

Expressing inflection tonally

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1 Introduction

Limburg dialects of Dutch have two distinctive tonal contours on syllables with primary stress. These tones are traditionally called *Schleifton* (‘dragging tone’) and *Stosston* (‘bumping tone’), but here we will use the terms ‘level high tone’ and ‘falling tone’.¹ The tones fall on the stressed syllable in the word, and serve to distinguish between minimal pairs. The following examples are from the Maasbracht dialect (which has been extensively studied by Hermans, 1994):

- | | | |
|-----|---------------------|------------------------|
| (1) | <i>falling tone</i> | <i>level high tone</i> |
| | mîh ‘minus’ | mîh ‘vile’ |
| | dæh ‘fir’ | dæh ‘then’ |
| | klâh ‘trap’ | klâh ‘hardly’ |
| | bî ‘bee’ | bî ‘with’ |
| | zî ‘side’ | zî ‘she’ |
| | pîp ‘to squeak’ | pîp ‘pipe’ |

The distinction between these two tones is also used to in inflectional morphology, e.g. to differentiate between neuter and feminine forms of adjectives (2a); if the neuter is level high (*wîls*), the feminine has a falling tone (*wîls*). If the neuter itself has a falling tone, nothing happens to the feminine, which still has a falling tone (2b).²

¹Thanks are due to Laura Downing, Ben Hermans, Gertjan Postma and Paul Boersma for comments. All usual disclaimers apply.

²A similar distinction is made in the realm of nouns, where singular nouns may carry a level tone, while the corresponding plurals have a falling tone.

(2)	neuter	feminine	masculine	
a.	wíís	wîís	wîzə	‘wise’
	dóúf	dòùf	dòvə	‘deaf’
	láám	láàm	lààmə	‘lame’
b.	káǎm	káǎm	káǎmə	‘calm’
	kléèn	kléèn	kléènə	‘small’

The only distinction between the neuter form and the feminine form thus is one of tone. Given the fact that neuter adjectives can have both falling and level tones, depending on lexical specification, it is reasonable as well as customary to assume that this form of the adjective represents the ‘underlying’ tonal distinction.

These facts have been taken by some analysts (notably Alderete, 1999) as evidence for the relevance of paradigmatic relations within phonology: the tones in (2a) would switch because in this way an opposition within the paradigm would be maintained (and higher-ranking markedness constraints would make such a switch impossible in cases such as (2b)).

In this article we defend what could be called a more ‘traditional’ approach to these facts, assuming a combinatorial view of morphology in which all alternations are due to the fact that one word consists of a different combination of morphemes than another word. There are no ‘paradigms’ in this view, only morphemes and configurations of morphemes. It is argued that we need a sophisticated representational analysis rather than one defined in terms of interparadigmatic (anti)faithfulness. We set up an inventory of inflectional tonal affixes such that the inflectional tonal differences follow. The patterns shown in (2) are argued to represent allomorphy rather than something else.

2 Tones and adjectival inflection: data

2.1 The phonology of tones

Limburg Dutch dialects, like the neighbouring Rhineland German dialects, are well-known for their use of lexical tone. There is quite some dialectal variation as to the phonetic realisation of these tones, but as far as is known, this does not really affect the phonology: the split between *falling tone* and *level high tone* is common to all dialects in this area.

In order to understand the interface between the phonology and the morphology, it is first necessary to understand the phonological identity of the so-called falling tone and the so-called level high tone. The following two pictures represent the F0

values for these two tones (for a speaker from the Roermond dialect, very close to Maasbracht³):

- (3) falling tone level high tone



The ‘falling’ tone is characterised by a clear downward movement; the ‘level high’ tone also moves slightly downward, but then goes up again towards the end. There are several ways to translate this into the phonology, but many analysts have converged on the following (see Gussenhoven, 2004, for an authoritative overview):

- (4) falling tone level high tone
- | | |
|-------|-------|
| HL | H(L)H |
| | |
| μ μ | μ μ |
| | |
| m t h | m t h |

2.2 Dialectology

The Limburg dialects are spoken in Dutch and Flemish provinces which are both called ‘Limburg’. Like most dialects in Europe, they are under a strong pressure of convergence to the standard language, in this case to Standard Dutch, but maybe to a slightly lesser extent than in some other areas in this particular corner of Europe (Kroon & Vallen, 2004). The area is on the periphery of the Dutch-speaking area, neighbouring both German and French dialects. For a large part, it did not become an administrative part of The Netherlands (or Belgium) until well into the 19th century (Kessels-van der Heijde, 2002). The following map shows the positioning of Limburg (the grey spotted area) with respect to the other parts of the Netherlands (the western most part of Limburg is Dutch, the eastern part is Flemish):

³The data were analysed with the *Praat* programme; <http://www.praat.org/>. The data are almost identical to those presented in Gussenhoven (2000).



