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Synchronic alternations between monophthongs and diphthongs in Franconian tone accent dialects: a metrical approach

Abstract: This paper proposes a synchronic analysis of vowel splits between diphthongs and monophthongs in Franconian tone accent dialects (spoken in parts of Belgium, Germany, and the Netherlands). In some dialects, the tonal contrasts between Accent 1 and Accent 2 are accompanied by vocalic oppositions. On the basis of data from Maastricht and Sittard Franconian, I argue that a unified phonological analysis of these related phenomena (tone, vowel quality) is possible if we assume that the accents differ in their metrical structure: Accent 1 is represented as a disyllabic foot, Accent 2 as a monosyllabic foot.

1 Introduction

Diphthongization is a common process across languages. To this point, the phenomenon has mostly been studied from a diachronic or purely representational viewpoint: some relevant papers discuss which diachronic changes are possible and which are not from a theoretical point of view and / or how diphthongs might be represented synchronically (see e.g. Schane 1984; Booij 1989; Hayes 1990; Harris 1995; Pöchtrager 2006; Caratini 2009). Other contributions focus on phonetic correlates that may trigger diphthongization from a diachronic / functional perspective (see e.g. Dols 1953; Goossens 1998; Peeters & Schouten 1989; de Vaan 2002; the most elaborate proposals can be found in Gussenhoven & Driessen 2004 and Gussenhoven 2007).

   The phonological treatment of synchronic alternations between monophthongs and diphthongs, however, has received little attention so far (yet see e.g. Chitoran 2002 for a detailed study of alternations between monophthongs and rising diphthongs in Romanian). This paper aims to contribute to our understanding of relevant phenomena: it discusses alternations between long monophthongs and falling diphthongs in the Franconian dialects of Maastricht and Sittard.

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In both dialects, these processes correlate with a prosodic opposition between two tone accents, which I refer to as Class 1 and Class 2. In segmental environments that show vowel splits, Class 1 items prefer falling diphthongs while Class 2 items prefer monophthongs, as in the alternation between [blɛif[c1]] 'stay, 1st ps. sg.' vs. [bli:və[c2]] 'stay, inf.' in Maastricht (see section 2 for further data).

I argue that these vowel splits can best be derived from a difference in the foot structure of the two accent classes (Class 1 has a syllabic trochee, Class 2 a moraic trochee; see 2.2 for further discussion). Based on a representational framework developed in Köhnlein (2011), and formulated in the framework of Optimality Theory (Prince & Smolensky 1993; McCarthy & Prince 1995), I demonstrate that both the tonal as well as the segmental surface differences between Class 1 and Class 2 can be related to the different (types of) feet of the accents; the analysis thus postulates an indirect relation between tones and segments that is mediated by metrical structure, rather than a direct tone-vowel interaction. This relates to well-established notions in the field, as both tone and segments have been shown to interact with foot structure independently: the mutual influence of segments and metrical structure is a well-established driving force for phonological processes, and synchronic phonological interactions between tone and stress have been reported repeatedly (see e.g. Yip 1989, 2002; de Lacy 2002, 2007). By postulating an indirect relation between tonal mapping and vowel quality, the proposal is in line with the claim that direct vowel-tone interactions are universally absent (as argued in e.g. Hombert 1977; Hombert, Ohala and Ewan 1979; de Lacy 2007; yet see Becker and Jurgec (this volume), Donohue (this volume) for possible counterexamples).

My analysis also contributes to a current theoretical debate on the representation of the accents: 'traditional' autosegmental analyses assume lexical tones to be responsible for the tonal surface contrasts between the accents (from now on: *tonal approaches*; see e.g. Gussenhoven 2000, 2012; Gussenhoven & Peters 2004; Hanssen 2005; Peters 2006, 2008; Fournier 2008). Yet in recent years, alternative proposals have been put forward, arguing that the accents may rather be regarded as a metrical opposition (from now on: *metrical approaches*) – see Boersma (this volume), where a metrical contrast is regarded as one step in the diachronic development of the accents, as well as Kehrein (2007, this volume); Hermans (2009); Köhnlein (2011, 2016) for synchronic analyses. This paper is relevant for the discussion as it not only suggests a metrical solution to the relevant patterns but also argues that tonal approaches have little if anything to say about the synchronic phonological properties of vowel splits. While my formalization of the splits follows the representational assumptions put forward in Köhnlein (2011), it should be noted that the basic insights concerning the vowel splits in question could equally be expressed in Hermans' and Kehrein's framework. Potential empirical differences between the

different approaches concern the tonal mapping across different dialects and dialect areas; see Köhnlein (2011) for discussion.

The paper is organized as follows: section 2 provides some background information on the tone accent opposition and introduces the relevant data. Section 3 presents a synchronic analysis of vowel splits between monophthongs and diphthongs in Maastricht and Sittard. In Section 4, I discuss why a metrical analysis of the patterns is to be preferred over a tonal one. Section 5 concludes the paper.

2 The Franconian tone accent opposition

2.1 General background

The Franconian tone accent area comprises Ripuarian, Moselle Franconian and Low Franconian dialects, situated in Germany, the Netherlands, Belgium, and Luxembourg. These dialects show an opposition between two tone accents, which can lead to accent minimal pairs with lexical and morphological function. In (1), I provide two lexical (a, b) and two morphological alternations (c, d) from Mayen (Schmidt 1986); the accent class is indicated by the superscripts 'c1' and 'c2':

(1) Accent minimal pairs from Mayen Franconian
   a. [man^c1] 'basket'   [man^c2] 'man'
   b. [tɔʊf^c1] 'pigeon'   [tɔʊf^c2] 'baptism'
   c. [haos^c1] 'house, dat. sg.'   [haos^c2] 'house, nom. sg.'
   d. [ʃdaːn^c1] 'stone, pl.'   [ʃdaːn^c2] 'stone, sg.'

Pitch is usually regarded as the primary auditory correlate of the opposition (as shown in Werth 2007, 2011 in tests with signal-manipulated stimuli); further correlates are duration and intensity (see e.g. Heike 1962, 1964; Schmidt 1986, 2002; Gussenhoven & Peters 2004; Hanssen, 2005; Peters 2006). The tonal melodies in Franconian dialects show a remarkable amount of inter- and intradialectal variation: within dialects, the contours of each accent often differ under different intonations (declaratives, interrogatives, sometimes continuatives and others) as well as with respect to the focal condition (focus phrase-final and non-final position; pre-focal and post-focal position, non-final and final position). This leads to a rich set of distinctive tonal melodies. Out of focus, the contrast can be neutralized (see Fournier 2008; Köhnlein 2011 for empirical evidence from perception tests).

