INTRODUCTION

The dialects of Limburg and the adjacent Ripuarian and Moselle-Franconian dialects have two tonal accents, Accent 1 and Accent 2. In the generative tradition it is taken for granted that these accents are to be represented tonally. In this article we want to take issue with this approach. We will show that there are an array of facts that cannot be explained with lexical tones. These facts rather suggest that the tonal contrast should be expressed in terms of prosodic constituency. The facts we will put forward all concern polysyllabic borrowings. We show that, in borrowings, the quality of the tonal accents depends on the quality of the posttonic vowel, and also on the structure of the syllable in posttonic position. Facts of this type are very problematic for a tonal approach, because, by definition, tones have nothing to say about relations between syllables. Our data are taken from the dialect of Maasbracht, in the middle of the Dutch part of Limburg.

We have structured our article in the following way. In the next section we define what we mean by a tonal account. In the second section we show that there are various phenomena where the quality of the tonal accents is determined by properties of the following syllable. In the third section we show that it is possible to explain these phenomena in terms of prosodic constituents. This leads us to the conclusion that the most economic way to represent the tonal accents is in terms of prosodic constituents, not in terms of lexical tone.

1 THE GENERATIVE REPRESENTATION OF THE TONAL ACCENTS

Since the publication of Schmidt's doctoral thesis (SCHMIDT 1986), the tonal accents in Limburg and the neighbouring dialect areas in Germany have regained the attention they had in the nineteen-thirties. Generative phonology also discovered them to be an interesting topic, due in particular to the efforts of Gussenhoven. In his work, Gussenhoven develops detailed analyses of the realizations of the two accents in various positions in the sentence. According to Gussenhoven and his co-workers, the contrast between the two accents is to be expressed in terms of tones. Important publications defending this hypothesis include: GUSSENHOVEN (2004), GUSSENHOVEN/VAN DER VLIET (1999), GUSSENHOVEN/PETERS (2004), (2008), HEIJMANS/GUSSENHOVEN (1998), PETERS (2006), (2008) and FOURNIER (2008). Consider the two words [haːˈs] 'glove' and [haːːs] 'hare', from the dialect of Roermond. Writing about this dialect, GUSSENHOVEN (2000) argues that the lexical contrast is tonal: whereas the word with Accent 1 does not have a tone at the
underlying level, its counterpart with Accent 2 has a high tone on its second mora. Thus, at the underlying level, the contrast between Accent 1 and 2 appears to be as follows:

(1)

\[
\begin{array}{c}
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet} \\
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\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\end{array}
\]

\[
\begin{array}{c}
\text{h a s} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\end{array}
\]

\[
\begin{array}{c}
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet} \\
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\end{array}
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\begin{array}{c}
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\end{array}
\]

The asterisks represent moras. Long vowels are attached to two moras. Onset consonants are attached to the same mora as the vowel to their right; after a long vowel, a coda consonant is linked to the second mora.

The realizations of the accents are determined by the interaction between the lexical tones and the intonational melodies. The declarative melody, for instance, has the structure HL, where H is the focus tone and L the boundary tone. The focus H-tone is inserted in the stressed syllable, where it fills the first mora. The boundary tone, occupying the final position of the intonational unit, spreads to the second mora. This only happens if that mora does not have a lexical tone. The focus syllables receive the following representations in declaration:

(2) \[ H H L_{\text{IP}} \]

\[
\begin{array}{c}
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\end{array}
\]

\[
\begin{array}{c}
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet} \\
\text{\textbullet\textbullet}\text{\textbullet}\text{\textbullet}\text{\textbullet} \\
\end{array}
\]

In (2), the bracket indicates the boundary of the intonational phrase, where the boundary L is attached. In the representation on the left, this L spreads to the second mora, creating a falling tone. In the representation on the right it does not spread. The resulting tonal structure is phonetically realized as a level high tone.