(5)

This article is based on data from a few different sources. These are, first, Hermans (1994), presenting a wealth of native speaker's intuitions on one individual dialect, Maasbracht Dutch, plus a very insightful analysis of some of these data, on which we will draw. Secondly, we use the so-called Goeman-Taeldeman-Van Reenen (GTR) database, a large survey on the phonology and morphology of dialects in The Netherlands and Flanders in the 1980s and 1990s. Maasbracht is approximately in the center of this area, as the map in (5) shows.

The GTR data were mainly used to check the robustness of the Maasbracht intuitions. With this goal in mind, we compared the feminine forms of the adjectives *klein* 'small', *oud* 'old', *goed* 'good', *heel* 'very', *rijp* 'ripe', *rond* 'round', *lang* 'long', *scheef* 'oblique' and *hoog* 'high' with their neuter or citation forms in the database.⁴ After filtering out those forms for which the tones were not transcribed, or not transcribed in an understandable way, we obtained 473 neuter-feminine pairs, with the following distribution (HH=level high tone, HL=falling tone):

⁴Neuter forms are those forms given in attributive position with a neuter noun; citation forms are those words which were elicited when the adjective was given in isolation, without any noun. We used the neuter forms for 'klein', 'oud' and 'geel' and the citation forms for the other adjectives. The reason why we did not make a uniform choice was purely pragmatic: there are not enough pure neuter/feminine pairs in the GTR database. Given the fact that both the neuter form and the citation form reflect the underlying representation, we trust that this choice does not affect the argument.

(6)	Tone on neuter	Tone on feminine	Number of adjectives	Proportion
	HH	HL	157	.33
	HH	HH	64	.14
	HL	HL	246	.52
	HL	HH	6	.01

It is easy to see that the number of falling neuter - level high feminine pairs is extremely small, especially given the fact that more than half of all the adjectives have an ‘underlying’ falling tone in the neuter. Furthermore, if we look at these six cases in more detail, we see that two of them can be discarded out of hand, in one case since the transcriber has noted that he was not sure about the tone, and in another case because a different adjective was used in the neuter than in the feminine. This leaves us with only 4 pieces of data (out of 473) with a falling-level high pattern for which we will not be able to provide a solution.

Further analysis shows that 46 out of the 64 level - level patterns are found for one single adjective, *rijp* ‘ripe’, the only one in our sample which ends underlyingly in a voiceless obstruent.⁵ This will turn out to be significant in the following section. As a matter of fact, given that we have reliable tonal data on 59 dialects for *rijp*, we can say that for this word level high-level high is the dominant pattern.⁶

All in all we can make the following observations:

- (7) a. If the stem ends in a voiced obstruent, a sonorant, or a vowel we find two patterns:
- i. neuter: falling, feminine: falling
 - ii. neuter: level high, feminine: falling
- b. If the stem ends in a voiceless obstruent (*rijp* ‘ripe’), we find level-level patterns (possibly next to the other two)

This conforms to the findings of Hermans (1994). As we have already seen above, this author describes a pattern in which underlyingly level high tones turn into falling tones on the surface, while underlyingly falling tones do not change at all. But Hermans also notes that “it is a curious fact of Limburgian morphophonology that tonal alternations can never take place when the base ends in a *voiceless* obstruent.”

⁵From the orthography, it might appear that *scheef* ‘oblique’ ends in a voiceless fricative, but this voicelessness is not underlying. It is a quirk of Dutch orthography that final devoicing is represented in fricatives, but not in stops. The word *rijp* actually has a fricative in some of the tonal Limburg dialects — *rjff* —, and this behaves as underlyingly voiceless. We will discuss some the implications of final devoicing in section 4.1.

⁶Eleven dialects show a level high-falling pattern, and one dialect shows a falling-falling pattern. These will be left out of consideration.

Hermans gives the following Maasbracht facts by way of illustration:

(8)	neuter	feminine	masculine	
	rík	ríkə	ríkə	‘rich’
	nááks	nááksə	nááksə	‘naked’
	záát	záátə	záátə	‘lame’

Although it is not true that all Limburg dialects display this ‘curious fact’ — we have just seen there are a few dialects where an alternation was found after all —, it is true for the majority, and we take this to be an absolute fact for Maasbracht. The generalisation was, incidentally, already made by van Wijk (1935). Given that we have sufficient detailed native speaker evidence only for the Maasbracht dialect, we will concentrate on this dialect in what follows; see Hinskens & Muysken (1986) for a thorough analysis of a slightly different system.