Across dialects, the most substantial realizational variation of the accents can be found in the final position of a phrase. Yet little variation occurs with regard to the tonal melodies in focus, non-final position. They are usually realized in similar ways across dialects that contrast declarative and interrogative intonation, leaving aside a tonal semi-reversal in so-called Rule B dialects, as opposed to the widespread Rule A(2), the dialect area to which the dialects under discussion belong. The precise differences between these different distributional rules are not relevant for this paper, and therefore I will not discuss them in further detail (for data and discussion on the different accent areas, see e.g. Schmidt 2002; Boersma this volume; Köhnlein 2011; Kehrein, this volume). In Rule A(2), Class 1 syllables have a falling tone in focused non-final declaratives and a rising tone in interrogatives, whereas Class 2 is realized as a high level tone versus a low level tone on the accent syllable (Tab. 1).

Tab. 1: Prototypical realizations of Class 1 and Class 2 in focused, non-final position (Rule A(2)).

Condition	Class 1	Class 2
Declaratives, non-final position	⌐\	⌐‿
Interrogatives, non-final position	_/	‿

2.2 Vowel splits between monophthongs and diphthongs

The Limburgian dialects of Maastricht and Sittard (East Low Franconian) present two well-documented cases of vowel splits between monophthongs and diphthongs (see Dols 1953; Hermans & van Oostendorp 1999, 2001; Hanssen 2005 for Sittard, and Endepols 1955; Cajot 2006 and Gussenhoven 2012 for Maastricht). Below, I introduce the relevant patterns. Note that in diphthongizing dialects, not all vowels will necessarily be realized as monophthongs in Class 2 and as diphthongs in Class 1; these issues will be discussed in section 3.

Maastricht. In the Maastricht dialect, we find two vowel splits between monophthongs and diphthongs. First of all, in morphological alternations between Class 1 and Class 2, tense high vowels in Class 2 correspond to falling diphthongs in Class 1, as shown in (2a); examples are taken from Endepols (1955). Moreover, as reported in Gussenhoven (2012), mid high vowels in Class 2 have a

diphthongal realization in Class 1. Since Gussenhoven (2012) gives data for some tonal minimal pairs only, I cannot provide morphological alternations for splits of the type (2b); yet there is no reason to assume that the splits will not occur in morphologically alternating forms as well.[1]

(2) Splits between monophthongs and diphthongs in Maastricht[2]
   a. [bliːvə^{c2}] 'stay, inf.'   [blɛif^{c1}] 'stay, 1st ps. sg.'
       [duːvə^{c2}] 'pigeon, pl.'   [dɔuf^{c1}] 'pigeon, sg.'
   b. /ɣəbeːt^{c2}/ [ɣəbeːt^{c2}] 'set of teeth'   /ɣəbeːt^{c1}/ [ɣəbeit^{c1}] 'territory'
       /spøːˈ^{c2}lə/ [spøːˈ^{c2}lə] 'play'   /spøːˈ^{c1}lə/ [spøyˈ^{c1}lə] 'rinse'

Sittard. The Sittard dialect has a more complex set of alternations than the Maastricht dialect: as described in Dols (1953), it has a vowel split between long tense mid vowels ([eː, oː, øː], Class 2) and diphthongs ([ɛi^{c1}, ɔu^{c1}, œy^{c1}], Class 1). The process does not affect all closed mid vowels, though: there is a second class of mid vowels not showing diphthongal realizations under Class 1. Some relevant cases are provided in (3); data are taken from Dols (1953). I refer to the two groups of mid vowels as 'diphthongizing' and 'non-diphthongizing', respectively. As Dols works from an entirely diachronic perspective, he does not offer many examples of synchronic alternations; some are given in (3a).

(3) (Non-) splits between monophthongs and diphthongs in Sittard
   a. Diphthongizing mid vowels
       [zeːf^{c2}] 'sieve'   [zɛif^{c1}kə] 'sieve-dim.'
       [doːn^{c2}] 'to do'   [gədɔuns^{c1}] 'ado'
       [ʃoːn^{c2}] 'shoe'   [ʃɔuns^{c1}reim] 'shoelace'
   b. Non-diphthongizing mid vowels
       [beːs^{c1}] 'beast'
       [drøːg^{c1}] 'dry'
       [boːn^{c1}] 'bean'

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1 The same holds for examples with /oː/, which are absent as well. Note also that a third vowel contrast is emerging: as Gussenhoven (2012) reports, the diphthongs /ɛi, ɔu, œy/ show more monophthongal realizations under Class 2, where they are realized as [ɛːᵉ, œːˠ, ɔːᵒ]. As, however, this monophthongization process is not (yet) complete, I will leave the data out of the discussion.
2 Before /r/, high vowels in Class 1 words are lowered to lax mid vowels rather than diphthongized. This is not surprising from a typological perspective, as vowels tend to behave differently before /r/ than in other contexts. For instance, in Dutch and German, diphthongs are prohibited before coda-/r/ (for overviews, see Booij 1995, van Oostendorp 2000 for Dutch, Wiese 1996 for German). At this point, however, I cannot see a straightforward synchronic phonological trigger for the lowering (yet see van Oostendorp 2005 for an analysis that regards the lowering as the outcome of a synchronic shortening process).

3 Analysis

3.1 Representational assumptions and tonal mapping

My analysis is based on a representational framework developed in Köhnlein (2011). I assume that the two accents differ in their foot structure: Class 1 has a syllabic trochee, Class 2 a moraic trochee. It is further assumed that all relevant dialects / dialect groups share this representation; cross-dialectal differences in the tonal melodies arise from computation: they are attributed to the (re-)ranking of constraints.

These differences in foorting entail consequences at the moraic level: I claim that the two feet have *foot head domains* of different size for Class 1 (syllabic trochee, first syllable is the head) and Class 2 (moraic trochee, first mora is the head): Class 1 feet branch at the level of the syllable, whereas Class 2 feet branch at the mora level. Consider the surface representation of the two accents below:

(4)   Metrical surface representation of Class 1 and Class 2

$$
\begin{array}{ccc}
\text{Class 1} & & \text{Class 2} \\
\text{F} & & \text{F} \\
\end{array}
$$
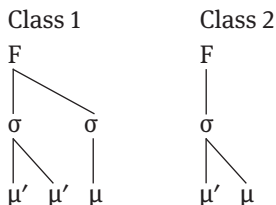
As is shown in (4), the head of a Class 2 foot is the initial mora, and the second mora is the dependent. Class 1 feet, on the othert hand, are obligatorily disyllabic. Their head is the initial syllable, the second syllable is the dependent. The second syllable of a Class 1 foot can either contain a vowel, or alternatively, it can be empty-headed (with an unpronounced vowel). The assumption that Class 1 feet are disyllabic makes it possible to unite different accent-related phenomena in Franconian. As we shall see below, it allows us to analyze diverse tonal melodies and vowel splits in a similar way. Furthermore, it is in line with the fact that in morphologically related accent minimal pairs, Class 1 correlates with more complex structures than Class 2 (van Oostendorp 2005; Köhnlein 2011). It can also account for predictable interactions between the voicing quality of obstruents and the accent class the items belong to (van Oostendorp this volume). This difference in head dependent relations between Class 1 and Class 2 influences the prosodic strength of moras in the stressed syllables of both accents: I assume

that the foot head strengthens all lower-level metrical structure it dominates; it creates a *foot head domain*. The principle is stated in (5):

(5) Foot Head Domains: Each foot head constitutes a foot head domain that comprises the foot head itself as well as all lower-level structure dominated by it.

