argued for by means of distributional evidence (Section 2) and will be supported by an analysis of the phenomenon of breaking (Section 3). In Section 4 I will formulate some conclusions concerning the representation of Frisian diphthongs and the representation of diphthongs in general.

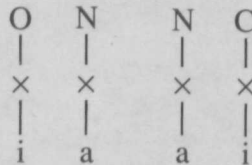
2. THE NON-LINEAR REPRESENTATION OF DIPHTHONGS

In a non-linear theory of syllable structure, [-cons] segments can in principle occur in two syllable positions, in the nucleus or in a non-nuclear position, either the onset or the coda. For instance, the sequences [ia] and [ai] may receive the following two different structural interpretations respectively:

(4) (a) *diphthong*:



(4) (b) *glide-vowel combination*:



(where N stands for Nucleus, O for Onset and C for Coda).

What are the empirical differences between these two types of structure? We expect vocalic segments within the same nucleus to be subject to co-occurrence restrictions with respect to each other. On the other hand, non-syllabic vocalic segments in onset or coda may be subject to restrictions on consonant clusters.

This difference between the two structural interpretations is nicely illustrated by Dutch. This language possesses among others the tautosyllabic sequences of [-cons] segments *ei* [ei], *ui* [ui], *ou* [ou], *oi* [oi] and *ai* [ai]. The first three of these sequences are traditionally called diphthongs. The two constituent parts of these diphthongs differ only marginally: a mid vocalic segment is always followed by a high vocalic segment with the same specifications for the features [back] and [round]. They can be followed in the same syllable by almost all Dutch consonants. On the other hand, [oi] and [ai] cannot be followed by any tautosyllabic consonant except the coronal obstruents /s/ and /t/, which do not belong to the rhyme proper, but to a word-final appendix (cf. Booij, 1983). This is illustrated in (5):

(5) (a) *diphthongs*: eip, uip, oup
eim, uim, oum

proven by the facts of resyllabification which is triggered by, for instance, the addition of a vowel-initial suffix. As pointed out in Rubach and Booij (1988), resyllabification does not affect nuclei. That is, only segments in the coda may shift to the onset of the next syllable. Therefore, real diphthongs are not affected by resyllabification, whereas post-nuclear glides are. This is shown in (7) for Dutch: in (7a) we have a long vowel followed by [i], in (7b) we have a real diphthong, i.e. a complex nucleus:

- (7) (a) aai 'caress', 1st ps. sg.: (a:i)_σ
 aaien 'id., pl.': (a:i)_σ(iən)_σ
 (b) rij 'row': (rei)_σ
 rijen 'rows': (rei)_σ(iən)_σ, not: (re)_σ(iən)_σ

The [i] in *rijen* is inserted between the diphthong and a following schwa by the rule of Homorganic Glide Insertion (cf. Booij, 1981).⁵

In traditional phonological descriptions, the difference between [i] and [u] as parts of diphthongs versus [i] and [u] as elements of onset or coda is accounted for by representing them in the latter case as [j] and [w] respectively. However, contrary to what these differences in transcription suggest, there is no inherent qualitative difference between [i] and [j], or [u] and [w]. Therefore the difference between the diphthongal and the non-diphthongal interpretation of such sequences can only be stated in terms of their position in syllable structure, as proposed in (4).⁶

Similar observations to those for Dutch can be made concerning the Frisian diphthongs and glide-vowel sequences. The falling diphthongs freely occur with following consonants, and are not subject to resyllabification. Hence, they are real diphthongs. On the other hand, the pre-vocalic [i] and [u] behave as parts of the onset, and occur freely with following vowels.⁷

[5] The same reasoning is used by Kaye and Lowenstamm (1984) to show that the post-vocalic [i] in French is not part of a diphthong, but forms a coda, because this [i] is subject to resyllabification, as illustrated by the word pair *travail* (tra)_σ(vai)_σ 'work' – *travailler* (tra)_σ(va)_σ(ie)_σ 'to work'.