GUSSENHOVEN’s approach has lead to important insights concerning the realization of tonal accents in various positions in the sentence. Without denying the importance of this work, we want to have a look at the typological predictions this approach makes and see whether they can be tested.

If it is true that the tonal accents are lexical tones, then certain predictions can be made with respect to the interaction between the segmental and tonal structures. In particular it ought to be the case that these interactions resemble the kinds of interactions that are typical of tonal languages. Let us give one schematic example of the type of phenomenon we are interested in. Suppose we have a word with two syllables, the first of which is stressed. In the schematic representation in (3), consonants and vowels are indicated by C and V, respectively.
The simple question we want to raise is the following. Are there any relations between the tone attached to the stressed vowel in V1 position, and the properties of the second syllable? For instance, are there any rules requiring the presence of H in the stressed syllable if the posttonic vowel is high, or are there any rules requiring the absence of H if the posttonic vowel is non-high? Relations of this type are not expected if the tonal accents are tones, since tones in real tone languages do not behave in this way. It just does not happen that the quality of a vowel determines the quality of a tone in a preceding syllable.\(^1\) To the extent that we find phenomena of this type in the Limburg dialects, there is reason to believe that the tonal accents in these dialects are not lexical tones, but something else. In this article we will systematically explore the relations that exist between the tonal accents located on a stressed syllable and the properties of the syllable that immediately follows.

To this end we have compiled a list of borrowings in the dialect of Maasbracht. We have worked with three informants, two male and one female. All three are between 55 and 60 years old. They have lived their whole life in Maasbracht. They speak their dialect at home, and, in non-formal circumstances, also at work. All three have a high level of school education, but they are not academics.

We obtained the judgments of the three informants in the following way. One of the authors of this article, who is a native speaker from Maasbracht, read out the list of borrowings in random order, asking, “Which pronunciation is correct: \(X_{\text{Accent 1}}\)” (pronouncing form X with Accent 1), “or \(X_{\text{Accent 2}}\)” (pronouncing form X with Accent 2). Only forms on which all three informants agreed were taken into consideration.

Due to lack of space we cannot develop a detailed account of all types of borrowings. Since words with antepenult stress are the least interesting, we decided to analyze them only superficially. In the next section we present an overview of our results.

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\(^{1}\) One reviewer has pointed out to us that various types of tone sandhi in Chinese dialects are a counterexample to this claim. We do not agree with the reviewer’s remark. In Chinese tone sandhi of the relevant type, vowel quality does not directly determine the tone of the preceding syllable. It only does so indirectly, through the mediation of foot structure. That is, foot structure decides which vowels are allowed in an unstressed syllable. Likewise, foot structure also decides which tones are allowed in the stressed syllable. Thus, the influence of vowel quality on the tone of the preceding syllable is only apparent; there is no direct relation between the quality of a vowel and the quality of a tone in the preceding syllable. Notice that our analysis of the Limburg facts is comparable in spirit to tone sandhi in Chinese dialects. For an overview of the literature on tone sandhi in Chinese dialects, readers are referred to CHEN (2000).
2 RELATIONS BETWEEN TONIC AND POSTTONIC SYLLABLES

In this section we investigate which relations exist between the stressed syllable and the immediately following syllable. As explained in the previous section, this is an important matter. If we do find such relations we have reason to believe that tonal accents should not be represented solely as tones, because tones do not interact directly with the properties of the next syllable.

The first regularity is the following: if the stressed syllable is followed by a high vowel in an open syllable, the stressed syllable almost always has Accent 2. We were able to compile 63 forms with this structure. Of these, 61 have Accent 2, and only two have Accent 1. Here are ten examples illustrating this regularity.

