The phonology of tone and intonation in the Dutch dialect of Venlo

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The Dutch dialect of Venlo has a lexical tone opposition comparable to the distinction between Accent I and Accent II in Scandinavian. The two word tone patterns are realised in a variety of different ways, depending on the intonation contour, on whether the word has a focus tone, and on whether it occurs finally or nonfinally in the intonational phrase (IP). Twelve such contexts are identified, and an autosegmental-metrical analysis is presented of the contours for the word tones in each of these. The analysis is instructive because of its clear illustration of the distinction between the phonological underlying representation and the phonological surface representation, as well as of the distinction between the latter representation and the phonetic realisation. In addition, because of the complexity of its tonal phonology, the dialect is of considerable typological interest for the study of word prosody and intonation.

1. Introduction

It would be reasonable to assume that the phonological exploitation of pitch for lexical purposes precludes an extensive use of the same phonetic parameter for intonation (cf. Tench 1996: 6). Thus, tone languages do not generally have complex intonation systems. Likewise, European languages with lexical tone contrasts, like Swedish and Norwegian, have simpler intonation systems than English, a language without lexical tone. Languages vary considerably in phonological complexity, however (Maddieson 1984).

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and from that perspective one might well expect languages in which a lexical tone contrast is combined with an extensive intonation system of the type found in English. In this article, it is shown that the Dutch dialect spoken in Venlo presents a case of this type of prosodic complexity.

The city of Venlo lies near the northwestern periphery of the area in which a binary lexical tone contrast is found, a region around Cologne stretching roughly from Duisburg in the north to Trier in the south, reaching just beyond the river Rhine in the east and spilling over into the Netherlands, Belgium and Luxembourg in the west. The dialects are more complex than Norwegian and Swedish, because in addition to the two lexical tone patterns, they have at least two ‘nuclear tones’ (intonational melodies), one signalling finality and the other signalling non-finality, including questions (Gussehoven & Bruce forthcoming). The special interest in the Venlo dialect is that it yet again doubles the number of forms: it has four intonational melodies, leading to eight different tonal patterns for a monosyllable pronounced in isolation, four for each lexical tone pattern. The number of contrastive pitch contours is further increased by the variation due to position in the intonational phrase (in nonfinal positions, different contours are used) and focus (outside the focus, the tonal opposition is maintained in final position, with the help of different sets of forms from the final focused forms). From a sociolinguistic point of view, the tonal complexity of the Venlo dialect is to be explained by its proximity to non-tonal Dutch dialects, which, like the standard language, have fairly complex intonation systems, and the dialect may thus be seen as transitional between the tonal dialects to the south and the non-tonal dialects to the north and west.

The purpose of this paper is to present the facts of this tonal system, and to show how the dialect exploits the phonetic resources, sometimes in quite subtle ways, to cope with the pressure of having to accommodate so many contrasts in its phonology. Our description only covers the ‘nuclear’ portions of the intonation contours, that is, the contour sections from the last focused syllable to the end of the intonational phrase.

The autosegmental-metrical model serves as the theoretical framework for our analysis. That is, we assume a hierarchical prosodic structure (Selkirk 1978, Nespor & Vogel 1986, Hayes 1989) and an autosegmental tonal representation whereby lexical and postlexical tones are arranged on a single tier (Pierrehumbert 1980, Beckman & Pierrehumbert 1986). An introduction to this theoretical framework is given in Ladd (1996). The organization of this article is as follows. By way of preview, we give the data in tabular form.

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[2] In the dialectological and phonetic literature, the opposition is known as ‘Schärfung’ vs. ‘Trägheitsakzent’, ‘Rheinische Akzentuierung’, ‘Tone 1’ vs. ‘Tone 2’, or ‘Stoßton’ vs. ‘Schleifton’, the latter also being the usual Dutch terms (‘stoottoon’ vs. ‘sleeptoon’) (Jongen 1972, Schmidt 1986, Peeters & Schouten 1989, Weijnen 1991). The dialects are classified as Limburgian, Ripuarian, and Mosel-Franconian (Goossens 1977, Wiesinger 1983).
in section 2, where we also present the relevant phonological characteristics of the dialect. In section 3 we propose and motivate the underlying tones of the various tonal morphemes that contribute to the shape of the pitch contours. Finally, section 4 presents the analysis, while a conclusion is given in section 5.

2. Overview of the data

As in the Maasbracht and Roermond dialects (Hermans 1985, Gussenhoven forthcoming), the contrast between Accent I and Accent II is only possible on stressed syllables with two sonorant moras, that is, on stressed syllables whose rime contains a long vowel, a diphthong, or a lax vowel followed by a sonorant consonant ([m, n, η, l, r]). This distribution suggests that the Tone Bearing Unit (TBU) in the Limburg dialects must be defined as the sonorant mora, as in Lithuanian (Halle & Vergnaud 1987), Serbocroat (Inkelas & Zec 1988), and Japanese (Poser 1984, Pierrehumbert & Beckman 1988). Although minimal pairs are not frequent, the tonal contrast can constitute the only difference between words, as shown in (1). There is a small subset of nouns whose singular and plural forms differ only in tone, in which case the singular has Accent II and the plural has Accent I; examples are given in (1f, g, h). (In (1d, e), the final schwa represents an inflectional suffix.)

<table>
<thead>
<tr>
<th></th>
<th>Accent I</th>
<th>Accent II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>[ne:t]</td>
<td>‘not’</td>
</tr>
<tr>
<td></td>
<td>[be:ɾ]</td>
<td>‘bear Noun’</td>
</tr>
<tr>
<td></td>
<td>[vø:r]</td>
<td>‘in front of’</td>
</tr>
<tr>
<td></td>
<td>[ˈspø:la]</td>
<td>‘rinse’</td>
</tr>
<tr>
<td></td>
<td>[ˈɜγɜɾa]</td>
<td>‘worse’</td>
</tr>
<tr>
<td></td>
<td>[beʃin]</td>
<td>‘legs’</td>
</tr>
<tr>
<td></td>
<td>[ɛrm]</td>
<td>‘arms’</td>
</tr>
</tbody>
</table>

The realization of the two word tone patterns depends on a number of contextual factors. Diagrammatic representations of the data are given in Table I. Each cell in this four-by-three matrix represents a schematic version of the pitch contours for the two lexical tone patterns (solid line: Accent I, interrupted line: Accent II). The four rows represent the intonation patterns, identified by the row headings ‘Declarative’, ‘Interrogative’, ‘Continuation’ and ‘Surprised Question’. The ‘Declarative’ intonation can be seen as the neutral intonation. ‘Interrogative’ intonation is the most likely intonation pattern used by a speaker who is asked to give a question intonation. ‘Continuation’ would typically be used for the word A in utterances of the type ‘First I say “A”, and then I say “B”’, or more generally in listing intonation. The intonation labelled ‘Surprised Question’ is another questioning pattern, which may be somewhat more marked than that labelled ‘Interrogative’.
Table I

Stylized contours for the lexical tone contrast (solid contours: Accent I; interrupted contours: Accent II) with ‘Declarative’, ‘Interrogative’, ‘Continuation’ and ‘Surprised Question’ intonations (rows) in focused nonfinal syllables, focused final syllables and nonfocused final syllables (columns). The vertical interrupted lines through the focused nonfinal contours represent the ends of the accented syllables. The ‘Interrogative’ intonation is not used on final focused syllables with Accent I.