One fact will turn out to be absolutely crucial for our present purposes: in the examples in (8), a schwa shows up on the feminine suffix. This schwa is crucially lacking in the examples in (2). We thus can make the following generalisation:

- (9)
- a. if the feminine has a level high tone, it also has a schwa
 - b. if the feminine has a falling tone, the schwa does not show up, regardless whether there is alternation in the paradigm or not

This is the correlation that will form the core of our discussion in the next two sections.

3 A representational analysis

We may simplify the representations in (4) in a number of ways. First, if we consider the low tone in the level high pattern as a phonetic effect, or as the effect of the OCP, we may further simplify this pattern into HH, which then contrasts with HL. We have of course already implied this in our discussion above, by introducing the term ‘level’ high tone.

Notice also that both tones feature a high tone on the first mora. It is true that these lexical tones are realized on exactly one syllable in every word: the syllable with main stress. In other words, the initial tone seems to be uniquely due to some principle relating high tone and stress, which of course has been known for a long time in the phonological literature (cf. Hulst & Smith, 1988, for an overview):

- (10) PITCH: The head mora of the syllable with primary stress needs to have a high tone.

One can view (10) as an Optimality Theoretic constraint (possibly formalized along the lines of de Lacy, 1999, 2002), in which case this constraint is inviolable in the grammar of Limburg. It is only the tone on the second mora in the main stressed syllable which can be either H or L, subject to lexical specification.

It is most likely that of these two, the Low tone is the phonologically marked one. For instance, if we have a minimal pair of words, one with a level tone and the other with a falling tone, and if one of those two is a function word and the other one a lexical word, it will be typically the one with the level high tone which is the function word and the one with the falling tone which is the lexical word (e.g. *bít* ‘with’ - *bî* ‘bee’, *zít* ‘she’ - *zî* ‘silk’). If we assume that function words are usually phonologically less marked than lexical words, we can understand these patterns as an indication that H will be the default tone.⁷

The next step in our analysis is that the neuter suffix is a truly empty morpheme with neither a schwa nor a mora nor a tone. The masculine suffix we assume to consist of a schwa plus a low tone. The feminine suffix, on the other hand, would consist of two parts: an empty vocalic position, and a tone.⁸

(11)	Neuter	Feminine	Masculine
		σ	σ
		 μ	 μ
		 \emptyset	 \emptyset
	\emptyset	L	L

3.1 Neuter and masculine suffixes

Let us first consider the neuter and the masculine suffixes. We can either of these add these to either a stem with an underlying low tone, or to one with an underlying high tone (or no underlying tone at all). This gives us four possibilities, two for the neuter and two for the masculine:

1. If we add a neuter (empty) suffix to a lexical form with a low tone, the underlying low tone will show up on the second mora. The reason for this is that tones need to be within the main stressed syllable, and the first mora is already occupied by a high tone, according to PITCH:

⁷Laura Downing (p.c.) points out that this analysis could be taken to imply that high tones also surface on stressless syllables. Usually they are taken to be toneless in the dialectological literature. In order to explain this, we will invoke TONETOSTRESS below, requiring all tones to be in a stressed syllable.

⁸See van Oostendorp (2005) for extensive argumentation for the existence of empty-headed morphemes in dialects of Dutch.

- (12) a. TONETOStRESS: Tones need to be in the syllable bearing main stress
 b. MAXTONE: Do not delete tones
 c. PITCH \gg TONETOStRESS, MAXTONE⁹

(13)

/kalm +Low/ + \emptyset	PITCH	TONETOStRESS	MAXTONE
a. [kùlm]	*!		
b. [kám]			*!
c. \rightarrow [kám]			

2. If we add an empty neuter empty suffix to a lexical form with an underlying level high tone, the result is a level high tone. If the adjective does not have any tone at all, we may surmise that the form will also turn up with a level high tone — this is the sense in which this tone is ‘unmarked’. In order to achieve this result, we assume that every mora in the stressed syllable needs to have a (high) tone. If the relevant constraint is ranked below MAXTONE, this does not affect the results we have obtained so far:

- (14) STRESSToTONE: All moras in the syllable bearing main stress must bear tone.