The different foot structures of Class 1 and Class 2 lead to different head domains: in disyllabic Class 1 feet, the syllable is the foot head and thus creates a head domain. By virtue of (5), the two moras in a Class 1 syllable belong to the foot head domain, as the foot head dominates them both. This makes them prosodically 'strong' at the foot level albeit they are not heads themselves. This is shown in (4), where strong moras are marked with primes.

Crucially, the prosodic strength of moras is different in bimoraic Class 2 feet. Here, only the first mora of the accent syllable is strong, as it is the foot head. The second mora, however, is the dependent of the foot and prosodically weak. As demonstrated in (4), it does not form part of the foot head domain since it is neither a foot head itself nor dominated by a foot head. While the approach largely builds on well-established concepts concerning the prosodic hierarchy (see e.g. Hayes 1985, 1987, 1995, Hyman 1985, McCarthy & Prince 1995, Prince 1990, de Lacy 2002, 2006, among others), head domains are an addition to these traditional approaches. They are motivated in Köhnlein (2011) on the basis of the tonal melodies from different Franconian dialect areas.

The basic tenets of the tonal mapping for Rule A build on the assumption that there is a mutual attraction between tones and metrically strong moras; these are more appropriate 'docking stations' for tones than weak moras (based on de Lacy 1999, 2002).[3] I assume that the basic requirement in Rule A(2) is that tones be licensed by a strong mora (= a mora that is part of a foot head domain):

(6) $T \rightarrow \mu'$: Assign one violation mark for every tone that is not associated with a strong mora.

Given the tonal melodies H*L for declaration and L*H for interrogation, Class 1 (two strong moras) can host both tones of the respective tonal melodies; Class 2 (one strong and one weak mora) can only license the starred tones

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3 For the mapping in Rule A, there is no need to differentiate between the prosodic strength of high and low tones, which can affect the tone-stress relation in some languages (see de Lacy 2002, 2007). Such differences, however, are relevant for the tonal mapping in Rule B, as argued in Köhnlein (2011).

while the trailing tones (L in declaratives, H in interrogatives) are realized in post-nuclear position.[4]

Tab. 2: Tonal mapping in Rule A for declaratives and interrogatives, focus, non-final position.

	Class 1	Class 2
Declarative, non-final position (H*L)	H*L | | μ′ μ′	H* ⟍ μ′μ
Interrogative, non-final position (L*H)	L*H || μ′μ′	L* ⟍ μ′μ

As shown in Tab. 2, the second mora of Class 2 receives its tonal content via spreading; this can be expressed with the following high-ranked constraint (based on Anttila & Bodomo 2000; Gussenhoven 2004):

(7)   μ → T: Assign one violation mark for every mora that is not associated with a tone.

This constraint outranks NoSpread, a standard constraint against tonal spreading (Goldsmith 1976). Lastly, a high-ranked constraint against the association of two tones to one mora (NoContour, Goldsmith 1976) excludes that both H* and L are realized on the strong first mora of the Class 2 syllable. Consider the corresponding tableau for the declarative melody H*L in (8); the computation for underlying L*H is identical, except for the tone values.

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4 In most dialects, this will preferably be the next available syllable with word stress. In cases where no such syllable is available, the tone docks onto the head mora of the next unstressed syllable; this position is metrically stronger than the second mora of a Class 2 syllable, as the latter mora is neither in the head domain of a foot nor a syllable head. Furthermore, a high-ranked constraint against spreading across the boundaries of the nuclear syllable prohibits the migration of the high tone to the left or to the right of the syllable boundary.

(8) OT tableau of tonal mapping for Class 2, phrase-medial declaratives

(μ′ μ) H*L	NOCONTOUR	T → μ′	μ → T	NOSPREAD
☞ a. (μ′ μ) ＼∕ H*				*
b. (μ′ μ) ∣ ∣ H* L		*!		
c. (μ′ μ) ＼∖ H*L	*!			
d. (μ′ μ) ∣ H*			*!	

In Class 1, the established constraint ranking results in a one-to-one association of the two tones with the two moras since, unlike in Class 2, both moras are metrically strong:

(9) OT tableau of tonal mapping for Class 1, phrase-medial declaratives

(μ′μ′) H*L	NOCONTOUR	T → μ′	μ → T	NOSPREAD
a. (μ′ μ′) ＼∕ H*				*!
☞ b. (μ′ μ′) ∣ ∣ H* L				
c. (μ′ μ′) ＼∖ H*L	*!			
d. (μ′ μ′) ∣ H*			*!	

I shall end this section with a note concerning the morphological relation between the two accent classes: in morphologically related, segmentally identical accent minimal pairs, the morpho-semantically more complex form belongs to Class 1

across dialects. Furthermore, function words, which tend to be unmarked across languages, belong to Class 2. Following van Oostendorp (2005), I therefore assume that Class 1 is the marked member of the opposition: while Class 2 receives a default footing, a moraic trochee, Class 1 is represented as an underlying disyllabic foot template /σ′σ/. These templates can be part of a lexical form, or they can be stored independently as prosodic morphemes. For instance, the shared underlying segmental representation of the Mayen minimal pair [ʃdaːnᶜ²] 'stone, sg.' versus [ʃdaːnᶜ¹] 'stone, pl.' is /ʃdaːn/. The singular form receives the unmarked moraic trochee, which results in a Class 2 membership; in the plural form, the stem combines with a plural morpheme enforcing a disyllabic foot – this results in a Class 1 item. As this is not in the focus of this paper, I will always provide the input forms together with their accent markings and ignore the footing process itself.

3.2 Vowel splits: basics

In section 3.1, the basics of the tonal mapping for Rule A(2) have been demonstrated: it has been shown that Class 1, which contains two strong moras, can host two tones while Class 2, with one strong and one weak mora, can host only one tone. Below, I shall demonstrate that the vowel splits in Maastricht and Sittard can be understood along similar lines: strong moras prefer to license a root node on their own, while weak moras tend to receive their segmental content via spreading. I assume that (long) diphthongs are structurally more complex than monophthongs: the second element of a diphthong licenses a root node on its own plus – depending on the feature theory one uses – also segmental features. Therefore, Class 1 syllables prefer diphthongs over monopthongs as they prefer two tones to one tone, while Class 2 syllables favor monophthongs and license only one tone. This can be related to the notion that metrically strong positions attract structure, while weak positions avoid it, as argued in e.g. van Oostendorp (1995, 2000). As, for the purposes of this paper, the most crucial difference between Class 1 and Class 2 is not one of vowel quality in the diphthongs but one of monophthongs vs. diphthongs, I will largely sidestep the complex issue of the precise featural representation of diphthongs.[5]

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5 The problems are manifold; they already start at the phonetic representation of the vowel quality in the two elements of diphthongs. In particular, but not only, the realization of the second element of diphthongs is often variable. For relatively recent studies on variability in diphthongal realizations of Standard Dutch diphthongs, see van der Harst et al. (2011).