The three columns in Table I represent the positional and focal conditions. The first column gives the nonfinal, focused realizations, the second the final focused realizations, and the third the final nonfocused realizations. In positions other than these three, the tonal contrast is neutralized. In columns two and three, where the contrast occurs on a final syllable, the contours for Accent I and Accent II also differ in duration: final syllables with Accent II have a greater degree of preboundary lengthening than final syllables with Accent I.

There are two peculiarities in the data, which pose a challenge to the description. First, in the ‘Declarative’ intonation, the phrase-final realization of Accent II differs radically from the realization in other positions. This can be seen in the first row, second and third columns, which show Accent II coming later than Accent I in nonfinal position, but earlier than Accent I in final focused syllables.
final position. Second, there is a gap in the data: while in general there exist two interrogative intonation patterns (labelled ‘Interrogative’ and ‘Surprised Question’, cf. rows 2 and 4 in Table I), only one interrogative contour is available for a finally stressed word with Accent I in final position, the ‘Surprised Question’ contour. A third point of interest concerns the low beginning of the focal rises for Accent I in the ‘Surprised Question’ context (Table I, last row, second and third columns). It will be argued that the start of the rise is the target of a L*-tone, which contrasts with a mid-pitched target of H* in the contours for Accent II in the same context as well as with the contours for both Accent I and Accent II in the ‘Continuation’ context.

3. UNDERLYING REPRESENTATIONS

3.1 The representation of the lexical tone

A cursory glance at the data in the first of the three data columns in Table I suggests that the second half of the syllable is higher in the case of Accent II than in the case of Accent I. We follow Hermans (1985; 1992a, b) in representing Accent II as a prelinked H on the second sonorant mora. Accent I would best seem to be left toneless: a stressed syllable with a single sonorant mora, like [kʊt] ‘cat’ or the first syllable of [tv.ʊrà] ‘hammer’, which do not tolerate the lexical tone contrast, have contour shapes resembling those of Accent I. This similarity can be captured by ensuring that monomoraic syllables and syllables with Accent I have identical tonal representations (see (2)). Since there is no reason for assuming that monomoraic syllables have lexical tone, the most obvious option is to assume that Accent I, too, is toneless.

A possible alternative solution whereby Accent I has a L-tone runs into the problem that Accent I only has a low-toned second mora in combination with ‘Declarative’ and ‘Interrogative’ intonation (cf. Table I), so that an explanation would have to be given of why the L is deleted when the ‘Continuation’ and ‘Surprised Question’ intonations are used.

[3] The representation of one of the word tone patterns as a prelinked H is reminiscent of Serbo-Croat (Inkelas & Zec 1988), but that situation is somewhat different. In the Stokavian dialects, a high tone appears on the first mora of the main stressed syllable, which after spreading left within the domain of the complex word, leads to tone patterns that are known as ‘falling’ in the case of initial stress and ‘rising’ in the case of non-peripheral stress. (Polysyllabic words never have final stress.) The need for lexical marking is caused by the fact that polysyllabic words with initial stress may be toneless. These later acquire a H-tone on the initial stressed syllable which does not spread left, and are thus distinct on the surface from other words with initial stress when they are prefixed. The pre-linked H of the other words therefore does not distinguish ‘falling’ from ‘rising’, but two types of words with ‘falling’ pitch accents.
(2) (a) Accent I: $F_{\sigma}(m \ m)_{\sigma}$
(b) Accent II: $F_{\sigma}(m \ m)_{\sigma}$
(c) Monomoraic: $F_{\sigma}(m)_{\sigma}$

(where $m$ represents a [+son] mora).

3.2 The representation of the focus tone

Like standard Dutch and German, Venlo Dutch has a focus-marking pitch accent, minimally one of which must be present in any utterance.\(^4\) The Venlo pitch accent is a single tone, which associates with the (first) mora of the syllable with primary stress of the focused word (strictly, the last word in the focus constituent). In almost all contexts, this focal tone is $H^*$. ($L^*$ occurs in one context, as discussed in Section 4.) As a result, the primary stressed syllable of a focused word with Accent I just has a focal $H^*$ on its first mora, shown in (3a), while a primary-stressed syllable of a focused word with Accent II has a focal $H^*$ followed by a lexical $H$, shown in (3b). A focused monomoraic syllable will have $H^*$ on its only mora.

(3) (a) Accent I (with focus): $F_{\sigma}(m \ m)_{\sigma}$
(b) Accent II (with focus): $F_{\sigma}(m \ m)_{\sigma}$
(c) Monomoraic (with focus): $F_{\sigma}(m)_{\sigma}$

The distribution of the word tone distinction resembles that of the ‘acute’ and ‘circumflex’ accents in Lithuanian, which is likewise only observed in stressed syllables with two sonorant moras, as described by Halle &

\[^4\] The regularities in the relation between pitch accent and focus are exactly those that have been described for Dutch and German (e.g. Gussenhoven 1992, Selkirk 1994, Winkler 1995).
Vergnaud (1987: 190). However, their solution cannot be adopted for Venlo. Their analysis would have it that Accent I has a stressed first mora, while Accent II has a stressed second mora, with H* associating with the stressed mora. In Accent II, we could postulate a subsequent insertion of a H tone so as to arrive at the tonal distribution in (3). This ‘mora-stress’ alternative is given in (4).

(4) Conceivable mora-stress theory

(a) Accent I (with focus): \[ F(\sigma(m)m) \]

(b) Accent II (with focus): \[ F(\sigma(m)m) \]

(c) Monomoraic (with focus): \[ F(\sigma(m)) \]

The reason why this analysis must be rejected is that it cannot characterize the distribution of the focus-marking tone. It was already pointed out in section 2 that the word accent contrast is preserved in IP-final position, even when there is no focus-marking H* on that syllable. In other words, in final nonfocused position, Accent I is toneless while Accent II has a H-tone on the second mora, as shown in (2). Our analysis allows us to say that the focus-marking tone goes to the first mora, regardless of the presence of the lexical tone, and that the lexical H goes to the second mora, regardless of the presence of the focus-marking tone. Under the mora-stress theory represented by (4), however, we would have to say that focus is marked by H* on the first mora in the case of Accent I and by HH* in the case of Accent II, while the nonfocus contrast is expressed by having H* on the second mora of Accent II syllables (with the first mora remaining toneless), and no tone on Accent I syllables. Clearly, in the mora-stress theory, the focus-marking tone and the lexical tone are confounded. An additional drawback of this alternative is that no independent evidence is available for the assumption that the mora, rather than the syllable, is a ‘stress-bearer’.