[6] Instead of an X-skeleton, Clements and Keyser (1983) use a CV-skeleton. In the CV-skeleton approach, [i] and [u] as parts of diphthongs could be linked to a V-slot, whereas they would be linked to a C-slot if they are not part of a real diphthong. Arguments for the superiority of the X-skeleton approach are given in Steriade (1988).

[7] The only co-occurrence restriction between [i], [u] and a following nucleus is that [i] does not precede [i], and that [u] does not precede [u]. This restriction may be assumed to follow from the Obligatory Contour Principle (McCarthy, 1986: 208) that prohibits adjacent identical elements on the melodic tier. However, as McCarthy himself argues as well, the OCP should not be interpreted as an absolute restriction, but rather as a principle of markedness, because in older pronunciations of Frisian we do find the sequence [ii] in words like *jier* [jiər] 'year', *tsjiis* [tsji:s] 'cheese' and *tsjien* [tsjɛn] 'ten'. As Jarich Hoekstra pointed out to me, the glide [i] is also often omitted before nuclear [i] in loanwords such as *S(j)inees* 'Chinese' and *mas(j)ine* 'engine'. The pre-nuclear [u] does not occur before [u]; instead, we find the labiodental approximant [v] in this position, as in *woede* [vuədə] 'rage'. The coda-constituent [i] does not occur after its nuclear counterpart, in conformity with the OCP, and for [u] this is very marginal (an example is *spriuw* [sprjuu] 'thrush').

- (b) *vowel + glide*: *aip, *oip
 *aim, *oim

However, [i] and [u] before an adjacent vowel must always be interpreted as onset constituents: they precede all kinds of vowels, and are subject to co-occurrence restrictions with preceding consonants. These facts are illustrated in (6) for [i]:

- (6) (a) *before short vowels*: jekker 'short coat' [iɛ],
 jopper 'short coat' [iɔ], juk 'yoke' [iʌ]
 (b) *before long vowels*: jujube 'id.' [iɪy], joelen 'scream' [iʊ],
 jegens 'toward' [iɛ:], jool 'fun' [iɔ:],
 jaar 'year' [iɑ:]
 (c) *before diphthongs*: jij 'you' [iɛi], jou 'you, acc.' [iɔu],
 juist 'correct' [iʌy]
 (d) *co-occurrence restrictions with preceding consonants*:
 *mi-, *ni-, *ri-, *li-

Similarly, the Dutch labiodental approximant [v] that has replaced the bilabial [w] (= [u]) occurs before all kinds of vowels, and cannot be preceded by a sonorant consonant.

Another reason for interpreting the pre-vocalic [i] and [u] in (6) as forming part of the onset is that otherwise we would have to allow for nuclei with three X-positions, because in Dutch long vowels and diphthongs count as two X-positions in the syllable template (cf. Booij, 1983). This is an undesired result since nuclei universally seem to obey the restriction that they contain at most two X-positions (cf. Kenstowicz & Rubach, 1987: 476). This restriction implies that real diphthongs cannot be headed by a long vowel, and that there are no real triphthongs. It makes the correct prediction for Dutch and Frisian that [i] and [u] following long vowels and diphthongs are always part of the coda.⁴ This structural interpretation of such sequences is

[4] In the phonological literature we find reference to overlong vowels, for instance for Estonian, which suggests that there are three degrees of length for vowels. This seems to be a problem then for the nucleus constraint proposed by Kenstowicz and Rubach (1987), which only allows for V and VV. However, Prince (1980) has shown that at the underlying level we need to assume only two degrees of length for Estonian vowels. That is, there is a lexical distinction between V and VV only. As Prince argues, the extra length of some vowels is a property of syllables in certain strong metrical positions, which can manifest itself on either vowels or consonants.

As argued in Booij (1983), the four degrees of vowel length in Marinahua, a language of Peru, can be predicted on the basis of metrical structure. Therefore, these length phenomena do not constitute counterevidence for the nucleus constraint.