(4) If the posttonic vowel is high, then the stressed syllable has Accent 2:

\[
\begin{align*}
[\text{bra}^2\text{ni}] & \quad \text{‘swank’} & [\text{kolo}^2\text{ni}] & \quad \text{‘colony’} \\
[\text{ba}^2\text{li}] & \quad \text{‘ railing’} & [\text{implo}^2\text{zi}] & \quad \text{‘implosion’} \\
[\text{ba}^2\text{mi}] & \quad \text{‘noodle’} & [\text{fidy}^2\text{si}] & \quad \text{‘confidence’} \\
[\text{a}^2\text{li}] & \quad \text{‘oil’} & [\text{dæn}^2\text{di}] & \quad \text{‘dandy’} \\
[\text{tro}^2\text{ni}] & \quad \text{‘mug’} & [\text{pæn}^2\text{ti}] & \quad \text{‘panty’}
\end{align*}
\]

These examples show that a posttonic high vowel favours Accent 2 in the stressed syllable, irrespective of the structure of the tonic syllable. Low, mid and high vowels and closed syllables also behave identically; they have Accent 2 if a high vowel follows. We found only two exceptions to this pattern. These are listed in (5).

(5) The exceptions to the regularity illustrated in (4):

\[
\begin{align*}
[\text{spe}^1\text{si}] & \quad \text{‘mortar’} \\
[\text{ækskvr}^1\text{zi}] & \quad \text{‘excursion’}
\end{align*}
\]

If the tonic syllable is followed by a non-high vowel, then it favours Accent 1. We were able to find 74 forms with posttonic [a]. The great majority of these forms, viz. 62, have Accent 1. Ten forms illustrating this pattern are listed below.

(6) a. If the posttonic vowel is low, then the stressed syllable has Accent 1

\[
\begin{align*}
[\text{dra}^1\text{ma}] & \quad \text{‘drama’} & [\text{sto}^1\text{ma}] & \quad \text{‘stoma’} \\
[\text{sahar}^1\text{ra}] & \quad \text{‘Sahara’} & [\text{o}^1\text{ma}] & \quad \text{‘grandma’} \\
[\text{hijer}^1\text{na}] & \quad \text{‘hyena’} & [\text{jamoi}^1\text{ka}] & \quad \text{‘Jamaica’} \\
[\text{zo}^1\text{da}] & \quad \text{‘soda’} & [\text{a}^1\text{an}^1\text{da}] & \quad \text{‘agenda’} \\
[\text{sor}^1\text{fa}] & \quad \text{‘sofa’} & [\text{va}^1\text{ran}^1\text{da}] & \quad \text{‘verandah’}
\end{align*}
\]

Only twelve words contradict this tendency. All these forms have a closed, stressed syllable, and the great majority has a voiceless obstruent in the onset of the posttonic syllable. We have listed them in (6b), under the heading “apparent exceptions”. The reason for this will become clear as we go on. There are only two forms with a closed stressed syllable, followed by a posttonic low vowel which is preceded by a voiced consonant. They are listed in (6c).
The phonological representation of the Limburg tonal accents

(6) b. Apparent exceptions

| [aːlˈfə]       | ‘alfa’       | [sərˈka]   | ‘circa’ |
| [muːlˈta]     | ‘Malta’      | [ˈkoʊntra] | ‘contra’ |
| [dɛlˈta]      | ‘delta’      | [pəmˈpa]   | ‘pampas’ |
| [ˈaʊrta]      | ‘aorta’      | [ɪnˈka]    | ‘Inca’  |

c. True exceptions

| [pænˈda]      | ‘panda’      | [prəˈde]   | ‘peanut’ |

If the posttonic vowel is mid, the stressed syllable immediately preceding it has a strong preference for Accent I. We were able to compile 37 forms with this structure. Of these, thirty obey the generalization; ten of them are listed below. Seven forms do not obey the regularity. Again, the great majority of them have a closed stressed syllable and a voiceless consonant in the onset of the following syllable. We have listed them under the heading “apparent exceptions”. There is only one example that has to be listed as a true exception.