3.2.1 Boundary tones

The four intonation contours of Venlo Dutch lead to a degree of intonational variety which is comparable to that of standard Dutch (Gussenhoven 1988, 1991) or standard German (Féry 1993, Grabe 1998). The four contours are
phonologically encoded as boundary tones: L, H, LH and HH. The bitonal sequences only appear in utterance-final position in the utterance. A priori, the HL and HH could be interpreted as bitonal boundary tones of a single constituent, or as sequences single boundary tones, each belonging to a hierarchically different prosodic constituent. These two options are shown for LH in (5a, b).

(5) (a) \[
\begin{array}{c}
L_1 \\
\text{H}_u
\end{array}
\]
(b) \[
\begin{array}{c}
L_u \\
\text{H}_u
\end{array}
\]

In Bengali, the difference between the configurations in (5a) and (5b) is contrastive. In combination with a L* pitch accent, the boundary H-tone of the phonological phrase and the boundary L-tone of the IP together signal narrow declarative focus, while L* in combination with an IP-final HL-boundary tone sequence signals (broad or narrow) interrogative focus (Hayes & Lahiri 1991). Of course, in U-final position, boundaries of the U and all lower ranks are identical and the difference between the two representations cannot, therefore, be read off from any timing characteristics: in either case, targets of H and L would typically be located in the last syllable of the U. In Bengali, the phonetic difference between the two representations is achieved by realising H at a higher pitch if it is associated with the higher constituent, so that interrogatives end in a higher peak than do narrow focus declaratives. In the case of the dialect of Venlo, there is not much evidence for choosing between the two representations in (5). We will assume that representation (5a) is correct for Venlo Dutch, because in our corpus, a single boundary H-tone may occur in nonfinal IPs, while bitonal boundary sequences only occur U-finally. Accordingly, the obligatory
boundary tones are taken to IP-final tones, and identified by subscripted ‘i’, while the corresponding boundary is indicated by ‘]’. The optional H is interpreted as a U-final boundary tone, and is identified by a subscripted ‘u’, while the U-boundary is marked ‘·’. In addition to the four boundary sequences, which in (6) are given together with their meanings, almost all IPs began with an L-tone in our corpus.

(6)  
Declarative:  \( L_i \)  
Interrogative:  \( L_i H_u \)  
Continuation:  \( H_i \)  
Surprised Question:  \( H_i H_u \)

Thus, an example of a fully specified one-word utterance is given in (7), an ‘Interrogative’ intonation of an Accent-II word (‘annoy’ cf. (1e)).

(7) \[
\begin{array}{c}
\text{Li } H^* \\
L_i H^* H L_i H_u \\
\text{‘Annoy?’}
\end{array}
\]

4. The contours

4.1 The neutralization of the tonal contrast

All the action in the tonal phonology of Venlo Dutch takes place on the sonorant moras of focused and of IP-final syllables. Before turning to those syllables, we discuss the neutralization of the lexical tone contrast that results from this restriction, as well as the way it is to be accounted for. In (8), the neutralization is illustrated in prefocal position with the minimal pair [ɛr’γəɾə] ‘worse’ (Accent I) and ‘annoy’ (Accent II). In (9), the neutralization is shown in postfocal position with the minimal pair ['spø:ɬə] ‘rinse’ (Accent I) and ‘play’ (Accent II). The ‘(0)’ marks the location where a lexical H has been deleted from the Accent-II word in each case.

of the examples in this article are from that set of sentences. Parts of the recorded materials were analyzed with the help of the LVS-package developed by Leo Vogten at the Institute for Perception Research of the Technical University of Eindhoven, and intensity and F0 tracks were plotted. The figures in this article were produced by the Graphics Department of the University of Nijmegen, where the F0 traces, together with the arrows as inserted by the first author on the basis of both tracks, were scanned in, retraced, and superimposed.
The two panels in Figure 1 show these neutralizations, with (8) shown in panel (a) and (9) in panel (b). The solid contour represents the utterance with the Accent-I word, while the interrupted contour is that of the utterance with the Accent-II word. The arrow is aligned with the voice onsets of the neutralized words, while the vertical lines indicate the ends of these words. The peak in the contours is the realization of the focal H* on [nʌg] ‘again’ (panel a) and [fɔstn] ‘understand’ (panel b). Observe that the contour sections which are marked off by the arrow and the vertical lines are the same, even though they correspond with words that have different contours in isolation. This neutralization distinguishes the Venlo dialect from Scandinavian, which preserves the word accent distinction in nonfocused positions. From now on, ‘m’ represents a sonorant mora in a focused syllable or an IP-final, stressed syllable.

Apparently, then, not just any sonorant mora in a stressed syllable is a licit TBU: TBUs must additionally be located either in the focused syllable or in the IP-final syllable. It is in fact common to find that phonological contrasts are restricted to specific locations (Alderete 1995). In this connection, Beckman (1996) observes that, relative to the coda, the onset is a privileged position in the syllable, and that the set of privileged syllables consists of stressed syllables and peripheral syllables. To account for such restrictions in Optimality Theory, she proposes a family of positional faithfulness constraints, the general idea being that faithfulness, the preservation of underlying contrasts, can be more strictly enforced in these privileged locations. Because these positions are evidently related to factors like
metrical strength and constituent edges, something which can be captured in a family of constraints that reflect this order of markedness, Beckman's approach is more explanatory than the postulation of a tone deletion rule. After thus informally confining TBUs to sonorant moras in focused and final syllables, we quickly move on to the description of the lexical tone contrast. (A treatment in Optimality theory of the related dialect of Roermond is provided in Gussenhoven (forthcoming)).

4.2 The 'Declarative' and 'Interrogative' contours

When \( L_1 \) ('Declarative') or \( L_i H_u \) ('Interrogative') end the U and the focused syllable is not IP-final, the contrast between the two word accents amounts to a difference in Fo timing: a fall immediately after the first mora in the case of Accent I vs. a fall after the second mora for Accent II. Illustrative contours
Pitch contours illustrating the lexical tone contrast on the first syllable of [spɔlə] ‘rinse’ (Accent I, solid contour; Accent II, interrupted contour) before L₁ (‘Declarative’ intonation, panel (a), see also (10a, b)) and L₁H₁ (‘Interrogative’ intonation, panel (b), see also (13a, b)).

are given in panel (a) in Figure 2. Clearly, the general shapes of these contours accord well with our tonal representations.