Ternes (1980, 1981) argues that languages with three degrees of length do occur, although they are very rare. He mentions Applecross Gaelic (Ternes, 1980) and certain dialects of Low German and High German (Ternes, 1981). This deserves further investigation, but may imply that the nucleus constraint is not universal but represents rather the unmarked case. Even then, we would prefer an analysis of Frisian which does not conflict with this universal tendency.

- (8) (a) (i) *before short vowels*:
 djip [dʲɪp] 'deep'
 kjelt [kʲɛlt] 'cold'
 njonken [nʲɔnkən] 'besides'
 pjuk [pʲʌk] 'stick'
 spjatte [spʲatə] 'to split'
- (ii) *before long vowels and diphthongs*:
 sjoege [sʲi:ɣə] 'knowledge'
 sjoel [sʲi:uəl] 'tow machinery'
 ljuensk [lʲyɔnsk] 'flattery'
 fjouwer [fʲɔ:uər] 'four'
 krjowe [krʲɔ:uə] 'to quarrel'
- (b) (i) *before short vowels*:
 twirre [tʲʉrə] 'whirlwind'
 twer [tʲɛr] 'disgusting'
 fuort [fʲʉot] 'away'
 toarn [tʲʉan] 'thorn'
- (ii) *before long vowels and diphthongs*:
 swier [sʲwiər] 'flourish'
 kwea [kʲwɛə] 'angry'
 koai [kʲwɑ:i] 'wooden ball'

The free occurrence of [u] before vowels is somewhat obscured in modern Frisian because in certain positions, in particular word-initially, it has changed into the labiodental approximant [v]. There also exists variation in this respect. For instance, the word *twa* 'two' may be pronounced as either [tʲwə] or [tʲva].

The data in (8aii) and (8bii) show that [i] and [u] also occur before long vowels and real diphthongs, as in Dutch. Therefore, the constraint that nuclei contain at most two X's also requires [i] and [u] to be interpreted as onset constituents. There is one clear difference with Dutch, though: unlike Dutch, both [i] and [u] can be preceded by all word-initial sonorant consonants (compare the Dutch data in (6d)):

- | | | |
|-----|---------------------------|--------------------------------|
| (9) | ljocht 'light' | rjocht 'right' |
| | mjoks 'dung' | njoggen 'nine' |
| | sloarp [slʲʌrp] 'draught' | kroadsje [krʲʌtsiə] 'to wheel' |
| | smoarch [smʲʌrx] 'dirt' | knoarre [knʲʌrə] 'knot' |

Therefore, this kind of distributional evidence is not available for Frisian. Note, however, that this by itself does not form negative evidence for the analysis of 'rising diphthongs' advocated here. The only thing that we are missing here is an additional piece of evidence that happens to be available for Dutch.

Another difference with Dutch is that whereas in Dutch the sequences [ai] and [ɔi] do not count as diphthongs, as explained above, these sequences are diphthongs in Frisian. This is clear from the fact that, for instance, [ai] occurs before a number of (non-appendix) consonants:

- (10) rein [rain] 'rain' neil [nail] 'nail'
 leik [laik] 'dredge iron' leip [laip] 'beanpole'
 deim [daim] 'fallow deer'

This again shows that the same phonological string can receive different structural interpretations, with different empirical consequences.

It is even possible that the same sequence of two tautosyllabic [-cons] segments may receive different structural interpretations within the same language. For instance, in Slovak the sequence /ie/ is sometimes a diphthong, and sometimes an onset + nucleus (Kenstowicz & Rubach, 1987: 474). Similarly, the sequence /u/ + vowel in French may receive two different structural interpretations. For instance, in *whisky* [ʷiski] the /u/ apparently belongs to the onset, since this word behaves phonologically as if it were consonant-initial, whereas in *oiseau* [ʷazo] 'bird' the sequence /ua/ is a diphthong, because it behaves as a vowel-initial word (cf. Kaye & Lowenstamm, 1984):

- (11) (a) le whisky [ləʷiski] 'the whisky': no vowel elision
 le oiseau [lʷazo] 'the bird': vowel elision
 (b) un petit whisky [ɛptiʷiski] 'a small whisky': no liaison
 un petit oiseau [ɛptiʷazo] 'a little bird': liaison