(7) a. If the posttonic vowel is mid, then the stressed syllable has Accent I:

| [kæˈnəʊ] | ‘canoe’ | [pəˈlo] | ‘polo’ |
| [piaˈnəʊ] | ‘piano’ | [əˈkɑr] | ‘car’ |
| [ˈmɛtrəʊ] | ‘metro’ | [pəˈroʊ] | ‘porno’ |
| [vəˈtəʊ]  | ‘veto’  | [tɾɪˈbəʊ] | ‘turbo’ |
| [kreˈdə]  | ‘credo’ | [sælˈvo] | ‘salvo’ |

b. Apparent exceptions:

| [səlˈtə]   | ‘somersault’ | [mənˈko] | ‘shortcoming’ |
| [kənˈtə]  | ‘account’  | [ʃəmˈpo] | ‘shampoo’ |
| [ˈfræŋko] | ‘Franco’   | [təmˈpo] | ‘tempo’ |

c. True exceptions:

| [sælˈdə] | ‘balance’ |

It is clear, then, that there is an important regularity: on the immediately preceding stressed syllable, high vowels induce Accent 2 and non-high vowels induce Accent 1. We can also conclude that this regularity tends to be obscured if a stressed syllable is closed, and the onset of the next syllable is voiceless. So far we have only looked at words with a penult stressed syllable followed by an open syllable. We will now move on to the words with penult stress ending in closed syllables.

We managed to compile 65 forms with this structure. The majority (fifty) of these forms have Accent 1 on the penult syllable. In (8a) we present ten instances of this pattern. There are fifteen forms with Accent 2. Eleven of these are apparent exceptions, in the sense that the stressed syllable is closed, and the onset consonant of the next syllable is voiceless. We have listed them in (8b). There are therefore four forms with a really exceptional Accent 2 followed by a closed syllable in final position. They are listed as exceptions in (8c).
(8) a. If the final syllable is closed, then the penult syllable favours Accent 1:

- [jaːnɪs] ‘Janus’
- [ɛːˈpɔs] ‘epic’
- [lɪsəˈjɜm] kind of high school
- [lɔːˈtrʌs] ‘lotus’
- [moːˈtɔr] ‘motor’

b. Apparent exceptions:

- [əbɔrˈtɪs] ‘abortion’
- [kɔrˈpʌs] ‘corpus’
- [sɪrˈkʌs] ‘circus’
- [hɜrˈpæs] ‘herpes’
- [hɔrˈtɪs] ‘hortus’
- [bʌlˈkɑn] ‘Balkans’

c. True exceptions

- [klɪtɔˈris] ‘clitoris’
- [smeːˈris] ‘policeman, pej.’

Clearly, words ending in a closed syllable tend to have Accent 1 in the stressed syllable immediately preceding it. Again there seems to be a rather large class of systematic exceptions; words with a stressed closed syllable followed by a voiceless consonant in onset position always have Accent 2.

With two exceptions, words with antepenult stress have Accent 2. Although we cannot give a detailed account of these words, due to lack of space, we give a few examples illustrating this regularity.

(9) a. Antepenult stress favours Accent 2:

- [aːˈlɪbɪ] ‘alibi’
- [koːˈlɪbri] ‘hummingbird’
- [spiːˈrɪts] ‘spirits’
- [laːˈzɔrəs] ‘sloshed’

b. Exceptions:

- [dɛrˈsɪbɛl] ‘decibel’
- [hɛrˈnɪja] ‘hernia’

To sum up, in the dialect of Maasbracht, the quality of the posttonic vowel determines the quality of the tonal accent in the preceding syllable; high vowels induce Accent 2 on the preceding syllable while non-high vowels induce Accent 1 on it. The quantitative structure of the posttonic syllable is also decisive; a closed syllable calls for Accent 1 on the preceding syllable. Furthermore, antepenult stress strongly favours Accent 2. There is one strong regularity overruling these generalizations; if the stressed vowel is closed and the onset consonant of the next syllable is voiceless, then the stressed syllable always has Accent 2. These results are listed in (10).
(10) a. A high vowel requires Accent 2 on the preceding syllable, if that syllable is stressed

b. A non-high vowel requires Accent 1 on the preceding syllable, if that syllable is stressed