(15)

/laam/ + \emptyset	PITCH	TONETOStRESS	MAXTONE	STRESSToTONE
a. [laam]	*!			**
b. [lám]				*!
c. [làam]	*!			**
d. [laám]	*!			*
e. \rightarrow [lám]				

The forms in (15a), (15c) and (15d) do not have a tone on one of the moras in the stressed syllable; they are therefore unacceptable. The choice is between (15b) and (15e). The latter wins, because it has high tones on all moras of the stressed syllable. From this we can conclude that PITCH is a more specific version of STRESSToTONE, which again could be formalized along the lines of de Lacy (1999, 2002).

3. If we add a masculine (low tone) suffix to a lexical form with a low tone, we will get a low toned form. At present, we have no clue as to which of the two underlying low tones is actually surfacing:

⁹We do not have evidence yet for TONETOStRESS \gg MAXTONE, but we will see this below.

(16)

/kɑlm + Low/ + /ə+ Low/	PITCH	TONEToSTRESS	MAXTONE	STRESSToTONE
a. [kɑlmə]	*!		**	**
b. [kɑ́lmə]			**!	*
c. [kɑ́lmə]			**!	
d. [kɑ́lmə́]		*!		*
e. [kɑ̀lmə]	*!			*
f. \emptyset [kɑ́lmə]			*	*

Note that this paradigm provides us with information on the ranking of TONEToSTRESS and MAXTONE: one of the two underlying tones has to be deleted here, because it cannot surface in a non-stressed position.

4. If we add a masculine (low tone) suffix to a lexical form without a tone, the low tone of the suffix will surface, and a falling tone will ensue:

(17)

/laam/ + /ə+ Low/	PITCH	TONEToSTRESS	MAXTONE	STRESSToTONE
a. [laamə]	*!		*	**
b. [láamə]			*!	*
c. [láámə]			*!	
d. [láàmə́]		*!		*
e. [lààmə]	*!			*
f. \emptyset [láàmə]				*

This concludes our analysis of the masculine and neuter forms (of stems not ending in a voiceless obstruent; we will return to the latter in section 3.3). Notice that the set of constraints that we require is relatively small and furthermore fairly ‘natural’, at least from a typological point of view. The only constraints we need are those establishing a relation between metrically strong positions and tones – and preferring high tones over low tones in this respect.

3.2 Feminine suffixes

We now turn to the feminine suffix, for which I propose that it consists of an empty mora plus a low tone. Independent phonological constraints will need to interpret the empty vocalic position. We propose that the default choice is that it simply does not get a phonological interpretation at all. In this way, it satisfies better the constraints of the family *STRUC, instantiated here as *SCHWA. If faithfulness (in particular a constraint against deletion of vowels, MAX-V) dominates this markedness constraint, masculine forms will not be affected:

(18)

/laam/ + /ə+ Low/	MAX-V	*SCHWA
a. [láàm]	*!	
b. ☞ [láàmə]		*

Yet feminine suffixes can do without the schwa without being unfaithful (we use /μ+Low/ in the tableaux to represent the feminine suffix of which the ‘real’ structure is the one given in (11)):

(19)

/laam/ + /μ + Low/	MAX-V	*SCHWA
a. ☞ [láàm]		
b. [láàmə]		*!

The Low tone in the feminine is underlyingly present, just like in the masculine, and therefore will show up wherever it can. The difference between neuter, masculine and feminine thus is a difference in lexical specification of the respective morphemes. Most important, at present, is the difference between the neuter and the feminine: whereas the latter has an underlying low tone, the former does not.

Without having to stipulate additional constraints we can now derive the pattern for the feminine suffix. If we add it to an adjective with an underlying low tone, one of the two low tones surfaces, and if we add it to an adjective without an underlying tone, the low tone of the suffix surfaces. The empty position will stay empty for faithfulness reasons just outlined. All of this is exactly like what we found for the masculine suffix. The only difference is that in this case we do not find a schwa:

(20)

/kalm + Low/ + /μ + Low/	PITCH	TONEToSTRESS	MAXTONE	STRESSToTONE
a. [kalm]	*!		**	**
b. [kál̩m]			**!	*
c. [ká̩lm]			**!	
d. [kà̩lm]	*!			*
e. ☞ [ká̩lm]			*	*

(21)

/laam/ + /μ + Low/	PITCH	TONEToSTRESS	MAXTONE	STRESSToTONE
a. [laamm]	*!		*	**
b. [láam]			*!	*
c. [láám]			*!	
d. [làam]	*!			*
e. ☞ [láam]				*

3.3 Stems in voiceless obstruents

Let us now turn to stems ending in a voiceless obstruent. These forms never alternate: neuter, masculine and feminine forms all have a level high tone. In addition a schwa shows up on the feminine, as the facts of (8), repeated here for convenience, show:

(8)	neuter	feminine	masculine	
	ríik	ríikə	ríikə	‘rich’
	nááks	nááksə	nááksə	‘naked’
	záát	záátə	záátə	‘lame’

The fact that low tones are avoided on syllables ending in an underlyingly voiceless obstruent is obviously in need of an independent explanation. There are reasons to assume that some constraint is active in the phonology of Limburg, disallowing the combination of low tone and voicelessness (see Hermans & van Oostendorp, 2001; Hinskens & van Oostendorp, 2005, for more discussion). One way to formalize this, is by assuming an implicational relation such as the following:

(22) $L \supset [+voice]$: A Low tone implies a feature value [+voice]

We could read this constraint as one requiring consonants always to be voiced in the vicinity of low tones, or as low tones dispreferring to land next to voiced consonants. This constraint can be seen as phonetically grounded in the sense that there is a clear connection between voicing of consonants and lowering of F0 values (Maddieson & Hess, 1987) — a more radical version of this analysis would have it that Low and [voice] are the same feature, see Halle & Stevens (1971); Bradshaw (1999); Harris (1994) among others, for arguments in favour of such a position. This constraint, then, directly blocks low tones from surfacing, if it dominates the faithfulness constraints on tone.¹⁰ This is illustrated in the following tableau for the masculine form of *rijk* ‘rich’ (assuming, irrelevantly, that the adjective itself does not carry a low tone):

(23)

/riik/ + /ə+ Low/	$L \supset [+voice]$	MAXTONE	STRESSTOTONE
a. [ríikə]		*	*!
b. [rîikə]	*!		*
c. ↵[ríikə]		*	

¹⁰In section 2, we noticed that there are a few dialects which do seem to display alternations in this case. If those data turn out to be right, this could be a result of a reranking of the relevant constraints.

The only form which can win has a high tone on the second mora. A low tone is disallowed next to a voiceless obstruent, and the second mora needs some tone because it is in a stressed position. Therefore the masculine suffix is realized only partly in this particular position.

How about the feminine morpheme? If things would work the same way as for the masculine forms, we would select *[ríík], which would be homophonous to the neuter form. This apparently does not happen. Notice, however, that the homophony itself is not always a fatal problem, since the feminine and neuter forms of *calm* with a falling tone are also homophonous: [kál̩m]. Furthermore, the feminine form which is selected, [rííkə] is homophonous to the masculine. So avoidance of homonymy within the adjectival paradigm cannot serve as an explanation.

In order to understand what is going on, I propose to refer to the REALIZE-MORPHEME, in accordance with a tradition in the phonological literature¹¹ and define it as a special type of faithfulness constraint.:

- (24) REALIZE-MORPHEME (RM): For every morpheme in the input, some phonological element should be present in the output.

This constraint could be interpreted in the light of recent work on Optimality Theory in semantics and pragmatics; see for instance Buchwald *et al.* (2002) and the contributions to Blutner & Zeevat (2004).¹² A central notion is *recoverability* (there is some debate in the literature on the correct terminology and the proper way of implementing this idea). This notion explains, for instance the ‘reduction’ of nominals to pronominals. If somebody says ‘He is coming’ in stead of ‘John is coming’, she may be satisfying the requirements of *STRUC, since pronouns contain less information (hence less structure) than nouns (or proper names). Why don’t people then reduce all nouns all the time? The answer is recoverability: a higher ranking constraint demands that we can only use ‘he’ if from the context we can recover the extra information that we are talking about John.

I propose that we have something very similar here in the phonology-morphology interface. We usually prefer the schwaless form for the feminine, since it contains less structure. However, in the case of stems ending in voiceless obstruents, this would mean that the suffix is not realized at all (it contains only a Low tone, and this cannot surface). But that would mean that the morpheme is completely unrecoverable: there is no trace in the phonological surface form which shows that it is there. In this case, then, we choose the allomorph with schwa, which will still be recoverable.

¹¹The name of this constraint is due to Samek-Lodovici (1996). See Kurisu (2001) for a different perspective, and an overview of earlier literature.

¹²A somewhat similar idea can be found in the work of Boersma (1999).

Let us now see how this constraint affects the analyses of the neuter, masculine and feminine forms for words ending in a voiceless obstruent. For neuter forms, evaluation of RM is vacuous: since there is no underlying material at all, nothing can serve as a representative of the neuter suffix on the surface. For the masculine, there are in principle two elements which can satisfy RM and since the schwa always surfaces for independent reasons, the tone is not necessary, so that also in this case addition of the constraint does not affect the argumentation.