(10)  
(a) ‘spɔlə]’    (b) ‘spɔlə]]
  H* L₁       H* H L₁
  rinse-INF    play-INF
  ‘Rinse’     ‘Play’
There is one aspect in the Fo contour shown in (10a) which is not predicted. A more or less linear interpolation between the high target of H* and the low target of L₁ predicts a shallower fall than the rather steep fall that is generally observed for Accent I. We can account for the steep fall by spreading the boundary tone to the free TBU in the focused syllable. As a result, a low target is produced on that mora, in addition to the final target. **Leftward tone spreading** (11) creates this extra target in Accent I syllables: it requires an empty TBU to be filled by a tone from the right, if this tone is different from the focal tone. (The reason why the spreading tone must be unlike the tone on its left will become clear in section 4.4, where H₁ crucially must not spread after a H-tone.)

(11) **Leftward tone spreading**

In (12), we give the revised representation of (10a). The contrast before L₁ corresponds in every respect to the contrast before L₁H₁, except that both contours end in a rise. The corresponding representations are given in (13). Illustrative contours are given panel (b) in Figure 2.

(12) `spøølɔ̃` (revised representation of (10a))

(13)

(a) `spøølɔ̃` } (b) `spøølɔ̃` }

Thus, our description predicts that the fall for Accent I in syllables that are further removed from the IP boundary will be steeper than the falls from syllables with Accent II or from syllables with one sonorant mora, which lack
a free TBU for the $L_i$ to spread to. We show this prediction graphically in (14).

\begin{figure}[h]
\centering
\includegraphics[width=0.7\textwidth]{fig3}
\caption{Average F0 values of falling pitch movements from $H^*$ in Accent-I syllables with two sonorant moras (solid line) and from $H^*H$ in Accent-II syllables (interrupted line) over three repetitions of the words [zawwasa] ‘worse’ (Accent I) and ‘annoy’ (Accent II) in the carrier sentence ‘You must now...say’. From van der Vliet (1993).}
\end{figure}
Van der Vliet (1993) measured slopes of falls on bimoraic Accent-I and Accent-II syllables in nonfinal position, for three repetitions of three one-syllable minimal pairs, three two-syllable minimal pairs, and one three-syllable minimal pair. In all three word types, the slopes for Accent I were steeper than those for Accent II. Figure 3 gives the averaged results for the three repetitions of the three-syllable minimal pair. The figure shows that even though the fall for Accent II is later, it is nevertheless less steep than that for Accent I. The difference shown in Figure 3 is representative of the difference between the realization of bimoraic Accent I and Accent II on nonfinal words in the contexts $L_i$ and $L_iH_u$. Leftward tone spreading may be seen as a phonologization of a more general implementation rule which creates the somewhat ‘drooping’ or ‘sagging’ interpolations that are found in many languages (Pierrehumbert 1980, Hayes & Lahiri 1991).

4.3 Final realizations with ‘Declarative’ and ‘Interrogative’ intonation

For two reasons the final context represents the greatest challenge in the Venlo Dutch data. First, in the ‘Declarative’ contour ($L_i$), Accent II shows up in a rather different shape than might be expected on the basis of the description for nonfinal syllables given in (10). Second, there is a gap in the data for the ‘Interrogative’: there is no contour for the focused ‘Interrogative’ Accent I. Thus, instead of twenty-four forms, the combination of the lexical tone contrast with the three structural positions and the four intonation patterns only yields twenty-three (see also Table I). The question is why the final focused ‘Interrogative’ Accent I is missing.

![Pitch contours illustrating the contrast between Accent I (solid contour) and Accent II (interrupted contour) in a final focused syllable before $L_i$ (‘Declarative’ intonation, see also (16a, b)).](image)
4.3.1 The final ‘Declarative’ context

In final position with ‘Declarative’ intonation, the falling movement for Accent I is not earlier than that of Accent II, as it is in nonfinal positions (cf. (10)), but tends to be a little later. Also, the final pitch for Accent II is not quite as low as that for Accent I, and the contour may even show a slight rise (see Figure 4). While the realization of Accent I is entirely as expected, a lineup of the tones for Accent II (namely, H*HL,) seems hopelessly inadequate as an account of the contour concerned: a late fall is predicted, but an early fall followed by a weak rise or level pitch is observed.

There are a number of ways in which the realization of Accent II could be accounted for. The corresponding version of this form in the dialect of Roermond is described by lining up the lexical tone after the boundary L-tone, so that the tonal representation is H*L, H (Gussenhoven forthcoming). That analysis is supported by the fact that whenever a syllable with Accent II appears finally in the IP the boundary tone(s) are located to the left of the lexical tone. For the Venlo dialect no such generalization can be made, however, and the solution would be entirely ad hoc. Rather, it is suggested that the lexical tone of the Venlo dialect undergoes assimilation. As we will see below, in final syllables the lexical tone always has the value of the boundary tone of the IP. This generalization is expressed in (15), lexical H-lowering, which assimilates a tone which is associated with the final mora to the following Ti.

\[ \text{(15) Lexical H-lowering} \]

The not-quite-low ending of the final ‘Declarative’ Accent II can be explained by assuming that Li is not associated with a mora. It receives a target which is just a fraction higher than that of the preceding L, which is associated with the final mora. This situation is reminiscent of descriptions of Japanese (Pierrehumbert & Beckman 1988) and Palermo Italian (Grice 1992: 190 ff.), which make a distinction between boundary tones which only

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[6] The peculiar location of the lexical tone is taken to result from the undominated position in Roermond Dutch of the constraint requiring the lexical H-tone to be aligned rightmost in its syllable. In particular, it ranks above the constraint aligning the IP-boundary tones rightmost in the IP.
have an association with their boundary (strictly, with their constituent node) and boundary tones which in addition associate with a TBU (a sonorant mora in Japanese, a syllable in Italian). In Japanese, for instance, the final boundary L-tone associates with the first mora of the following Accentual Phrase if this mora is not already associated with an H-tone. Interestingly, when the mora is ‘occupied’, the L is still realized, but its target is higher than it would have been if it had associated with a mora, all else being equal. In the Venlo dialect, the lower end point of the fall in Accent I realizations, then, is due to its association with the final sonorant mora (Leftward tone spreading (11)). Examples (16a, b) represent the final four words of much longer utterances with a prenuclear accents on the portions not shown here.

The final nonfocused contours support the analysis presented so far in two respects. First, the effect of Lexical H-lowering is apparent whenever a final syllable with Accent II combines with L_i. Thus, it can be seen in the nonfocused final ‘Declarative’, as shown in (17b). In (17) and Figure 5, the
final syllables represent the plural (a-example) and singular (b-example) forms of the morpheme for ‘leg’.