I assume that synchronically, the vowel splits discussed in this paper derive from underlyingly bimoraic (Maastricht) or monomoraic (Sittard) monophthongs. In both dialects, the same constraint enforces diphthongization in Class 1; it is given in (10), adapted from Selkirk's (1995) requirement on prosodic headedness (see also Krämer 2009):

(10) HEADEDNESS (μ' / ROOT): Assign one violation mark for every strong mora that does not dominate its own root node.

Notice that the structure of this constraint differs f somewhat rom the ones given for the tonal mapping, as e.g. T $\rightarrow \mu'$ in (6). That is, the tonal mapping associates the moras of the two accent classes with an underlying tonal melody, and the weakness of the second mora of Class 2 prohibits the association of underlying material with this mora (this would violate T $\rightarrow \mu'$). The diph-thongization processes, on the other hand, are cases of strengthening rather than weakening: high-ranked HEADEDNESS (μ' / ROOT) enforces the insertion of a second root note in Class 1. Still, the tonal mapping and these segmen-tal processes share the same core aspects, as metrical structure interacts with tones and segments in similar ways: two strong moras in the accent syllable correspond to two tones / two segments, and one strong mora corresponds to one tone and one segment.

3.3 Vowel splits in Maastricht

As shown in 2.2, Maastricht has synchronic vowel alterations between long tense high and mid vowels for Class 2 vs. falling diphthongs for Class 1; the relevant patterns are given in (11). I assume that these alternations can be attributed to a diphthongization of underlying tense high and mid monoph-thongs in Class 1. Note that other long vowels do not diphthongize in Class 1, viz. the long lax mid vowels [ɛː, œː, ɔː] and the long low vowel [aː]. This can be attributed to high-ranked faithfulness constraints, which preserve the struc-ture of these vowels.

(11) Synchronic alternations between underlying monophthongs (Class 2) and falling diphthongs (Class 1)
/iː, uː, yː/ → [iː^{c2}, uː^{c2}, yː^{c2}] vs. [ɛi^{c1}, ɔu^{c1}, œy^{c1}]
/eː, oː, øː/ → [eː^{c2}, oː^{c2}, øː^{c2}] vs. [ei^{c1}, ou^{c1}, øy^{c1}]

3.3.1 Underlyingly long high vowels

Class 1. Underlyingly long high vowels diphthongize in Class 1. As argued above, this can be attributed to the influence of high-ranked HEADEDNESS (μ' / ROOT). This constraint outranks a corresponding faithfulness constraint protecting underlying associations between underlying vowels and moras, MAXLINK-μ[V] (Morén 2000, 2001, 2003):

(12) MAXLINK-μ[V]: Assign one violation mark for every vowel linked to a mora in the underlying representation that is not linked to that mora in the surface form.

Additionally, the insertion of a second root node for the newly created diphthong violates a low-ranked constraint against insertion (McCarthy & Prince 1995):

(13) DEP-ROOT: Assign one violation mark for any root in the surface form that is not present in the underlying form.

Furthermore, we have to express that the delinked second mora associates with an inserted vowel instead of the word-final consonant. This can be expressed with a high-ranked constraint against moraic consonants (see Morén 2000, 2001, 2003, Krämer 2009):

(14) *μ[C]: Assign one violation mark for every moraic consonant.

A tableau for the input /du:f^{c1}/ 'pigeon, pl.' is given in (15):

(15) OT tableau for /du:f^{c1}/ 'pigeon, pl.'

/du$_{\mu\mu}$f^{c1}/	HEADEDNESS (μ' / ROOT)	*μ[C]	DEP-ROOT	MAXLINK-μ[V]
a. duf $\mu'\,\mu'$	*!			
☞ b. dɔuf $\mu'\mu'$			*	*
c. duf $\mu'\mu'$		*!		*

Class 2. The monophthong surfaces faithfully in Class 2 since HEADEDNESS (μ' / ROOT) is not violated by the weak second mora: weak moras are not required to license a root node. Consider the tableau in (16) for the form /du:və^{c2}/ 'pigeon, pl.':

(16) OT tableau for /duːvə^{c2}/ 'pigeon, pl.'

/du$_{μμ}$və^{c2}/	HEADEDNESS (μ' / ROOT)	DEP-ROOT	MAXLINK-μ[V]
☞ a. duvə^{c2} μ' μ			
b. dɔuvə^{c2} μ'μ		*!	*

3.3.2 Underlyingly long closed mid vowels

Class 1. Like underlyingly long high vowels, underlying long tense mid vowels diphthongize in Class 1 since the strong second mora is required to license a root node. The computation works along the same lines as for high vowels; tableaux for the inputs /ɣəbeːt^{c1}/ and /ɣəbeːt^{c2}/ are given in (17) and (18), respectively:

(17) OT tableau for /ɣəbeːt^{c1}/ 'territory'

/ɣəbe$_{μμ}$t^{c1}/	HEADEDNESS (μ' / ROOT)	*μ[C]	DEP-ROOT	MAXLINK-μ[V]
a. ɣəbet^{c1} μ'μ'	*!			
☞ b. ɣəbeit^{c1} μ'μ'			*	*
c. ɣəbet^{c1} μ'μ'		*!		*

(18) OT tableau for /ɣəbeːt^{c2}/ 'set of teeth'

/ɣəbe$_{μμ}$t^{c2}/	HEADEDNESS (μ'/ROOT)	*μ[C]	DEP-ROOT	MAXLINK-μ[V]
☞ a. ɣəbet^{c2} μ'μ				
b. ɣəbeit^{c2} μ'μ			*!	*
c. ɣəbet^{c2} μ'μ		*!		*

3.4 Vowel splits in Sittard

The Sittard data given in 2.2 show a more complex diphthongization pattern than the Maastricht case, as only some long tense mid vowels diphthongize in Class 1 while other tense mid vowels surface as monophthongs in both accent classes. A summary of the underlying representations and the corresponding phonetic realizations are given in (19):

(19) Synchronic alternations between underlying monophthongs (Class 2) and falling diphthongs (Class 1)
    a. Underlyingly short tense monophthong → monophthong in Class 2, diphthong in Class 1
       /e, o, ø/ → [eː[c2], oː[c2], øː[c2]] vs. [ɛi[c1], ɔu[c1], œy[c1]]
    b. Underlyingly long tense monophthong → always monophthong
       /eː, oː, øː/ → [eː[c1,2], oː[c1,2], øː[c1,2]]

As (19) indicates, the difference between diphthongizing and non-diphthongizing mid vowels is attributed to an underlying length contrast; I adopt this from an earlier analysis by Hermans & van Oostendorp (1999, 2001): the diphthongizing vowels derive from an underlyingly short vowel that is lengthened under stress, the non-diphthongizing ones are underlyingly bimoraic. The main difference between the approach advertised here and that of Hermans & van Oostendorp is to be found in the representation of the accent opposition: unlike the foot-based approach presented in this paper, Hermans & van Oostendorp postulate an underlying lexical tone for Class 2. I will discuss this question in section 4, which contains a comparison between tonal and metrical approaches.