For the feminine form, we now have to assume that recoverability outranks structural markedness, i.e. $RM \gg *SCHWA$:

(25)

/riik/ + /μ + Low/	RM	*SCHWA
a. [ríik]	*!	
b. \Rightarrow [ríikə]		*

One way of picturing the working of RM is by assigning a subscript to the elements of every morpheme. RM then has it that every subscript has to be present on some element on the surface:

(26)

underlying representation	bad surface form	good surface form	good surface form
$r_i l_i l_i k \emptyset_j$ $\quad \quad \quad \downarrow$ $\quad \quad \quad L_j$	$r_i l_i l_i k_i$	$r_i l_i l_i k_i$ $\quad \quad \quad \downarrow$ $\quad \quad \quad L_j$	$r_i l_i l_i k \emptyset_j$

The underlying representation has two morphemes, corresponding to two subscripts, i and j . The candidate surface form in the middle is bad because it has only one of those two subscripts. The two forms at the right hand side obey RM, because they have both subscripts. (The rightmost one will eventually be chosen because of the phonological constraint $L \supset [+voice]$.)

Note that the required visibility, if seen this way, is somewhat abstract, because it is intermediated by subscripts. This provides us with a way to distinguish between the two possible output representations for forms such as the feminine for *calm*:

(27)

underlying representation	bad surface form	good surface form
$k_i a_i l_i m_i \emptyset_j$ $\quad \quad \quad \downarrow \quad \downarrow$ $\quad \quad \quad L_i \quad L_j$	$k_i a_i l_i m_i$ $\quad \quad \quad \downarrow$ $\quad \quad \quad L_i$	$k_i a_i l_i m_i$ $\quad \quad \quad \downarrow$ $\quad \quad \quad L_j$

Even though the two potential output forms are homophonous, we now have a theory-internal reason to choose for the rightmost one: this one still contains all indices of the underlying representation. For this reason, there is no need to insert a schwa (or

preserve it) in this case. Note that the ‘bad’ surface form will surface in the derivation of the neuter, simply because the rightmost form will be unavailable here.¹³

This completes our analysis of tone in adjectival inflection in Limburg Dutch. We repeat the constraint rankings we have called upon in (28):

- (28) a. PITCH»TONEToSTRESS»MAXTONE»STRESSToTONE
 b. L▷[+voice]»MAXTONE
 c. MAX-V,RM»*SCHWA

The subhierarchies in (28a) and (28b) regulate the distribution of tone, and (28c) regulates the occurrence of schwa. The two processes are almost independent, except that deletion of underlying tone will affect RM in exactly one case: that of feminine suffixes before voiceless obstruents.

4 Paradigms and representations

4.1 Lenition and final devoicing

The previous section presented the main line of analysis. In this section we will fill in a few details, and compare our analysis to two alternatives.

In addition to the tonal behaviour already mentioned, the feminine form of the Limburg Dutch adjective is different from the neuter in another respect: stem-final underlying /d/ lenites to [j]:

(29)	neuter	feminine	masculine	
a.	róòd	róòj	róòjə	‘red’
b.	ríík	rííkə	rííkə	‘rich’
	zóót	zóótə	zóótə	‘salted’

Lenition of this type usually only happens to /d/’s in (intervocalic) onset position in dialects of Dutch (such as in the masculine form here Zonneveld, 1978). Yet in the feminine form chosen here, there is no vowel.¹⁴

¹³This means either that we restrict the Generator function in such a way that it cannot add morphological affiliations to segments (this was called *Consistency of Exponence* in Prince & Smolensky (1993)), or that the faithfulness constraint RM only looks at those subscripts which are already present underlyingly: none, in the case of the neuter.

¹⁴Furthermore, this lenition is pervasive in the Limburg dialect area. The GTR database contains 58 Limburg Dutch dialects with reliable data on the adjective *goed* ‘good’. None of these end in a plosive (whereas all the neuter forms do). For 24 dialects, the final segment is transcribed as [i]; 28 dialects have [j], and the rest have [w], [u] or [y].

Notice that this fact gets a natural explanation under the analysis proposed here. Since the feminine suffix contains an empty vocalic position, the /d/ will still be literally intervocalic in the feminine, even if one of the two vowels is not pronounced, and hence be prone to lenition. The neuter does not provide such a position, on the other hand, and therefore the /d/ at the end of the neuter is not subject to lenition.