c. A closed syllable requires Accent 1 on the preceding syllable, if that syllable is stressed

d. A stressed, closed syllable followed by a voiceless consonant has Accent 2

e. A stressed syllable in antepenult position has Accent 2

We can legitimately conclude, then, that relations between the posttonic syllable and the preceding stressed syllable do exist. In our view this is problematic for the tonal approach. By this we mean any theory which is based on the premise that the tonal accents are only to be represented as tones. These are theories of the type described in section 1; theories that posit underlying tones to represent the lexical contrast, and that combine these lexical tones with intonational ones. Theories of this type have difficulties with the regularities formulated in (10), because it is not possible to directly relate the quality of a tone to properties of the next syllable.

Normally, in generative phonology, relations between adjacent syllables are expressed in terms of prosodic constituents. This means that the facts presented in this section ought to be explained in terms of prosodic constituency. If we succeed in this enterprise, then we can claim that prosodic constituency determines the distribution of tones. But if that is the case, we can also claim that the lexical contrast between the two accents can be described in terms of prosodic constituency. This again entails that the Limburg tonal accents are not really tonal, in the sense that they emerge out of an interaction between lexical and intonational tones. Rather, they are intonational tones whose distribution is determined by a word's prosodic structure.

In the next section we will show that it is possible to explain the generalizations of (10) in terms of prosodic constituents.

3 AN ANALYSIS WITH PROSODIC CONSTITUENTS

In the generative literature on stress it is well documented that vowels of low sonority, such as high and central vowels, avoid stress. Conversely, vowels of relatively high sonority tend to attract it. Studies in which these phenomena are put into a theoretical perspective include DE LACY (2002; 2004; 2006) and KENSTOWICZ (1997; 2004). One of the constraints formulated in the generative theory of stress is the following (cf. DE LACY's work in particular):

(11) *NON-HEAD/HIGH-SON

A segment of high sonority cannot exclusively occupy a dependent position.
We define a segment of high sonority as any segment with greater sonority than a high vowel. Thus, high vowels, sonorant consonants and obstruents are irrelevant for the constraint *NON-HEAD/HIGH-SON. As a consequence of this constraint mid and low vowels tend to avoid a dependent position, whereas high vowels and schwa can easily be located in that position. To see what this means, consider the schematic representations in (12).

(12) a. unacceptable

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*  
*  
C V C V
```

b. acceptable

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*  
*  
C V C V
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Both representations show a trochee, because the first asterisk is the head, as expressed by the vertical lines. The second asterisk is therefore a dependent. Given the constraint *NON-HEAD/HIGH-SON, the representation on the left is avoided, because the dependent position of the higher constituent contains a high sonority segment. Furthermore, this segment exclusively occupies the dependent position, in the sense that it does not occupy any other position. The representation on the right does not violate *NON-HEAD/HIGH-SON, because here a low sonority segment occupies the dependent position.

Before we continue, we want to say a few words about the prosodic representations we will be working with. Basically, we adopt the theory of stress proposed in HALLE/VERGNAUD (1987). In this theory, prosodic structure is expressed by asterisks that are assigned metrical structure (that is, they are given head or dependent status). There is one major difference, however. We assume that there is no independent level at which syllables exist. We only have moras, which are located at the lowest level of asterisks. All in all there are three levels, at least within the domain of the word. At the lowest level the moras are located. At the highest level, the main stress constituent is located. There is also an intermediate level. The positions carrying an asterisk at this level are strong and therefore not subject to reduction rules. Under certain conditions it can also mean that they are realized as secondary stress.

There are two other constraints that are important for us. One is the traditional MINIMALSIZE (cf. HAYES 1995, PRINCE/SMOLENSKY 1993). We formulate it in the following way:

(13) MINIMALSIZE

The constituent at the main stress level must branch.
According to this constraint, the constituent expressing main stress must have two daughters. Due to this constraint, the representation in (14a) is undesirable, whereas the one in (14b) is preferred.

(14) a. undesirable

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  *  
 /   
*    *
 /    /
C V C V
```

b. preferred

```
  *  
 /   
*    *
 /    /
C V C V
```

The second constraint we have to mention requires the head of the constituent at the main stress level to branch. We will call it PROKOSCHLAW, after RIAD (1992), and we formulate it as follows:

(15) PROKOSCHLAW

If a vowel exclusively occupies a position in the dependent of the main stress constituent, then the head of this constituent must branch.