Lastly, note that for the analysis I will assume that diphthongization only changes the second part of vowel to create a diphthong, and that the first part stays phonologically tense. That is, I regard the surface forms as [ei[c1], ou[c1], øy[c1]] and attribute the more open / lax pronunciation of the first element to phonetic implementation.

3.4.1 The diphthongizing monophthongs: underlyingly short tense mid vowels

In Sittard, underlyingly short tense mid monophthongs surface as long tense vowels in Class 2 and as falling diphthongs in Class 1. Among the vowels that exhibit an accent opposition, tense mid vowels are the only vowels in the

Sittard vowel system that do not have a short counterpart (Hanssen 2005: 48): high tense vowels and lax mid vowels can be short or long; furthermore, long tense [aː], which cannot be short, corresponds to short lax [ɑ], which is never long. The non-diphthongizing short vowels as well as non-diphthongizing [aː] will be treated in 3.3.3; for the moment, I will focus on mid tense vowels only.

We can conclude that only mid vowels are always long on the surface without having some short correspondent; in Sittard, this length must be phonological, as the accent contrast can be realized only on syllables with two sonorant moras (see Hanssen 2005).[6] For our purposes, this observation can be translated into a high-ranked constraint stating that tense mid vowels should not be followed by a moraic coda:

(20) *V[TENSE, MID]C$_\mu$: Assign one violation mark for every tense non-high vowel that is followed by a moraic coda consonant.

Admittedly, this constraint is of rather complex nature (as it involves a comparison between neighboring segments). Yet at least, the generalization can be extended to stressed syllables in Standard Dutch (e.g. Gussenhoven 2009) and Standard German (e.g. Mangold 1999), albeit in these varieties, the restriction also holds for high tense vowels: all of these can never be followed by a moraic consonant. Next to *V[TENSE, MID]C$_\mu$, another unviolated constraint in the Sittard dialect is the STRESS-TO-WEIGHT principle (Kager 1989, Prince 1990):

(21) STRESS-TO-WEIGHT: Assign one violation mark for every stressed syllable that is not bimoraic

The combination of high-ranked *V[TENSE, MID]C$_\mu$ and STRESS-TO-WEIGHT prohibits short tense mid vowels in stressed syllables. For underlyingly monomoraic tense vowels, the necessary insertion of a second mora violates low-ranked DEP-μ. While the abovementioned constraints affect the two accent syllables in similar ways (a second mora will be inserted in each case), the crucial difference lies in the segmental content of that mora (long monophthong for Class 2 vs. diphthong for Class 1): vowel lengthening in Class 2 is the default option in Sittard, as no additional root node has to be inserted, and DEP-ROOT

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6 The restriction holds for most Franconian dialects (see Gussenhoven 2000; Schmidt 2002; Peters 2006; Köhnlein 2011).

does not need to be violated. Consider the Class 2 tableau in (22) for the form /don^{c2}/ 'do':

(22) OT tableau for /don^{c2}/ 'do'

/do$_\mu$n^{c2}/	*V$_\mu$[TENSE, MID]C$_\mu$	STRESS-TO-WEIGHT	DEP-ROOT	DEP-μ
a. doun^{c2} | \\ μ′μ			*!	*
☞ b. don^{c2} ⋀ μ′μ				*
c. don^{c2} | \\ μ′μ	*!			*
d. don^{c2} | μ′		*!		

In Class 1, we find insertion of a high vowel instead of lengthening. Like in Maastricht, insertion is driven by HEADEDNESS (μ′ / ROOT), which equally satisfies *V$_\mu$[TENSE, MID]C$_\mu$ and STRESS-TO-WEIGHT, but leads to a violation of lower-ranked DEP-ROOT and DEP-μ. A tableau for /gədons^{c1}/ 'ado' is given in (23):

(23) OT tableau for /gədons^{c1}/ 'ado'

/gədo$_\mu$ns^{c1}/	HEADEDNESS (μ′ / ROOT)	*V$_\mu$[TENSE, MID] C$_\mu$	STRESS-TO-WEIGHT	DEP-ROOT	DEP-μ
☞ a. gədouns^{c1} | | μ′μ′				*	*
b. gədons^{c1} ⋀ μ′μ′	*!				*
c. gədons^{c1} | | μ′μ′		*!			*
d. gədons^{c1} | μ′			*!		

3.4.2 The non-diphthongizing tense mid vowels

As indicated above, not all tense mid vowels show diphthongization under Class 1: unlike the diphthongizing short monophthongs, underlyingly long tense mid vowels surface faithfully. The constraint enforcing diphthongization in Class 1, HEADEDNESS (μ' / ROOT), is outranked by MAXLINK-μ[V], which also captures that other underlyingly long vowels do not diphthongize in Class 1. The ranking of the two constraints differs between Maastricht and Sittard, which reflects the different nature of the diphthongization processes (underlyingly long vowels diphthongize in Maastricht, underlyingly short vowels diphthongize in Sittard). A tableau for the form /be:s^{c1}/ 'beast' is provided in (24):

(24) OT tableau for /be:s^{c1}/ 'beast'

/be$_{\mu\mu}$s^{c1}/	MAXLINK-μ[V]	HEADEDNESS (μ' / ROOT)
☞　a.　beis^{c1} $\mid \setminus$ $\mu' \mu'$	*!	
b.　bes^{c1} $\setminus$ $\mu' \mu'$		*

3.4.3 The non-diphthongizing vowels

As indicated in 3.3.1, there are several underlyingly short vowels that show an accent opposition but do not trigger lengthening / vowel splits in the Sittard dialect. Leaving the opposition between [ɑ] and [aː] aside for another moment, all long vowels that show an accent contrast have short counterparts, which indicates that the short variants do not lengthen under stress but rather contain a moraic coda. This can be expressed with a constraint that enforces coda consonants to be moraic, WEIGHT BY POSITION (e.g. Morén 2000, 2001, 2003):

(25) WEIGHT BY POSITION (WBYP): Assign one violation mark for every non-moraic consonant

This constraint outranks *μ / C and Dep-μ, yet WBYP is lower-ranked than *V$_{\mu}$[TENSE, MID]C$_{\mu}$; thus, for underlyingly monomoraic tense mid vowels in the input, lengthening / diphthongization will still be preferred over assigning a mora to the coda consonant. Consider the tableau in (26) for the input /mɛs/ 'mass':

(26) OT tableau for /mɛs/ 'mass'

/mɛ$_μ$s/	*V$_μ$[TENSE, MID]C$_μ$	WBYP	*μ / C	DEP-μ

☞ a. mɛs
  ||
  μμ
			*	*

b. mɛs
  ⋀
  μμ
		*!		

c. mɛs
  |
  μ
		*!		*

The situation is somewhat more complex with respect to the low tense vowel [aː], which is always long (similar to tense mid vowels), and contrasts Class 1 and Class 2. Given 'Richness of the Base' in OT, this implies that an underlyingly monomoraic /a/ in the input could trigger lengthening but would have to block diphthongization in Class 1. Two possible explanations could be given to account for this difference: one the one hand, it might be argued that underlying /a/ in fact results in [ɑ] on the surface, and the quality difference between predictably long [a] and predictably short [ɑ] would thus be phonetic rather than phonological.