The nucleus constraint referred to above correctly implies that Frisian sequences of long vowels + /i/, /u/ are not real diphthongs (compare the Dutch data in (7)). Before an inflectional vowel these instances of /i/ and /u/ systematically shift to the onset of the next syllable (Cohen *et al.*, 1966: 139):

- (12) aai (a:i)_σ 'egg' aaïen (a:)(iæn)_σ
 bliuw (bli:u)_σ 'stay, sg.' bliuwen (bli:)(uən)_σ
 priuw (pri:u)_σ 'taste, sg.' priuwen (pri:)(uən)_σ
 moai (mo:i)_σ 'beautiful' moaie (mo:)(iə)_σ

In sum, I have argued that Frisian does not have both falling and rising diphthongs. What are called rising diphthongs should be interpreted as sequences of a pre-nuclear non-syllabic vocalic segment followed by a nuclear vowel or diphthong. Thus we can make the generalization that all Frisian diphthongs are falling.

There is a remarkable parallel to be drawn here with Italian. The traditional claim for Italian is that it has both rising and falling diphthongs. Rising diphthongs are said to occur in e.g. *nuovo* 'new' [nʷovo] and *piẽde* 'foot' [pĩɛde]. Falling diphthongs are said to occur in e.g. *poiché* 'since' [põke], *Europa* 'id.' [ẽɹo:pa], and *aurora* 'dawn' [ãɹo:ra]. However, Marotta (1988)

has shown that both the prevocalic [i] and the postvocalic [i] and [u] should be interpreted as extra-nuclear. That is, the only real diphthong in Italian is [ɔɔ]. Marotta also bases herself on distributional evidence of the kind used above for Frisian and Dutch. For instance, whereas the [i] co-occurs with all kinds of vowels, the [u] only occurs with the [ɔ]. The restriction of the [u] to a following [ɔ] is to be expected in a diphthongal interpretation of this sequence. Marotta also shows that in the case of sequences ending in [u] or [i], these high segments must be considered codas, because they cannot be followed by another consonant, whereas nuclei can. We may conclude then that Italian has only rising diphthongs.

In the next section I will adduce additional support for the claim that rising diphthongs do not exist in Frisian. This additional support is found in the phenomenon of 'breaking' illustrated in (2) above. The crucial point to be made is that breaking is to be seen as a form of nucleus shortening, and hence the [i] and [u] originating from broken nuclei must be interpreted as pre-nuclear.

3. BREAKING

The reconstruction of the emergence of falling diphthongs and so-called 'rising diphthongs' that I will defend in this section is partly based on the analysis and argumentation given in van der Meer (1985). Van der Meer proposed the following historical reconstruction of the emergence of breaking:

- (12) I long mid vowels: /e, o, ɛ, ɔ/
- II diphthongization: /iɪ, uo, ɪɛ, ɔɔ/
- III (a) centralization of the second constituent in non-breaking environment: /iə, uə, ɪə, ɔə/⁸
- (b) breaking: change of the diphthongs in II into 'rising diphthongs' in breaking environment: /iɪ, uo, ɪɛ, ɔɔ/⁹

One of the issues concerning breaking discussed in the literature on Frisian is whether it is still a rule of Frisian (Tiersma, 1979, 1980, 1986); van der Meer, 1985). It has become clear from this discussion that the rule of breaking is comparable to, for instance, the German Umlaut rule: the rule is strongly morphologized and speakers of Frisian have to learn which words exhibit broken forms in which environments. Moreover, there is a

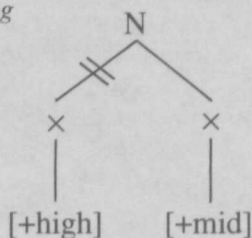
[8] The schwa symbol used here to indicate the centralizing nature of these falling diphthongs should perhaps not be equated with the phonetic schwa, because according to De Graaf and Tiersma (1980) the second parts of these diphthongs still partially reflect the phonetic nature of the first part of the diphthong.