(a) \{[ik sex wal de;volk kynzbéin]\}

I say most certainly artificial-legs
‘I most certainly DO say artificial legs’

(b) \{[ik sex wal de;volk kynzbéin]\}

I say most certainly artificial-leg
‘I most certainly DO say artificial leg’

Second, Leftward tone spreading, which earlier was shown to spread the boundary $L_i$ to a free mora in a focused syllable, can be generalized so as to spread $L_i$ to final unfocussed syllables, which accounts for the fully low ending in (17a). In fact, as will be motivated more fully in section 4.4, any free mora in a focal or final syllable will be associated with the nearest tone on the right, provided it is unlike the preceding tone. That is, the associated left-hand tone may be focal or lexical, while the associating right-hand tone may be a lexical tone or a boundary tone. The revised formulation (11′) expresses this generalisation.

(11′) Leftward tone spreading (revised)

\[
\begin{array}{c}
\alpha T \\
\vdots \\
\neg \alpha T
\end{array}
\]

4.3.2 Extra lengthening for final syllables with Accent II

Whether focused or unfocussed, final syllables with Accent II are consistently longer than final syllables with Accent I. The greater duration of final
syllables with Accent II has been observed in other Limburg dialects (de Bot, Cox & Weltens 1990, Verhoeven & Connell 1992, Hermans 1994). For the Maasbracht dialect, Hermans (1994) assumes that the lexical tone triggers the addition of a mora, which creates a three-way quantity contrast between monomoraic, bimoraic and trimoraic rimes in IP-final position. Evidence for this interpretation is not strong, however. Alternatively, one could assume that the lexical tone on the final mora causes the syllable to be longer than a syllable without this tone, all else being equal. The effect of tones on segmental duration is well-known from studies of both lexical tone and intonation (Lyberg 1981a, b). Informal observation suggests that the lengthening is an exaggerated kind of preboundary lengthening, i.e., not just the vowel is lengthened, but also the coda consonant. This may be an indication that we are not dealing with a difference in vowel quantity. A quantity change (the addition of a third mora) would predict more locally defined lengthening, with intrasyllabic compensatory effects. For example, the quantity difference between Standard Dutch [tak] and [ta:k] expresses itself in a longer vowel but a slightly shorter consonant in the latter word than in the former (Jongman 1998, Hofhuis, ms). Thus, we will assume that the extra lengthening of final Accent-II syllables is to be attributed to the phonetic implementation of the lexical tone in the dialect of Venlo, to be referred to as final ACCENT-II LENGTH.

4.3.3 The final ‘Interrogative’ context

The representations of the ‘Interrogative’ contours of final Accent I and II are predicted to be, respectively, H* L1 H0 and H*LL1 H0 (where the latter has a lexical L instead of H on account of (15)). However, there does not appear to be a form that corresponds to the Accent I contour H* L1 H0. Native speakers do not accept a falling-rising pronunciation of a monosyllabic word with Accent I, and when asked to give an interrogative intonation offer a contour that we will analyze as the ‘Surprised Question’ intonation (to be discussed in section 4.4). That is, two interrogative intonation contours, ‘Interrogative’ and ‘Surprised Question’, are available in the dialect, except for final focused Accent-I words, for which there is only one. The explanation for the avoidance of H* L1 H0 lies in the conflicting functions of syllable lengthening that are involved here. The usual option open to speakers faced with tone crowding is a lengthening of the syllable in order to accommodate the pitch movements concerned (Lyberg 1981a, b; Silverman 1987: 28), but this is precisely the option which is denied to the Venlo speaker, since lengthening is the phonetic cue for Accent II. Postlexical restrictions on combinations of tones and TBUs are not unknown. The first claim to this effect was made by Leben (1976) for a variety of American English. Although (18a) is fine, (18b) would not be used. Instead, a fall to
mid occurs. Similarly, Féry (1993: 91) claims that in German H*LH is a marked option on final monosyllables.

(a) We could demonstrate L*H L H

(b) We could strike L*H L H

(Avoid Leben 1976)

In Venlo Dutch, then, there is a ban on the use of the L_iH_u contour on a final focused syllable, unless it is accompanied by the lexical tone. If there is no lexical tone, the duration of the falling-rising contour would make it so similar to the form for Accent II that the dialect prefers to use the ‘Surprised Question’ intonation instead. Figure 6 illustrates the contour for Accent II on a final focused syllable before L_iH_u.

(a) {Is tet a:nə be:rə}

(b) {Is tet be:rə}

(Avoid H*L_iH_u)

The nonfocused final ‘Interrogative’ contours are presented in (20a, b). In this context, in which a rising contour is found on both Accent I and Accent...
II, the pressure on the phonetic resources is diminished. Quite as we would expect, the lexical tone has assimilated before L₁ in (20b). In both contours, the Hₜ creates a final rise from a low target. In this position, then, the only phonetic difference between the two tonal patterns is one of duration, as shown in Figure 7.

Figure 7
Pitch contours showing the contrast between Accent I (solid contour) and Accent II (interrupted contour) in a final nonfocused syllable before L₁Hₜ ('Interrogative' intonation, see also (20a, b)).

(20)

(a) \{maː hɛpsɔ dan ɣɛŋ kvnzbein\}  
L₁ Hₜ L₁ Hₜ  
but have-you then no artificial-legs  
‘But don’t you HAVE artificial legs?’

(b) \{maː hɛpsɔ dan ɣɛŋ kvnzbein\}  
L₁ Hₜ L₁ Hₜ  
but have-you then no artificial-leg  
‘But don’t you HAVE an artificial leg?’

Now that we have solved the two IP-final peculiarities in the data of Table I, the unexpected contour for the final ‘Declarative’ Accent II and the
absence of a falling-rising ‘Interrogative’ for final Accent I, we turn to the contours containing H.

4.4 The ‘Continuation’ and ‘Surprised Question’ intonations

The issue of interest in the contours with H is the difference between the phonological and the phonetic lowering of H*. In the ‘Surprised Question’ context, Accent I begins at fully low pitch. In the remaining contexts before H (‘Continuation’) and H H (‘Surprised Question’), the focal H* is realized at mid pitch. We will argue that the general lowering of H* to mid pitch is achieved in the phonetic implementation, while the specific lowering in the syllables with Accent I before H H is reflected in the phonological representation.