Due to this constraint the representation in (16a) is undesirable, whereas the one in (16b) is preferred.

(16) a. undesirable

```
  *  
 /   
*    *
 /    /
C V C V
```

b. preferred

```
  *  
 /   
*    *
 /    /
C V C V
```

In (16a) the second vowel occupies a position in the dependent daughter of the main stress constituent. This being the case, PROKOSCHLAW requires the head daughter of the main stress constituent to branch. The constraint is violated in (16a), but not in (16b). For this reason the representation in (16b) is preferred by PROKOSCHLAW. Notice that this constraint creates a long vowel in (16b), because the vowel is linked to two moras.

With these preliminaries out of the way we can proceed to develop an analysis of the relations mentioned in (10). We will start with the generalization in (10a), which states that a high vowel favours Accent 2 in the preceding syllable.
Consider a form like \([ba:2\text{-}mi]\) ‘noodle’, which is one of the forms listed in (4). These forms illustrate the generalization in (10a). We propose that this word has the following representation:

\[\text{(17) The representation of } [ba:2\text{-}mi]: \]

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For this reason it can only be parsed at the mora level and the intermediate level, not at the level of main stress. Now the preceding syllable receives two asterisks at the intermediate level. It receives two constituents of this type because the main stress constituent is subject to MINIMAL SIZE (13). Therefore, this constituent must have two daughters. In this way a second mora must be created, in order to carry the daughter asterisk required by MINIMAL SIZE. The representation in (18) satisfies all relevant constraints, including PROKOSCHLAW (15). Although the long vowel occupies a position in the dependent of the main stress constituent, it also occupies a position in the head of the main stress constituent. Therefore, it does not exclusively occupy a position in the dependent of the main stress constituent. This entails that PROKOSCHLAW does not apply in the representation in (18). As a result, the long vowel does not become overlong.

(18) The representation of [ka:no]:
```
    *
  /   \
*/\   \ *
\k a n o
```

We have also seen that closed syllables favour Accent 1 in the preceding syllable and have formulated this tendency in (10c). A form like [ja:nys] 'Janus', appearing in (8), instantiates this tendency. One of the oldest constraints of the generative theory of stress is a constraint excluding branching constituents from a dependent position. It is one of the cornerstones of the theory of stress developed in HAYES (1980).

(19) QUANTITY SENSITIVITY (QS) If a constituent branches at the intermediate level it may not occupy a dependent position in the main stress constituent.

Now consider the representation of the word 'Janus', given in (20).

(20) The representation of [ja:nys]:
```
    *
  /   \
*/\   \ *
\j a n y s
```
The vowel [y] is a high, lax vowel. As far as *NON-HEAD/HIGH-SON (11) is concerned, this vowel could therefore be located in a dependent position. And yet, in the representation in (20) it does not. This is a consequence of the constraint QS. The final consonant requires a mora, creating a branching constituent at the intermediate level. Due to QS, this branching constituent should not occupy a dependent position in the main stress constituent. Now, exactly the same situation arises as in the form we have just explained. Not being allowed in a dependent position, the branching constituent cannot be parsed at the level of the main stress constituent. It can therefore only be parsed at the mora level and the intermediate level. The preceding syllable receives two asterisks at the intermediate level. It receives two constituents of this type because the main stress constituent is subject to MINIMALSIZE (13). Therefore, it must have two daughters. In this way a second mora must be created. This mora carries the asterisk required by MINIMALSIZE.