There is also an alternative analysis, for which we first have to consider the most likely output candidate for *rood* ‘red’ without lenition. Hitherto we have assumed that this is the following:

$$(30) \quad \begin{array}{c} \text{r o o d} \\ \downarrow \\ \text{L} \end{array}$$

However there is something definitely uncomfortable about this analysis and this is that Limburg Dutch, like all Dutch dialects has a process of final devoicing, which is to say that the final segment is not [d], but rather devoiced [d̥] (or [t]). The problem with this obviously is that we have evidence that (underlyingly) voiceless obstruents such as /t/ do not permit Low tones in front of them.

This implies that we have to distinguish between underlyingly voiceless and devoiced consonants. One way to achieve this effect is by following Ernestus (2000) and assume that while voiced consonants are [+voice] and voiceless consonants are [-voice], the result of final devoicing has no specification for voicing at all (Ernestus, 2000, gives a range of phonetic, phonological and experimental evidence for this). In that case, we could split up the constraint called $L \triangleright [+voice]$ above into two parts:

- (31) a. $* \left[\begin{array}{c} \text{L} \\ \text{-voice} \end{array} \right]$: disallowing the combination of [-voice] with a low tone
 b. $L \triangleright [+voice]$: requiring low tones to be accompanied by [+voice] segments.

An underlyingly voiceless [t] would violate both constraints, whereas a devoiced [d̥] would only violate the second one. If we then put the constraint in (31a) at the inviolable position we have awarded to the voicing constraint in the previous section, and demote $L \triangleright [+voice]$ to a much lower position, the result is that devoiced consonants are more permissive, and will usually tolerate low vowels before them.

Yet among these devoiced consonants, [d̥] happens to be the only one which can avoid violating the second constraint at a relatively low cost, viz. by turning into a sonorant [j]. In this way, then, the lenition can be seen as an Emergence of the Unmarked effect on the constraint in (31b): falling tones are permitted before devoiced consonants, but only in case nothing can be done to change those devoiced

consonants into something more acceptable (see Hinskens & van Oostendorp, 2005, for an elaboration on this idea).

4.2 Paradigms or morphemes

Having now set up a representational OT analysis, we may compare it to another OT account of the same phenomenon, one in terms of paradigms, proposed by Alderete (1999).¹⁵

Alderete (1999) gives a purely morphological approach based on output-output correspondence relations. To be more precise, Alderete (1999) defends a notion of Anti-faithfulness: some morphological forms – e.g. forms in a paradigm – desire to be *different* from other surface form in some properly described way. (Again, we will not go into all of the technicalities of the approach.)

For the Limburg data, Alderete assumes that low tones are absent altogether: a falling tone is represented with a high tone on the first mora, and nothing on the second mora. This makes them thus less marked than level high tones. Further, there is a constraint \neg NO-FLOP-TONE, which informally states the following:¹⁶

- (32) \neg NO-FLOP-TONE If a segment s_1 is linked to a tone T_1 in the neuter, a corresponding segment s_2 should not be linked to a corresponding tone T_2 in the feminine (and masculine)

The following gives the input-output pair for the masculine form of *lame* as well as the neuter form (which does not change from input to output):

(33)	input	output	neuter
	l a a m+ ə	l a a m+ ə	l a a m
	$\begin{array}{c} \diagdown \\ \text{H} \end{array}$ $\begin{array}{c} \\ \text{L} \end{array}$	$\begin{array}{c} \\ \text{H} \end{array}$	$\begin{array}{c} \diagdown \\ \text{H} \end{array}$

The output form of the masculine has changed from input to output, because \neg NO-FLOP-TONE requires the tonal association of the masculine to be different from that

¹⁵The representational analysis presented here is forecasted in a derivational framework by Hermans (1994). We are aware of only one further analysis, by Hinskens & Muysken (1986), but we will not discuss this here because it deals with a dialect with a slightly different pattern, and favours an analysis which is based on theoretical assumptions very different from the one presented here.

¹⁶Alderete (1999)'s approach is based on antifaithfulness of the feminine form with respect to the neuter or citation form. Note that it would also be possible to construct a paradigm uniformity approach with faithfulness to the masculine form. As far as I can see, this would have the same properties as the Alderete (1999)'s theory – it would share its advantages, but also its problems.

of the neuter. The reason why this affects the last mora of the word is because of tonal alignment: within syllables, tones prefer to be at the left edge. (We interpreted the same facts to mean that the masculine suffix has a low tone, which the neuter suffix does not have.)

¬NO-FLOP-TONE does not take effect if the neuter has a falling tone. In that case there is only one tonal association: of the high tone to the first mora, but this cannot be undone because of a high-ranking constraint (we argued this to be PITCH, for Alderete (1999) it is again left alignment of tone in syllables).