In the ‘Continuation’ intonation, with just H at the IP-end, focal H* is realized at mid pitch. For Accent I, this results in a rising movement from mid to high pitch across the stretch between the focal syllable and the end of the phrase. For Accent II, a high level pitch, with just a weak rise at the beginning of the focused syllable, is observed. These contours occur both on IP-final and IP-nonfinal syllables. In panel (a) of Figure 8, the contrast is shown on phrase-final focused syllables. The tonal analyses are given in (21a, b), while the implementation rule that lowers H* is given in (22).

\[(21)\]

(a) \([\text{dɪç} \ \text{hæs} \ \text{xæm} \ \text{bein}] \ldots\]
\[\text{(H* L)} \quad \text{H* H} \]
‘you have no legs
‘YOU have no LEGS …’

(b) \([\text{dɪç} \ \text{hæs} \ \text{xæm} \ \text{bein}] \ldots\]
\[\text{(H* L)} \quad \text{H* H H} \]
‘you have no leg
‘YOU have no LEG …’

\[(22)\] Phonetic H*-lowering (Implementation)

\[H^* \rightarrow \text{mid pitch } /_{\mu}(m \ldots)\]
\[\ldots \text{H} \]

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At first sight, rule (22) would appear to have to look two segments ahead in forms like (21b). This seems undesirable, as implementation rules are assumed to have a local structural description, and according to some authors refer even more restrictively to lefthand tones only (Pierrehumbert 1980: 161 ff., Liberman & Pierrehumbert 1984: 231). The ‘local’ nature of the context in (21b) is, however, guaranteed by the status of the righthand context as a boundary tone. Pierrehumbert & Beckman (1988: 125 ff.) insist that even though a boundary tone is temporally coordinated with the initial
A minimal pair of contours showing the lexical tone contrast in the ‘Surprised Question’ intonation is given in panel (b) of Figure 9. Again, these contours occur both finally, as in these examples, and nonfinally. The contour for Accent II moves from mid pitch (due to Phonetic H*-lowering), to high pitch in the accented syllable, and to extra high pitch at the phrase end. The contour for Accent I begins at fully low pitch in the accented syllable, and then follows the same trajectory as Accent II. We account for the low starting point of Accent I by means of the allomorphy statement (23), which assigns L* as the focal tone to Accent-I words in the ‘Surprised Question’ intonation.⁷

![Diagram](image)

The allomorphy statement (23) differs from the situation in many other varieties of Dutch, where the occurrence of L* versus H* is uniquely determined by the semantics of the intonation (for instance ‘Declarative’ vs. ‘Interrogative’). In the Venlo dialect, L* not only signals a particular intonational meaning, together with H₁H₃, but also a lexical tone category. In the case of segmentally specified morphemes, allomorphy is reasonably common. For instance, the Dutch plural suffix [s] is preferred to [b] after weak syllables, while in English the indefinite article has the form [b] before vowels and [s] before consonants. We are not aware of comparable cases in intonation, however. Since there is no reason to expect intonational morphology to be principally different from segmentally encoded morphology, our (23) is in a sense a case that might have been expected.

As observed above, both Accent I and Accent II end in an extra high rise as a result of H₃. The implementation rule, which also occurs in standard

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⁷ The θ requires any second mora after the target to be toneless. Alternatively, if reference to tonelessness is to be avoided, an unspecified T* can be inserted, which is specified as L* before H₁H₃ and as H* elsewhere.
Dutch and was described for English by Pierrehumbert (1980) as Upstep, is given in (24). It raises $H_u$ above the level of the preceding $H$.

\[
\begin{align*}
(24) \text{\textit{Upstep}} & \quad H_u \rightarrow \text{extra high} / ] \} \\
& \quad (\text{Implementation}) \quad \big| \\
& \quad H_i \quad —
\end{align*}
\]

In (25), we give the representations of the contours in panel (b) of Figure 8. They represent the final four words of much longer utterances which have a prenuclear accent (on the word for ‘arms’ in ‘In exchange for two arms’), and the downsloping section of the contour therefore represents the slope from these preceding accents.

\[
(25) \quad \begin{array}{ccc}
\text{(a)} & \cdots \text{kraistikhej yem bein]} & \text{(b)} & \cdots \text{kraistikhej yem bein]} \\
& \big| & \big| & \big| & \big|
\end{array}
\]

\[
\begin{array}{c}
L^* \quad H_i \quad H_u \\
\text{get-you here no legs} \\
\text{‘... you won’t receive LEGS?’}
\end{array} \quad \begin{array}{c}
H^* \quad H_i \quad H_u \\
\text{get-you here no leg} \\
\text{‘... you won’t receive a LEG?’}
\end{array}
\]

The forms in (25a, b) sound, respectively, like the (American) English ‘low rise’ and the ‘high rise’ in the description of Pierrehumbert (1980), who transcribed the English contours as $L^*H-H\%$ and $H^*H-H\%$. That is, (25b) does not sound as if it has a mid beginning, then moves to high, and then to extra high; the auditory effect is rather that of a level high pitch followed by the extra high at the end. Similarly, (21a, b), one of the most subtle distinctions in the dialect, sound respectively like an unemphatic rise and a high level tone. Clearly, although the effect of phonetic $H^*$-lowering in Accent-II syllables is visible in the acoustic records (cf. the interrupted contours in panels (a) and (b) of Figure 8), to the ear the first target is not detectable. This is obviously because the mid and high targets are too close together to be heard as separate phonetic events.

However, the early rising movement for Accent II is auditorily more salient when the two adjacent $H$-tones come to occur on different syllables. This happens when schwa is inserted between a tautosyllabic liquid and

---

[8] Pierrehumbert’s rule of Upstep would raise $H_u$ to extra high, and $L_i$ to high (making $L$ equivalent to non-upstepped $H$), after $H_i$. In our description of Venlo Dutch, only $H_i$ is involved in Upstep.
labial or dorsal consonants as the result of svarabhakti (Booij 1995: 128). For example, a bimoraic syllable like ['tשמ] is pronounced ['tשמ] on the surface, causing the second mora to be filled by [a(m)] instead of by [m(m)]. As a result, when the ‘Continuation’ or ‘Surprised Question’ intonation is used for the singular ['tשמ] ‘arms’ (Accent II), H* and lexical H occur on different syllables, creating the auditory effect of a rise from mid to high distributed over two syllables. In the ‘Surprised Question’ intonation, this mid-to-high rise contrasts with the rise from low to high occurring on the segmentally identical plural form, where the high target on the second syllable is due to the spreading of H₁ by Leftward tone spreading. In Figure 9, panel (a), we illustrate this contrast. The representations are given in (26a, b). Even though the beginning point of the rise for Accent II (interrupted contour) is not much higher than that of the rise for Accent I (solid contour), the target of L* of Accent I has a longer duration than that of H*, causing the pitch of the vowel [ε] to sound lower.

\[\text{Figure 9}\]

Pitch contours illustrating the contrast between Accent I (solid contour) and Accent II (interrupted contour) on a disyllabic word before H₁H₂. Panel (a) shows the contrast before a final (nonfocused) word with Accent I (see also (26a, b), while panel (b) shows the same contrast before a final (nonfocused) word with Accent II (see also (27a, b)).
for two arms get-you here no legs
‘Won’t you receive any legs for two ARMS?’

for an arm get-you here no legs
‘Won’t you receive any legs for an ARM?’