[9] I also assume a phonetic detail rule which changes /wɔ/ into [wa] in order to account for the pronunciation of words like *doaske* [dʏaskə] (cf. 2). Cf. also Hoekstra (1988).

considerable variation in breaking between different dialects and different generations of speakers.

The question that is relevant in the context of this paper is how the historical process of breaking should be interpreted phonologically. My claim is that breaking is a process of nucleus shortening. That is, the first parts of the diphthongized mid vowels are removed from the nucleus, and hence they become part of the onset through the universal CV-rule that assigns a prevocalic segment to the onset (cf. Levin, 1985). That is, breaking is interpreted as follows:

(13) *Breaking*



Given this characterization of Frisian breaking, it will not apply to long vowels, because in the case of long vowels both X's are linked to the same segment on the melodic tier. In addition, we need a convention of phonetic interpretation which states that [-cons] segments in non-nuclear position will always be interpreted as [+high, -mid] (see below).

This proposal as to the phonological interpretation of breaking is similar in spirit to that proposed by Anderson (1974, Ch. 17) with respect to breaking in Icelandic. He deals with Icelandic breaking in a very important chapter of his monograph in which he analyzes the inadequacy of linear phonology with respect to a number of phonological phenomena. Icelandic exhibits the following alternations:

- (14) eu ~ ju
 ea ~ ja
 é ~ je

Anderson (1974: 280) then remarks:

We could [...] treat this as a shift in the syllabicity boundary, and give a rule such as the following:

(-)

syll	-	+
son		+
cons	-	-
high	-	
low	-	
back	-	

→

	-	+
		+
	-	-
	-	
	-	
	-	

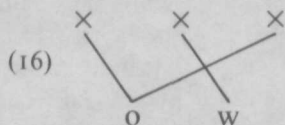
[...] /e/ will become *j* by later phonetic processes specifying all glides as high in Icelandic.

It will be clear that Anderson's proposal with respect to Icelandic breaking is comparable to that for Frisian breaking proposed above in that it interprets breaking as primarily a change in syllabicity. The difference with Anderson's analysis is that breaking is not conceived here as a change in specification for the feature [syllabic], but as a change in syllable structure. The rule of raising that raises the first parts of /*ɛ*/ and /*o*/ into /*i*/ and /*u*/ respectively can be considered as a universal principle: 'in the unmarked case...glides...are [+high]' (Harris, 1985: 39). Harris' claim as to the universality of raising is thus supported by the fact that it also applies in Frisian and Icelandic, as pointed out above.

Tiersma (1979: 11) suggested another source for the glides in the broken forms. According to him, they emerged from the insertion of homorganic glides between the two morae of a long vowel, followed by the deletion of the first mora. For instance, [wo] is derived as follows from the long /oo/:

$$(15) \quad oo \rightarrow o^w o \rightarrow ^w o \rightarrow wo$$

However, this explanation can be excluded on principled grounds: in non-linear phonology the insertion of a homorganic glide between the two morae of a long vowel is impossible, because of the universal wellformedness condition that association lines may not cross. This condition would be violated by the insertion of the [w] into the long /oo/, as illustrated in (16):



Moreover, Tiersma's analysis implies that the nuclei were lengthened, and contained three X-positions at a certain stage. This violates the universal restriction that nuclei contain at most two X's.

My analysis of Frisian breaking as nucleus shortening is strongly supported by the fact pointed out by Miedema (1958) that the non-breaking dialects in the south-western part of Friesland and on the Frisian islands exhibit vowel shortening in those environments in which the other dialects exhibit breaking. Both breaking and shortening have the effect of shortening the rhyme of syllables, either by shifting the first X of the nucleus to the onset (the breaking dialects) or by deleting the first X of the nucleus (the non-breaking dialects). In the latter case, the plural form of *beam* [bɪəm] 'tree' is

[bɛmən], in contrast to the broken plural [bjɛmən] in the breaking dialects (example from Tiersma, 1979: 3).¹⁰

The interpretation of breaking as a result of nucleus shortening is also confirmed by the phonetic investigations reported in De Graaf and Tiersma (1980). In that paper, it is shown that 'broken diphthongs' are significantly shorter than their non-broken counterparts. This is to be expected since, generally, segments in the nucleus have a longer duration than those in non-nuclear position.