We now have explained the regularities formulated in (10a–c). The central hypothesis allowing us to explain them is that in the Limburg dialects two constraints are very important: *NON-HEAD/HIGH-SON (11), which excludes vowels of relatively high sonority from a dependent position, and QS, which excludes branching constituents from a dependent position in the main stress constituent. In the case of the posttonic high vowels one branching constituent is created to the left of the final constituent at the intermediate level, as shown in (17). In the case of posttonic mid and low vowels, and also in the case of posttonic closed syllables, two non-branching constituents are created to the left of the final constituent at the intermediate level, as shown in (18) and (20).

Having explained the difference between Accent 1 (two non-branching constituents at the intermediate level) and Accent 2 (one branching constituent at the intermediate level) we have to answer the question why these representations are realized as Accent 1 and Accent 2, respectively.

Recall from the first section (cf. [2]) that in declaratives a focus syllable with Accent 1 is realized as a falling tone, whereas a focus syllable with Accent 2 has a level high tone. To account for this difference we simply have to say that the declarative melody HL is carried by the asterisks at the intermediate level. This yields the tonal difference between Accent 1 and Accent 2. We illustrate this with the representations in (21).

In [ja:lnys] the two tones of the declarative melody are both assigned to the long vowel, creating a falling pitch phonetically. In the case of [ba:ml], however, the two tones of the declarative melody are assigned to two different vowels, located in separate syllables. The first vowel, lengthened by PROKOSCHLAW (15), carries the high tone, creating a level high tone phonetically. The second vowel, which activates PROKOSCHLAW, carries the low tone of the declarative melody.

Let us now briefly discuss antepenult stress. Recall that words of this type have a strong preference for Accent 2. We have formulated this tendency in (10e). An example illustrating this is [azəlibi] ‘alibi’, appearing in (9). We propose that the prosodic structure of this example is as in (22).
The phonological representation of the Limburg tonal accents

(21) The tonal difference between Accent 1 and Accent 2 in declaratives:

Accent 1

\[
\begin{array}{c}
\text{main stress level} \\
\text{HL} \\
\text{intermediate level} \\
\text{** * * *} \\
\text{mora level} \\
\text{** * * * *} \\
\text{j a n y s}
\end{array}
\]  

Accent 2

\[
\begin{array}{c}
\text{main stress level} \\
\text{H L} \\
\text{intermediate level} \\
\text{* * *} \\
\text{mora level} \\
\text{* * * *} \\
\text{b a m i}
\end{array}
\]

(22) The representation of \([a:libi]:\)

\[
\begin{array}{c}
\text{main stress level} \\
* \\
\text{intermediate level} \\
* * * \\
\text{mora level} \\
* * * * \\
\text{a l i b i}
\end{array}
\]

Why is it that words with antepenult stress have such a strong preference for Accent 2? Suppose they were to have Accent 1. In that case a word with antepenult stress would be represented as in (23).

(23) The representation of *[a:libi] (with the wrong tonal accent):

\[
\begin{array}{c}
\text{main stress level} \\
* \\
\text{intermediate level} \\
* * * \\
\text{mora level} \\
* * * * \\
\text{a l i b i}
\end{array}
\]

In this representation the two syllables following the first vowel are unparsed by the main stress constituent. This is a consequence of the fact that all prosodic constituents are maximally binary. The representation in (22) is to be preferred over the one in (23) because more syllables are parsed by the main stress constituent. It is therefore preferable in terms of the parsing constraints; the more asterisks included in the main stress constituent, the better (cf. PRINCE/SMOLENSKY 1993).

This leaves us with the tendency we formulated in (10d). We have seen that words with a stressed closed syllable followed by a voiceless onset consonant always have Accent 2. A representative example is \([a:2fa] \text{ ‘alpha’},\) appearing in (6b). This
tendency is so strong that it overrules any other tendency. Stated differently, in closed
syllables that are followed by an onset, Accent I is only allowed if the onset contains
a voiced consonant, as in [kvr'tor] 'cursor' (8), for instance.