If one wanted to maintain a phonological quality contrast between the two vowels, then monomoraic tense /a/ would be prohibited on the surface, and one would have to account for predictable lengthening in both accent classes, thus also for non-diphtongization in Class 1. Bimoraicity could be enforced by e.g. changing *V$_μ$[TENSE, MID]C$_μ$ to *V$_μ$[TENSE, NON-HIGH]C$_μ$. The most straightforward explanation for blocking of diphthongization, then, would arguably be to state that [ai] and [au] are prohibited diphthongs in the Sittard dialect. This holds beyond the lengthening cases: the dialect only allows diphthongs with a mid vowel as the first element and high vowels as the second one.[7]

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7 A more abstract generalization might be made under the assumption that the representation of vowel height in mid vowels is a combination of that for high and low vowels: using elements instead of 'traditional' features, the facts could be expressed by stating that the second mora of a syllable can license a root node on its own but not a feature. Under this assumption, [ei] would be allowed, as both parts of the diphthong share the element |I|; [ai], however, would be prohibited since the second part of the diphthong would have to license the element |I| on its own: [a] only contains the element |A|, and [i] contains the element |I|. [ae] or [ao] would be ruled out as well, since the second position would still have to license |I| on its own (for further discussion of diphthong representation in element theory, see Harris 1995). The same effect could be achieved by assuming that mid vowels contain both a feature [high] and a feature [low].

4 Some arguments against a synchronic tone-vowel interaction in Franconian

In the previous section, I have developed a synchronic analysis of vowel splits between diphthongs in Class 1 and monophthongs in Class 2 in the Maastricht and the Sittard dialects. The essence of the analysis is that the synchronic trigger of the splits can be traced to different foot structures of the two accent classes. Alternatively, one could attribute the segmental processes to the influence of a lexical tone; such an analysis has been presented by Hermans & van Oostendorp (1999, 2001) for the Sittard dialect, albeit, as we shall see, they assume that the influence is indirect (yet see more recent work by Hermans 2009 for a metrical analysis of the accents; see also van Oostendorp, this volume, for a metrical approach to predictable voicing alternations in the Moresnet dialect).

The authors assume that Class 2 has two high tones (HH, intonational H followed by lexical H): the lexical tone is always aligned with the right edge of the syllable, i.e. the second mora; the intonational H precedes it on the first mora. Class 1, on the other hand, has a high tone and a low tone (HL, both tones intonational). In my analysis, I have adapted Hermans & van Oostendorp's idea that the diphthongizing mid vowels in Sittard are underlyingly short: these vowels lengthen in Class 2 but diphthongize in Class 1. In Hermans & van Oostendorp's approach, diphthongization is regarded as the unmarked option, which is blocked under Class 2. In a nutshell, the authors argue that high tones require to be linked to segments that are dominated by a syllable head, i.e. the first mora of a syllable. The second component of a diphthong has its own root node. This root node is linked to the second mora, and is therefore not sponsored by the syllable head (the first mora). As the second mora of Class 2 has to license a high lexical tone, which itself must be connected to the syllable head, diphthongization is blocked, and lengthening occurs: this way, the lexical high tone can be linked to the (bimoraic) monophthong, and is still licensed by the syllable head. In Class 1, on the other hand, the underlyingly short vowels can diphthongize, as there is no lexical tone blocking the process. The second mora receives a default low tone, which does not require to be linked to segmental material sponsored by the first mora. As a consequence, a high tone on the second mora corresponds to a monophthong (HH, Class 2), and a low tone on the second mora corresponds to a diphthong (HL, Class 1).

The approach provides a feasible solution for the tonal melodies in declaratives; however, some difficulties may arise with respect to the tonal contours in interrogatives. As can be observed from data provided in Hanssen (2005), the interrogative contours in Sittard are the mirror image of those in declaratives, at least in non-final focus position (see also Tab. 1). That is, for Class 1, HL in declaratives

corresponds to LH in interrogatives; likewise, for Class 2, HH corresponds to LL. These facts seem problematic for any approach that relates diphthongization to a direct influence of tonal quality (even when, as is the case of Hermans & van Oostendorp's analysis, the interaction is mediated by metrical structure): if a high tone on a second mora blocks diphthongization, but a low tone allows it, one might expect that there could be opposite diphthongization patterns for declaratives (Class 2 has H on the second mora, and Class 1 has L) and interrogatives (Class 2 has L on the second mora, and Class 1 has H): that is, diphthongization would be blocked in Class 2 declaratives (blocking high tone on the second mora), but it would be possible in Class 2 interrogatives (non-blocking low tone on the second mora). Similarly, diphthongization in Class 1 would be allowed in declaratives (non-blocking low tone on the second mora) but prohibited in interrogatives (blocking high tone on the second mora).[8]

Furthermore, recall that the tonal contrast between the accents can often be neutralized outside of focus. Empirically, this has been confirmed in perception tests for the dialects of Roermond (Fournier 2008) and Arzbach (Köhnlein 2011). If the presence of a lexical tone could influence segmental structure (either directly or indirectly), one could imagine the existence of dialects where tonal contrasts as well as vowel splits are neutralized outside of focus. To this point, however, there are no indications that such patterns may exist. Instead, vowel splits seem to be retained throughout all prosodic contexts, even when the tonal opposition is neutralized. Under my metrical approach, this asymmetry is not at all surprising but rather follows from the analysis. First of all, tonal neutralization in non-focus positions is expected to be possible: since tonal contrasts are solely due to the mapping of intonational tones, neutralization will occur when there is a 'lack' of intonational tones. Accordingly, the opposition will first be neutralized in contexts where no pitch accents or boundary tones are present, as for instance in non-focus, non-final position of an intonational phrase.

While the metrical approach thus predicts the possibility of tonal neutralization in non-prominent positions in a phrase, it also predicts that (phonologized) vowel splits between the accents should be maintained. Unlike intonational tones, which can or cannot be present on accent syllables (depending on the relative phrasal prominence of that syllable), segmental structure and metrical structure should always interact: they are not dependent of the position of the

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8 One may try to solve this issue by postulating a derivational analysis, e.g. by assuming that the tonal change from H to L occurs after diphthongization has applied. Yet this would still involve a complex interaction of lexical tones, intonational tones, and vowel quality at different levels of representation. Furthermore, as far as I can see, this would still not rule out the possibility of unattested dialects with reversed diphthongization patterns across different pragmatic contexts.

accent item in an intonational phrase. Therefore, in dialects with vowel splits, we expect to find segmental correlates of the accent opposition, even when the tonal contrast is neutralized, which is borne out by the facts.