In the contours in a panel (a), the final word ([bïn] ‘legs’) has Accent I. The same realization of the contrast between the singular and plural forms for ‘arm’ is obtained if the final mora of the IP is occupied by a lexical H, as shown in panel (b) of Figure 9. In this case, it is the lexical H that spreads leftwards to the empty mora after L*, as shown in (27a).

The final point to be made in this section concerns the phonological nature of the L*, as opposed to the phonetic status of Phonetic H*-lowering. Why must the low pitch in Accent I syllables with ‘Surprised Question’ intonation be assumed to be the target of L*, rather than of a H* whose realization is
extra low by yet another implementation rule? In addition to the argument based on the phonetic facts, there is the theoretical argument that L* is required to trigger Leftward tone spreading (11'). This rule must not apply to H after H*, as this would neutralize the opposition between Accent I and Accent II in the ‘Continuation’ intonation, as shown in (28). In (28a), H_i incorrectly spreads to the second free mora of the Accent I [bein] ‘legs’, leading to an identical sequence of targets as in (28b), which has the singular form of the same word. The correct representation for (28a) is one without spreading, as in (21a), producing a rise from mid to high on a final syllable, as in (21a), or mid pitch on a nonfinal focused syllable, as in a correct version of (28a). In other words, Leftward tone spreading cannot apply to a tone that has the same value as T*: if a H-tone must spread in (26a) and (27a), T* must be L*.

$\text{(28)}$

(a) $\{[\text{d} \text{o} \text{ kins bein ze\v{a}}]\}$  
(b) $\{[\text{d} \text{o} \text{ kins bein ze\v{a}}]\}$

\[
\begin{align*}
&\text{you can legs say-INF} \\
&\text{(incorrect form)}
\end{align*}
\]

\[
\begin{align*}
&\text{you can leg say-INF} \\
&\text{‘You can say LEG’}
\end{align*}
\]

4.4.1 Final nonfocused contours with $H_i$

To complete our account of the Venlo forms, we give the nonfocused IP-final ‘Continuation’ and ‘Surprised Query’ forms, which are as predicted. When
the lexical H is followed by \( H_i \), there is the expected slightly longer duration compared to syllables with Accent I. In (29) and (30), the representations of contours with \( H_i \) and \( H_i H_u \) are given. In (30a, b), (23) caused insertion of \( L^* \) on the word [hep].

\[ (29) \]

(29a) \{[maː hepsɔ doŋ yɛŋ kvensbein]\}

\[ L_i H^* H_i \]

but have-you then no artificial-legs
‘But don’t you HAVE artificial legs, …?’

\[ (29b) \]

(29b) \{[maː hepsɔ doŋ yɛŋ kvensbein]\}

\[ L_i H^* H_i \]

but have-you then no artificial-leg
‘But don’t you HAVE an artificial leg, …?’

\[ (30) \]

(30a) \{[maː hepsɔ doŋ yɛŋ kvensbein] \}

\[ L_i L^* H_i H_u \]

but have-you then no artificial-legs
‘But don’t you HAVE artificial legs?’

\[ (30b) \]

(30b) \{[maː hepsɔ doŋ yɛŋ kvensbein] \}

\[ L_i L^* H_i H_u \]

but have-you then no artificial-leg
‘But don’t you HAVE an artificial leg?’

If we are allowed an encore, it may be instructive to close with a consideration of the behaviour of compounds and simplex words with secondary stress in final position.
4.5 Final secondary stress

Nominal compounds receive the focus-marking tone on the main stress of the first constituent, quite as in standard German and Dutch. Unlike Scandinavian, the Limburg dialects maintain the lexical tone contrast in both constituents (provided of course that the second constituent has final primary stress and the compound is used in IP-final position). Thus, four patterns are available: I–I, I–II, II–I, II–II. In Swedish, by contrast, compounds generally have Accent II on the first constituent and no word tone on the second, regardless of whether the constituent words have Accent I or Accent II in isolation (Bruce 1977, Gussenhoven & Bruce forthcoming). Non-compound words, too, may have two locations for the tone contrast in Venlo Dutch. In words with antepenultimate primary stress and final secondary stress, examples of which are given in (31), both the primary stress and the secondary stress can have lexical tone. Unlike compounds, such ‘dactylic’ noncompound words have predictable tone structures: the primary stress has Accent II, while the secondary stress has Accent I (see (31a)) unless the coda consists of a cluster of nasal consonant and voiceless obstruent (see (31b)). (Of course, these redundancies must be stated in the grammar. For the dialect of Maasbracht, Hermans (1994: 302 ff.) offers a treatment of such regularities in an Optimality framework.)

\[(31)\] (a) II–I (b) II–II
\[\text{‘algerbra’ ‘elephant’ ‘monitor’ ‘saviour’}\]

The existence of words with two locations for the lexical tone provides an opportunity for illustrating contours on single words that otherwise only occur in multi-word expressions. Thus, we can contrast final ‘Interrogative’ and ‘Declarative’ contours for Accent II on a word like ‘elephant’, as is done in (32). The weak rise resulting from LL has a higher-pitched ending than a fall in an Accent I syllable would have reached (see also Figure 5), but a lower-pitched ending than the rise that results form L_i H_u, as shown in Figure 10.

\[(32)\]
\[(a) \text{‘An elephant!’} \quad \text{‘An elephant!’}\]
\[(b) \text{‘An elephant?’} \quad \text{‘An elephant?’}\]

Another interesting form arises when a disyllable with two Accent-II syllables is pronounced with the ‘Surprised Question’ intonation. In (33), we
show the word for ‘saviour’ as a one-word utterance with this intonation. All five H-tones are needed in the representation. The first two receive different targets, mid for H* and high for lexical H, respectively. Because the final syllable has Accent II, the third H is there to provide the appropriate lengthening in the final syllable. The next, H\textsubscript{i}, is required as the context for Phonetic H-lowering (22) and Upstep (24), while H\textsubscript{u} provides the final upstepped target.

Example (33) provides a dramatic illustration of the finding that the Obligatory Contour Principle (OCP) is not a universally observed constraint in tonal representations even within the same morpheme (Odden 1986). Of course, observance of the OCP in intonation, where the tones frequently originate from different paradigms, is not unknown. Hayes & Lahiri’s (1991) account of the paradigm of nuclear tones of Bengali crucially depends on the OCP. In their analysis, all combinations of the tones in the three tonal paradigms (the pitch accent, the righthand boundary of the phonological phrase, and the righthand boundary of the intonational phrase) are actually attested in the language, except combinations with adjacent like tones. Beckman & Pierrehumbert (1986) propose a paradigm of pitch accents for English that obeys the OCP, rejecting the H*H proposed by Pierrehumbert (1980), though OCP violations are widely tolerated for combinations of pitch accents and boundary tones, such that both H* H-H % and L* L-L % are well-formed contours. Venlo Dutch, then, provides an interesting typological counterpoint to English and Bengali.