Words like [ol^2fa], with Accent 2 in a closed penult position, must have a
representation similar to [ba^2mi] (17), and they exclude a representation similar to
the one of [ka^1no] (18). The latter representation is what we would expect, because
the final vowel in [ol^2fa] is highly sonorous.

Suppose [ol^2fa] were to have Accent 1. It would then have the following represen-
tation:

(24) The (incorrect) representation of [ol^2fa]:

\[
\begin{array}{cccc}
\text{main stress level} \\
\text{intermediate level} \\
\text{mora level} \\
\hline
\alpha \quad 1 \quad \text{f} \quad a
\end{array}
\]

Apparently, a sonorant consonant in the coda position only allows a mora in the head
position of an intermediate constituent if it is followed by a voiced onset. Let us
assume that sonorant consonants in the head position of an intermediate constituent
must have the feature "Voice". We know that the feature "Voice" is only possible if it
is linked to the onset position. If it is not linked to an onset, it is erased (Lombardi
1995). These requirements explain the widespread phenomenon of final devoicing.

We can now analyze the tendency of (10d) in the following way. In forms where a
sonorant consonant is followed by a voiceless consonant in the onset, the requirement
that "Voice" be licensed by the onset cannot be met. If "Voice" cannot be licensed by
the onset, then the requirement that a sonorant consonant in a head mora be specified
for Voice cannot be met either. If that requirement cannot be met, then a sonorant
consonant cannot be allowed in the head position of a constituent at the intermediate
level. This implies that Accent 1 is not possible. The representation of [ol^2fa], then,
must be as follows:

(25) The (correct) representation of [ol^2fa]:

\[
\begin{array}{cccc}
\text{main stress level} \\
\text{intermediate level} \\
\text{mora level} \\
\hline
\alpha \quad 1 \quad \text{f} \quad a
\end{array}
\]
In this representation the main stress constituent violates MINIMAL SIZE (13), which requires that the main stress constituent branch. If it were to branch, then the highly sonorous vowel in final position would violate the constraint *HEAD/HIGH-SON (11). We assume that this constraint is inviolable.

We have now explained all the facts described in the preceding section in terms of prosodic constituents. An important conclusion is that Accent 1 contains two non-branching constituents at the intermediate level, whereas Accent 2 contains one branching constituent at this level. It is not necessary to refer to tone to explain the facts from the preceding section. In fact, the most important tendencies formulated in (10a–c) cannot possibly be explained in terms of tones alone, because tones cannot directly refer to properties of the next syllable. Only prosodic constituents can relate properties of two consecutive syllables to each other.

If the analysis of borrowings forces us to account for the difference between Accent 1 and Accent 2 in terms of prosodic constituents, then the lexical contrast should also be expressed in this way. It is certainly preferable to express the contrast in terms of the representations that are necessary anyway. At the level of underlying contrast we therefore also posit the following representations:

\[
\begin{array}{c}
\text{Accent 1} \\
\text{intermediate level} \\
\text{mora level}
\end{array} \quad \begin{array}{c}
\text{Accent 2} \\
\text{intermediate level} \\
\text{mora level}
\end{array}
\]

CONCLUSION

We have shown that the distribution of the tonal accents is often predictable. If a stressed syllable is followed by a high vowel, then it favours Accent 2. If a stressed syllable is followed by a vowel of high sonority then it strongly prefers Accent 1. Furthermore, if a stressed syllable is followed by a closed syllable, then it clearly prefers Accent 1. Regularities of this type cannot be expressed solely in terms of tones. They can only be explained by reference to prosodic constituents. Concretely, we have proposed that Accent 1 is a (phonetic) syllable containing two non-branching constituents at the intermediate level, whereas Accent 2 is a (phonetic) syllable containing one branching constituent at the intermediate level. These representations are necessary to account for the regularities we have observed. If they are needed on independent grounds, we can also use them to express the lexical contrast. Lexical tones are therefore superfluous.
REFERENCES