Alderete (1999) mentions the following advantages of his approach (p. 226):

1. “The analysis presented here accounts for accent purely in terms of H tones, and as emphasized above, the analysis is in line with recent approaches to tonal accent systems like the one given in Pulleyblank 1986 for Tonga.”
2. “A second point in favor of [Alderete (1999)’s] analysis is that it relates a wide range of morphologically triggered shifts as effects of a specific type of Anti-Faithfulness. Thus, the loss of a link in the dragging tone mutation is treated on a par with the obligatory shifts found in Japanese and Aguaruna.”
3. “A final argument in favor of the account of the accentual mutation in terms of AntiFaithfulness is that it explains the relation between the properties of the accent shift with independently needed constraints. ”

I believe that none of these arguments hold. Ad 1, it can be observed that there are independent reasons to assume that Low tone is the marked tone in Limburg Dutch, and the morphologically active one. It serves to mark the plural (which thus has a falling tone) from the singular (with a level tone) in nouns, for instance (e.g. *béin* - *bèin* ‘leg - legs’), and in all minimal pairs where one of the two forms is a lexical word and the other one a function word, the lexical word has the falling tone and the function word the level tone (e.g. *zíi* - *zîi* ‘she - silk’). This can be understood if function words are supposed to have an unmarked phonological structure, whereas lexical words are more marked, and if the Low tone is marked, i.e. present in the phonological representation. Whatever the merits of the assumption that only High tones are present for the analysis of Tonga, it seems to be jumping to conclusions to assume that this should carry over to all other languages, including Limburg dialects.

Points 2 states that the anti-faithfulness analysis has as an advantage that it relates the Limburg facts to those of the morphologies of other languages. But the same seems to be true for an analysis which holds that neuter and feminine have different suffixes.

Finally, Alderete (1999) mentions as an advantage of his analysis that it uses phonological constraints which are motivated independently; but the same is true for the analysis presented here. In sum, none of the ‘favourable’ properties mentioned by

Alderete (1999) seem to be convincing enough to blow out the approach mentioned here.

In return, Alderete (1999) does not discuss the interaction with voicelessness on obstruents, and it is hard to see how those facts could be incorporated into a paradigmatic approach. We might be able to constrain \neg NO-FLOP-TONE in such a way that it does not affect words ending in a voiceless obstruent, but even then, there is no reason why a schwa should appear at the same time. Allomorphy is not a notion to which we can refer, since this approach does not refer to morphemes at all: the tonal shift is encoded in the morpheme-specific constraint \neg NO-FLOP-TONE, not in the representation of any kind of constraint.

On a formal level, we argue that interparadigmatic faithfulness is too abstract and too powerful a formal device to incorporate into our theory too lightly. The approach defended in this article might be slightly abstract since it involves an empty vocalic position. At the same time, the antifaithfulness approach is abstract in many more ways. Not only does it posit ‘toneless’ mora’s in stressed syllables, which then have to be interpreted as low, but also do we have to assume correspondence relations among individual segments and tones in words - and none of these can be observed phonetically anymore than morphological superscripts can.

Since the latter approach is more parsimonious, and at the same time seems more successful from an empirical point of view, we conclude that it is preferable over its current competitors. We claim that it is the interaction between phonology and morphology which gives us exactly the pattern we find in Limburg Dutch adjectival inflection.

5 Conclusion

In this paper, we have discussed tone in Limburg Dutch adjectival inflection. These facts require an analysis which allows for some level of abstraction, since both the neuter and the feminine seem to be ‘empty’ at first sight, but they react differently to different phonological contexts – e.g. to stems with an underlying level high tone, and to stems ending in a voiceless obstruent.

We have compared two approaches to this problem: one requires a strong formal device of output-output faithfulness (which has been argued by Potts & Pullum (2002) to be so powerful as to make the theory computationally intractable) and still appears to be empirically inadequate, e.g. in the way the context after voiceless stops has to be dealt with. The other theory requires some marginal abstraction in the form of an empty vocalic position representing the feminine.

The representational approach may have another, conceptual advantage. A minimalist formal theory of phonological representations already predicts empty moras to

exist. If we allow floating moras, we should be able to have these also underlyingly — if only because of Richness of the Base — and there is also no specific reason within autosegmental theory why there should be some corresponding vocalic material to which these mora's could potentially be connected. In other words, if we want to disallow a representational approach, we have to ban these structures by extra stipulation. On the other hand, antifaithfulness relations among members of a paradigm do not seem to be part of a minimalist theory of phonological representations.

In general, it seems wise to be cautious and a little bit conservative, especially if the analysis which is achieved in this way is empirically more adequate than the more radical alternative. That seems the lesson to be learned from the Limburg facts.

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