Since in metrical approaches, such as the one advertised here, tone and segmental structure interact with prosodic structure independently, the analysis makes another prediction that seems to be correct: it predicts that an underlying metrical contrast may be expressed at the segmental level only (but not tonally). This indeed seems to be possible: for Franconian, Cajot (2006) reports several dialects to the South of Maastricht that have undergone vowel splits which correlate with the tone accent opposition; yet according to Cajot, these dialects have given up the tonal contrast between Class 1 and Class 2. As, however, Cajot's data are based on auditory judgments only, and the set of presented data is too small to draw any firm conclusions, these facts could not be considered in more detail. More empirical research on these dialects is needed.

5 Conclusion

In this paper, it has been shown that synchronic alternations between monophthongs and diphthongs in the Franconian dialects of Maastricht and Sittard can be analyzed as the segmental manifestation of foot-based oppositions between two accent classes. With respect to the ongoing discussion concerning the autosegmental analysis of the Franconian tone accent opposition (tonal approaches vs. metrical approaches), it has been argued that the possibility of synchronic vowel splits in Franconian is to be expected under a metrical approach while it seems much more difficult to incorporate the facts in a tonal framework. One possibility could be to deny the phonological status of these oppositions and solely regard them as a matter of phonetic implementation, as may be concluded from the discussions in Gussenhoven & Driessen (2004) and Gussenhoven (2007). In cases of subtle phonetic contrasts, this may be a reasonable explanation (and in this paper, it has been as well with respect to the phonetic implementation of diphthongs in Sittard, albeit not to account for a predictable contrast); yet for synchronic alternations that extend the limits of what would usually be regarded as a purely phonetic phenomenon, such as the one between high vowels and falling diphthongs in Maastricht, this does not seem to be a favorable approach. Indeed, Gussenhoven (2012) does not attribute the avoidance of Class 1 on high vowels in Maastricht to phonetic implementation but to other functional considerations: essentially, as Gussenhoven argues, making a tonal contrast on high vowels would jeopardize the vocalic contrast. Such functional considerations, however, do not necessarily tell us anything about the synchronic phonological organization of the phenomenon.

References

Anttila, Arto & Adams Bodomo. 2000. Tonal polarity in Dagaare. In Vicky Castens & Frederick Parkinson (eds.) *Trends in African Linguistics, vol. 4: Advances in African Linguistics,* 119–134. Trenton, NJ: African World Press.

Boersma, Paul. This volume. The history of the Franconian tone contrast.

Booij, Geert. 1989. On the representation of diphthongs in Frisian. *Journal of Linguistics* 25, 319–332.

Booij, Geert. 1995. *The phonology of Dutch*. Oxford: Clarendon Press.

Cajot, José. 2006. Phonologisch bedingter Polytonieverlust – eine tonlose Enklave südlich von Maastricht. In Michiel de Vaan (ed.) *Germanic Tone Accents. Proceedings of the First International Workshop on Franconian Tone Accents, Leiden, 13–14 June 2003.* Zeitschrift für Dialektologie und Linguistik – Beiheft 131, 11–24. Stuttgart: Franz Steiner Verlag.

Caratini, Emilie. 2009. *Vowel and consonantal quantity in German: synchronic and diachronic perspectives.* Doctoral dissertation, Université de Nice, Universität Leipzig.

Chitoran, Ioana. 2002. The phonology and morphology of Romanian diphthongization. *Probus* 14:2, 205–246.

de Lacy, Paul. 1999. *Tone and prominence*. Ms., Amherst: University of Massachusetts.

de Lacy, Paul. 2002. The interaction of tone and stress in Optimality Theory. *Phonology* 19, 1–32.

de Lacy, Paul. 2006. *Markedness: reduction and preservation in phonology*. Cambridge: Cambridge University Press.

de Lacy, Paul. 2007. The interaction of tone, sonority, and prosodic structure. In Paul de Lacy (ed.), *The Cambridge handbook of phonology*, 281–307. Cambridge University Press.

Dols, Willy. 1953. *Sittardse diftongering*. Sittard.

Donohue, Cathryn. This volume. Tones and vowels in Fuzhou revisited.

Endepols, Joseph. 1955. *Woordenboek of diksjenaer van 't Mestreechs*. Maastricht: Boosten & Stols.

Fournier, Rachel. 2008. *Perception of the tone contrast in East Limburgian dialects.* Doctoral dissertation. Radboud Universiteit Nijmegen (= LOT Dissertation series 196).

Goldsmith, John. 1976. *Autosegmental phonology*. Doctoral dissertation, MIT. [Published 1979, New York: Garland].

Goossens, Jan. 1998. Stoottoon en diftongering van Wgm. I en u in Limburg. *Taal en Tongval* 8, 99–112.

Gussenhoven, Carlos. 2000. On the origin and development of the Central Franconian tone contrast. In Aditi Lahiri (ed.) *Analogy, levelling, markedness: principles of change in phonology and morphology*, 213–260. Berlin: Mouton de Gruyter

Gussenhoven, Carlos. 2004. *The phonology of tone and intonation*. Cambridge: Cambridge University Press.

Gussenhoven, Carlos. 2007. A vowel height split explained: compensatory listening and speaker control. In Jennifer Cole & Jose Ignacio Hualde (eds.) *Laboratory Phonology 9*, 145–172. Berlin/New York: Mouton de Gruyter.

Gussenhoven, Carlos. 2009. Vowel duration, syllable quantity, and stress in Dutch. In Kristin Hanson & Sharon Inkelas (eds.) *The nature of the word*. Essays in honor of Paul Kiparsky, 181–198. Cambridge, MA/London, UK: MIT Press.

Gussenhoven, Carlos. 2012. Asymmetries in the intonation system of the tonal dialect of Maastricht Limburgish. *Phonology* 29, 39–79.

Gussenhoven, Carlos & Wilske Driessen. 2004. Explaining two correlations between vowel quality and tone: The duration connection. *Proceedings of the Speech Prosody 2004 Conference (Nara, Japan)*, 179–182.

Gussenhoven, Carlos & Jörg Peters. 2004. A tonal analysis of Cologne Schärfung. *Phonology* 21, 251–285.

Hanssen, Judith. 2005. *Tone and intonation in the dialect of Sittard*. MA thesis, University of Nijmegen.

Harris, John. 1994. *English sound structure*. Oxford: Blackwell.

Harst, Sander van der, Hans van de Velde & Roeland van Hout. 2011. The diphthongal vowel space paradox. *ICPHS XVII*, 827–830. Hong Kong, International Conference on Phonetic Sciences XVII.

Hayes, Bruce. 1985. *A metrical theory of stress rules*. New York: Garland.

Hayes, Bruce. 1987. A revised parametric theory of stress. *Proceedings of the Northeastern Linguistics Society* 17, 274–269.

Hayes, Bruce. 1990. Diphthongization and coindexing. *Phonology* 7, 31–71.

Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies*. Chicago: University of Chicago Press.