5. Summary and Conclusion
Bruce (1977) showed that the study of the lexical tones of Swedish cannot be undertaken without taking their interaction with postlexical tones into account. An account of the lexical tone contrast in the Dutch dialect of Venlo, too, must involve the postlexical tones as well, since the occurrence of different intonation contours causes the lexical tone contrast to show up in

Representationally, the word accent opposition in the Dutch dialect of Venlo is to be understood as the contrast between the presence of a lexical H on the second sonorant mora of a stressed syllable (Accent II) versus its absence (Accent I). In order to be included in surface representation, the lexical tone must occur in either (or both) of two conditions: (a) when focal T* occurs on the first mora of the same syllable, (b) when the lexical tone occurs on an IP-final mora. In other words, the contrast is neutralised in nonfinal, nonfocused contexts.

The need to accommodate so many contrasts in a single tonal system gives rise to an unusual degree of phonetic precision in the realization of relevant sections of the intonation contour. Venlo maintains phonological contrasts within a phonetic space that in the standard language can be used for free variation within the same phonological category, which explains why nonnative listeners are generally at a loss when presented with the contrast in at least some of the intonational contexts. Although perceptual research is still due, it would seem that ‘Declarative’ and ‘Continuation’ pronunciations of minimal pairs are particularly hard for speakers of the standard language to hear, who will typically only interpret the intonational meanings. The functional pressure on the system is also apparent from the gap: one of the 24 theoretically possible forms is missing. The contour would have to be a fall-rise on an U-final syllable pronounced without the lengthening that the articulation of a complex tone movement would naturally require. The reason why the lengthening would have to be absent is that it is used to signal the occurrence of Accent II in the same context.

Our analysis provides a good illustration of the target-interpolation model introduced by Pierrehumbert (1980), and of the assumptions the model makes about phonological representations and phonetic implementation. The analysis is summarized in Table II, which has the same structure as Table I. In each cell, tonal representations for Accent I appear above those for Accent II. The generalizations that were made in the course of our discussion are repeated here. First, the allomorphy statement for the focal tone (earlier given as (23)), then the two phonological rules Leftward tone spreading and Lexical H-lowering, earlier given as (11’) and (15). Finally, the two implementation rules of Phonetic H*-lowering and Upstep, earlier given in

[9] The distinctions are at least as subtle as lexical tone distinctions in Asian languages. For instance, the data presented by Svantesson (1989) in his Figure 3 to illustrate the difference between the high rise and the high level tone in Blang (Mon Khmer) is comparable to the distinction between the two word tones in the Venlo dialect when realized on monosyllabic words with a ‘Continuation’ intonation.
**Table II**

Phonological representations of the 23 contours presented in Table I (solid contours: Accent I; interrupted contours: Accent II). Open dots represent targets in the contours for Accent II, while filled dots represent targets in the contours for Accent I, or for both Accent I and II when their targets coincide.

(22) and (24), while Final Accent-II length, which was not given earlier as a numbered example, is listed below as (39).

(34) \[
\sigma
\]

```
Focus: L*/m(m) … ] }
         |         |         |
         - \(\emptyset\) … \(H_i H_u\)
         \(H^*\) elsewhere
```

(35) *Leftward tone spreading*

```
 \(m \ldots m \ldots\ ]
\(\alpha T\) \(\ldots\)-\(\alpha T\)
```
There are five main theoretical points that could be made on the basis of the data. None of these are new, but they do provide interesting confirmation of current assumptions in intonational phonology.

- The context-sensitivity of phonetic implementation rules was demonstrated on the basis of the realization of H-tones: H* is lower than usual before H_i (Phonetic H*-lowering), while H_u is higher that usual after H_i (upstep). See rows three and four of Table II.
- We motivated the difference between a phonological L* and a lowered H*, showing that it is useful to make a distinction between effects that are to be attributed to the implementation (Phonetic H*-lowering) and effects that are to be attributed to the phonological representation (the insertion of L* instead of H* in the final ‘Surprised Question’ contour for Accent I).
- The weak rise at the end of IP-final syllables with ‘Declarative’ Accent II (see Table II first row, last two columns) is to be attributed to a difference in the association of L_i: if it cannot spread to the final mora, it will be realized as a slightly higher target than when it can. This confirms the differences between tones with and without secondary association found by Pierrehumbert & Beckman (1988) and Grice (1995).
The F0-target of the lexical tone on an IP-final mora causes IP-final syllables with Accent II to be longer than IP-final syllables with Accent I (see Table II, last two columns). A possible analysis of the extra lengthening as a quantity change could be rejected on the basis of the distribution of the lengthening effect over the syllable rime.

Lastly, underlying tonal representations in intonation languages may be different from surface phonological representations. The need for a phonological assimilation of a lexical H was demonstrated: when this H occurs on the last mora of the IP, it adopts the value of the IP-final boundary tone (Lexical H-lowering) (see the first and second rows, third and fourth columns). Phonological rules have been postulated before in the description of intonation, but so far alternative analyses have seemed possible which avoided the postulation of an underlying representation which was distinct from the surface representation. Thus, Gussenhoven proposed a tone deletion rule for English (1983) and Dutch (1988, 1991) (‘complete tone linking’). This optional process deletes the trailing tone of a prefinal bital phonic accent, causing the sequences [H*L H*L] and [L*H L*H] to become [H* H*L] and [L* L*H], respectively. An alternative analysis is possible – though not advocated here – if H* and L* are added to the (underlying) inventory of pitch accents. A second case concerns the intonational tone system of Bengali, which can be more insightfully interpreted in terms of tonal morphemes if an OCP-motivated tone deletion rule is employed (Hayes & Lahiri 1991). This rule (given as $H_p \rightarrow \emptyset/\ldots H$) allows a single focal pitch accent $L*H_p$ to mark focus in both Declaratives and Interrogatives, while without the rule the less elegant assumption must be made that $L*H_p$ is used only in narrow focus Declaratives, while $L*$ is used before $H_i$ in (narrow focus and neutral) Interrogatives. That is, for both Dutch and Bengali phonological adjustments of the underlying tones can be motivated, but alternative solutions seem possible. The evidence for the phonological status Lexical H-lowering (15) is stronger. It can be motivated on the basis of four types of contour (focused and nonfocused final syllables with Accent II in ‘Declarative’ and ‘Interrogative’ intonation), and there does not appear to be a reasonable non-phonological account of the observation that the phonetics of the lexical tone on a phrase-final mora mimics that of the following phrasal boundary tone.

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