Interestingly, the glide-vowel combinations that arose through breaking do not violate the phonotactic regularities of Frisian: bi- and triconsonantal onset clusters with [i] and [u] also occur as onsets of syllables with other vowels than those resulting from breaking. This is illustrated in (17), a list of words which already occur in Old Frisian, i.e. before breaking emerged:

- (17) ljocht 'light' rjocht 'right, justice'
 stjonke 'to smell' fjochtsje 'to fight'

The analysis of breaking as nucleus shortening also bears upon the analysis given by van der Meer (1985), whose first analysis of breaking was published in van der Meer (1977), and is summarized in van der Meer (1985: 13). The following analysis was proposed: long vowels are interpreted as bimoric. The [+mid] long vowels are diphthongized. In the breaking environments, the stress is shifted from the first to the second mora, the first mora is changed into a glide. In the non-breaking environments, the second, unstressed mora is reduced to a schwa.

However, stress shift as the cause of breaking is doubtful anyway. First of all, one of the most important insights of metrical phonology, a subtheory of non-linear phonology is that stress is not a property of segments or morae, but of syllables. In languages like Lithuanian which are traditionally called mora accent languages, it is not the case that either the first or the second mora bears stress. Rather, what mora accent boils down to is that the stress of the syllable manifests itself as a high tone on either the first or the second mora (cf. Hermans, 1984).

Secondly, why should the stress shift to the next mora? Van der Meer's answer to this question was that in Frisian stress falls on the penultimate mora of the word, and that consequently stress is shifted to the right after the addition of new syllables (by morphological rules like plural and diminutive formation). Tiersma (1979) appears to accept this suggestion. However, this seems a highly implausible assumption since Germanic languages like Frisian typically have word-initial stress, i.e. they count from the left edge of the word, not from the right edge, as Romance languages do.

[10] Note that Tiersma's analysis of breaking also implies that the nuclei were lengthened by the insertion of a glide, whereas it is clear that breaking has to be interpreted as a form of shortening.

Moreover, breaking also occurs in environments in which there can be no stress shift. First, we also find breaking after the addition of suffixes that consist of consonants only, for instance the superlative suffix *-st* (*moaist* [mʏaist] 'most beautiful') and the conjugational suffixes *-st* and *-t*, as illustrated by the following forms of the verb *sliepe* /sliəpə/ 'to sleep' (from Tiersma 1985: 22):

- | | | |
|------|------------------------|-------------------------|
| (18) | 1sg. sliep [sliəp] | pl. sliepe [sliəpə] |
| | 2sg. sliepst [sliʊpst] | pret. sliepte [sliʊptə] |
| | 3sg. sliept [sliʊpt] | part. sliept [sliʊpt] |

Second, breaking also occurs in the first constituent of compounds, where the first constituent, i.e. the breaking morpheme, keeps the main stress of the word. This is shown in (19).

- | | | |
|------|-----------------------|-----------------------------------|
| (19) | beam [bɛəm] 'tree' | beamtûke [bɛəmtukə] 'tree branch' |
| | jier [iə] 'year' | jierdei [iʊdei] 'birthday' |
| | stien [stiən] 'stone' | stienpûst [stiʊmpust] 'furuncle' |

In van der Meer (1985: 45–46) the analysis of breaking as stress shift is replaced with an analysis in which breaking is primarily seen as caused by shortening. This change of view was prompted by the fact that breaking in breaking dialects correlates with shortening in non-breaking dialects, and by the fact that breaking also occurs in environments in which no new syllable has been added. It is still assumed that stress shift occurs, but as the consequence rather than as the cause of breaking. The main difference between van der Meer's analysis and the one advocated in this paper is that van der Meer's view of shortening is primarily a phonetic one, whereas my analysis stresses the structural aspect of breaking, i.e. nucleus shortening. This primarily phonetic interpretation is formulated as follows:

As long as such diphthongs were genuinely long there was no problem from an auditive point of view, for in for instance [iʊ] the length of [i] must have compensated for its smaller natural sonority vis-à-vis the following [ʊ]. However, this compensation was largely absent in shortened [iʊ], so that as a result the inherent greater natural sonority of the [ʊ] must have struck the human ear, which must in due time have led to that ear interpreting a shortened (half-long) [iʊ] as having its main stress on its second element, i.e. the [ʊ]. (van der Meer, 1985: 45)

However, these two points of view are not incompatible. Van der Meer focuses on the PROCESS of shortening, whereas my analysis deals with the phonological EFFECT of this shortening. That is, van der Meer may be right in that shortening in the temporal sense could have been the cause of the emergence of breaking. As Catford (1977: 165) points out, the difference between vowels and glides is phonetically a difference in length: glides exhibit a much faster transition to the next segment than vowels.

What remains to be explained is why shortening occurred. Probably, this had to do with the fact that word-internal syllables tend to be shorter than word-final ones. This can also be observed in the Frisian rule of shortening (cf. Tiersma, 1985: 19) that shortens long vowels of stems when a plural or diminutive suffix is added. In the case of suffixes which consist of consonants only, breaking also results in reducing the length of the otherwise very long rhyme.

4. CONCLUSIONS

In this paper I have argued that non-linear phonology allows for two structural interpretations of tautosyllabic sequences of [-cons] segments: they can either form a complex nucleus (i.e. a real diphthong) or consist of a simple nucleus plus an extra-nuclear constituent (onset or coda). Both structural possibilities, which appeared to be well motivated for languages such as Dutch, Italian and French, are also necessary for a correct account of such sequences in Frisian. In relation to this issue, the constraint on nuclei that they contain at most two X-positions correctly predicted that combinations of long vowels and a tautosyllabic [-cons] segment cannot be real diphthongs.

Secondly, on the basis of distributional and historical evidence Frisian was shown to possess falling diphthongs only. This result supports the claim made by Kenstowicz and Rubach (1987) that falling/rising is a parameter, i.e. a language cannot have both falling and rising diphthongs:

The glide is characteristically oriented in the same direction with respect to the core [i.e. the head of the diphthong, GEB] throughout the entire system of diphthongs, as either onglide (Slovak) or offglide (English, Canadian French). It is natural to construe this left-right orientation as fixing a parameter of the representational system. (Kenstowicz & Rubach, 1987: 476)

The languages discussed so far in this paper appear to obey this principle, now that the category of rising diphthongs has been removed from the grammar of Frisian. Both Dutch and Frisian possess only falling, i.e. left-headed diphthongs. Conversely, Marotta (1988) has shown that Italian has only the rising diphthong [uɔ]. Kaye and Lowenstamm's (1984) analysis of French implies that this language also possesses rising diphthongs only: [ya] as in *roi* [rɔa] 'king', [yɛ] as in *soin* [sɔɛ] 'care' and [yi] as in *nuit* [nyɪ] 'night'. Thus we can say that complex nuclei in Dutch and Frisian are left-headed, and that they are right-headed in Italian and French.

Of course, it requires further investigation of other languages to see whether this can be upheld as a universal restriction. For instance, Finnish is said to have sixteen diphthongs, thirteen of which end in a [+high] segment, and three of which begin with a [+high] segment (Karlsson, 1982).

Can all these diphthongs be analysed as left-headed, or can the three with an initial [+high] constituent be qualified as 'false diphthongs'? Another relevant language here is Afrikaans, which according to Lass (1987: 114) possesses a number of falling diphthongs, like its ancestor Dutch, but also a diphthong [ɛø] which is 'usually rising' and two diphthongs which are ambiguous in this respect ([öə] and [ëə]). The analysis of this issue is complicated by the question as to which criteria we should use in determining the head of a diphthong (cf. Lass, 1987, for a discussion of this issue). Thus, the parameter hypothesis defines an interesting research programme with respect to tautosyllabic sequences of [-cons] segments.

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