Heike, Georg. 1962. Suprasegmentale Merkmale der Stadtkölner Mundart. Ein Beitrag zur "Rheinischen Schärfung." *Phonetica* 8, 147–165.

Heike, Georg. 1964. *Zur Phonologie der Stadtkölner Mundart. Eine experimentelle Untersuchung der akustischen Unterscheidungsmerkmale*. Marburg: Elwert.

Hermans, Ben. 2009. The phonological structure of the Limburg tonal accents. In Kuniya Nasukawa & Phillip Backley (eds.) *Strength relations in phonology*, 325–380. Berlin/New York: Mouton de Gruyter.

Hermans, Ben & Marc van Oostendorp. 1999. *The derivational residue in phonological Optimality Theory*. Amsterdam: John Benjamins.

Hermans, Ben & Marc van Oostendorp. 2000. Synchrone beperkingen op de Sittardse diftongering. *Taal en tongval* 51 (2), 166–186.

Hermans, Ben & Marc van Oostendorp. 2001. Voice–tone interaction in a Limburg dialect. Evidence for feature licensing. In Ton van der Wouden & Helen de Hoop (eds.) *Linguistics in the Netherlands*, 81–91. Amsterdam: John Benjamins

Hombert, Jean-Marie 1977. Development of tones from vowel height. *Journal of Phonetics* 5, 9–16.

Hombert, Jean-Marie, John J. Ohala & William G. Ewan. 1979. Phonetic explanations for the development of tones. *Language* 55, 37–58.

Hyman, Larry M. 1985. *A theory of phonological weight*. Dordrecht: Foris.

Jurgec, Peter & Michael Becker. This volume. Interactions of tone and ATR in Slovenian.

Kager, René. 1989. *A metrical theory of stress and destressing in English and Dutch*. Dordrecht: Foris Publications.

Kehrein, Wolfgang. 2007. Moraic stress in Franconian – and elsewhere. Talk presented at *Phonetics and Phonology* 4, Nijmegen.

Kehrein, Wolfgang. This volume. There's no tone in Cologne: against tone segment interactions in Franconian.

Köhnlein, Björn. 2011. *Rule reversal revisited: Synchrony and diachrony of tone and prosodic structure in the Franconian dialect of Arzbach*. Doctoral dissertation: Leiden. (= LOT Dissertation series 274).

Köhnlein, Björn 2016. Contrastive foot structure in Franconian tone accent dialects *Phonology* 33.1, 87–123.

Krämer, Martin. 2009. *The phonology of Italian*. Oxford: Oxford University Press.

McCarthy, John & Alan Prince. 1995. Faithfulness and reduplicative identity. In Jill Beckman, Laura Walsh-Dickey & Suzzane Urbanczyk (eds.) *University of Massachusetts occasional papers in linguistics*, vol. 18, 249–384. Amherst, MA: GLSA Publications.

McCarthy, John & Alan Prince. 1996. Prosodic morphology 1986. *Technical Report* #32, Rutgers University Center for Cognitive Science.

Morén, Bruce. 2000. The puzzle of Kashmiri stress: Implications for weight theory. *Phonology* 17, 365–396.

Morén, Bruce. 2001. *Distinctiveness, coercion and sonority: A unified theory of weight*. New York: Routledge Publishers.

Morén, Bruce. 2003. Danish stød and Eastern Norwegian pitch accent: the Myth of lexical tones. Talk presented at the 13th *Manchester Phonology Meeting*.

Oostendorp, Marc van. 1995. *Vowel quality and phonological projection*. Doctoral dissertation, Tilburg University.

Oostendorp, Marc van. 2000. *Phonological projection*. Berlin: Mouton De Gruyter.

Oostendorp, Marc van. 2005. Expressing inflection tonally. *Catalan Journal of Linguistics* 4 (1), 107–127.

Oostendorp, Marc van. 2012. Quantity and the three–syllable window in Dutch word stress. *Language and Linguistics Compass* 6, 343–358.

Oostendorp, Marc van. This volume. Tone, final devoicing and assimilation in Moresnet.

Peters, Jörg. 2006. The Cologne word accent revisited. In Michiel de Vaan (ed.) *Germanic tone accents. Proceedings of the first international workshop on Franconian tone accents, Leiden, 13–14 June 2003*. Zeitschrift für Dialektologie und Linguistik – Beiheft 131, 107–133. Stuttgart: Franz Steiner Verlag.

Peters, Jörg. 2008. Tone and intonation in the dialect of Hasselt. *Linguistics* 46, 983–1018.

Peeters, Wim & Bert Schouten. 1989. Die Diphthongierung der westgermanischen î- und û-Laute im Limburgischen. *Zeitschrift für Dialektologie und Linguistik* 56, 309–331.

Pöchtrager, Markus. 2006. *The structure of length*. Doctoral dissertation, University of Vienna.

Prince, Alan. 1990. Quantitative consequences of rhythmic organization. In K. Deaton, M. Noske & M. Ziolkowski, (eds.), CLS 26-II, *Papers from the parasession on the syllable in phonetics and phonology*, 355–398. Chicago: Chicago Linguistic Society.

Prince, Alan & Paul Smolensky. 1993. *Optimality theory: Constraint interaction in generative grammar*. New Brunswick: RuCCS-TR-2, Rutgers Center for Cognitive Science, Rutgers University.

Schane, Sanford A. 1984. The fundamentals of particle phonology. *Phonology Yearbook* 1, 129–156.

Schmidt, Jürgen E. 1986. *Die mittelfränkischen Tonakzente (Rheinische Akzentierung)*. Stuttgart: Steiner (Mainzer Studien Zur Sprach- und Volksforschung 8).

Schmidt, Jürgen E. 2002. Die sprachhistorische Genese der mittelfränkischen Tonakzente. In Peter Auer, Peter Gilles & Helmut Spiekermann (eds.) *Silbenschnitt und Tonakzente*, 201–233. Tübingen: Niemeyer (Linguistische Arbeiten 463).

Selkirk, Elisabeth. 1995. Sentence prosody: Intonation, stress and phrasing. In John Goldsmith (ed.) *The handbook of phonological theory*. London: Blackwell.

De Vaan, Michiel. 2002. WGm. *î en *û voor r in Zuid-Limburg. *Taal en Tongval*, 54, 171–182.

Werth, Alexander. 2007. Perzeptionsphonologische Studien zu den mittelfränkischen Tonakzenten. *Zeitschrift für Dialektologie und Linguistik* 74 (2), 292–316.

Werth, Alexander. 2011. *Perzeptionsphonologische Grundlagen der Prosodie: Eine Analyse der mittelfränkischen Tonakzentdistinktion*. Zeitschrift für Dialektologie und Linguistik – Beihefte, Band 143. Stuttgart: Franz Steiner Verlag.

Wiese, Richard. 1996. *The phonology of German*. Oxford: Oxford University Press.

Yip, Moira. 1989. Feature geometry and cooccurrence restrictions. *Phonology* 6, 349–374.

Yip, Moira. 2002. *Tone*. Cambridge: Cambridge University Press.