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The phonological representation of the Limburgian tonal accents

1 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 I want to take issue with this approach. I will show that there is an array of facts that cannot be explained with lexical tones. These facts rather suggest that the tonal contrast should be expressed by prosodic constituency. Specifically, I will argue that Accent 2 is a trochee dominating two syllables, whereas Accent 1 is a monosyllabic trochee. This has also been suggested in a recent manuscript by Wolfgang Kehrein (Kehrein 2010). The facts I will put forward are all polysyllabic borrowings. I show that, in borrowings, the quality of the tonal accents depends on the quality of the posttonic vowel. Facts of this type are very problematic for a tonal approach. My data are taken from the dialect of Maasbracht, in the middle of the Dutch part of Limburg.

With the exception of Wolfgang Kehrein (2010), these facts have so far not been taken into consideration in the literature. With this study I hope to fill this gap.

It should be noted that my article is only concerned with borrowings. Native, truly Germanic, items are not taken into consideration. Although the question how the accents are distributed in native items is very important, it is a different issue, one I cannot go into due to lack of space.

I have structured this article in the following way. In the next section I define what I mean by a tonal account. In the second section I show that the quality of the tonal accents can be determined by the quality of the vowel in the following syllable. In the third section I show that it is possible to explain these correlations in terms of prosodic constituents. This leads me 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.

2 The classical generative representation of the tonal accents

Since the publication of Schmidt's doctoral thesis (Schmidt 1986) the tonal accents in Limburg and the neighboring dialect areas in Germany regained the attention they used to have in the thirties of the 20th century. Also generative phonology discovered it as an interesting topic, in particular due 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 coworkers the contrast between the two accents is to be expressed in terms of lexical tones. Important publications defending this hypothesis are: Gussenhoven & Van der Vliet (1999), Gussenhoven (2004 & 2008), Heijmans & Gussenhoven (1998), Peters (2006, 2008) and Fournier (2008). Consider the two words [ha:²s] 'glove' and [ha:¹s] 'hare', taken 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, the word with Accent 2 has a high tone on its second mora. Thus, at the underlying level the contrast between Accent 1 and Accent 2 looks as follows:



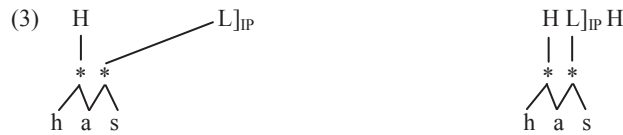
The asterisks represent moras. Long vowels are attached to two moras. An onset consonant is attached to the same mora as the vowel to its right; after a long vowel a coda consonant is linked to the second mora.

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, in non-final position, receive the following representations in declaratives:



In (2) the bracket indicates the boundary of the intonational phrase, to which 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.

The representations in (2) account for the realizations of the two accents if they are located in the non-final position in a sentence. If they occupy the final position, Accent 2 is realized with a falling-rising tone. Gussenhoven (2000) accounts for this with a metathesis rule, switching around the final H and boundary tone. In final position, then, the representation of the two accents is as in (3).



Gussenhoven's approach has led to important insights with respect to the realization of the 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 are made with respect to the interaction between segmental structure and tonal structure. In particular it should be the case that these interactions should resemble the kind of interactions that are typical of tonal languages. Let me give one schematic example of the type of phenomenon I am interested in. Suppose we have a word with two syllables, the first of which has a high tone. In the schematic representation below consonants and vowels are indicated with C and V.



The simple question I want to raise is the following. Are there any relations between the high tone in V₁ position, and the properties of the second syllable? For instance, are there any rules requiring the presence of H in the first syllable if the vowel in the second syllable is high? Or, are there any rules requiring the absence of H if the vowel of the second syllable is non-high? Relations of this type are not expected if the tonal accents are tones. The reason is that 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. To the extent that we do find phenomena of this

type in the Limburgian 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 quality of a vowel and the tonal properties of the syllable preceding that vowel.

To this end I have compiled a list of borrowings in the dialect of Maasbracht. We have worked with three informants, two males 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 school education, but they are not academics.

I have obtained the judgments of the three informants in the following way. As a native speaker of Maasbracht, I read out the list of borrowings in random order, asking: ‘which pronunciation is correct: X Accent 1’ (pronouncing form X with Accent 1) ‘or X Accent 2’ (pronouncing form X with Accent 2).

Due to lack of space I cannot develop a detailed account of all types of borrowings. I therefore restrict myself to words with penult stress. In the next section we present an overview of the results.

3 Correlations between tonic and posttonic syllables

In this section I investigate the correlations that exist between a vowel’s quality and the tonal quality of the preceding syllable. As explained in the previous section this is an important matter. If these relations do exist, there is reason to believe that the tonal accents should not be represented with lexical tones only, because tones do not directly interact with properties of a vowel in the next syllable.

The first regularity is the following: if a syllable contains a high vowel, then the preceding syllable almost always has Accent 2. I was able to compile 63 forms with this structure. Of these, 61 have Accent 2, and only 1 has Accent 1. Here are 10 examples illustrating this regularity.

(5) *If a vowel is high, then the preceding syllable has Accent 2*

[bra: ² ni]	‘swank’	[kolo: ² ni]	‘colony’
[ba: ² li]	‘railing’	[implo: ² zi]	‘implosion’
[ba: ² mi]	‘noodle’	[fidi: ² si]	‘confidence’
[ɔ: ² li]	‘oil’	[dæn ² di]	‘dandy’
[tro: ² ni]	‘mug’	[pæn ² ti]	‘panty’

These examples show that a high vowel favours Accent 2 in the preceding syllable, irrespective of the structure of that syllable. Low, mid and high vowels and also closed syllables behave identically; they have Accent 2 if a high vowel follows. I found just one exception to this pattern, the word [ækskʏr¹zi] ‘excursion’.

If a syllable has a non-high vowel, then the preceding syllable favours Accent 1. I was able to find 74 forms with posttonic [a]. The great majority of these forms, viz. 62, has Accent 1. Below 10 forms illustrating this pattern are listed.

(6) a. *If a vowel is non-high, then the preceding syllable has Accent 1*

[dra: ¹ ma]	‘drama’	[sto: ¹ ma]	‘stoma’
[saha: ¹ ra]	‘Sahara’	[o: ¹ ma]	‘grandma’
[hije: ¹ na]	‘hyena’	[jamci: ¹ ka]	‘Jamaica’
[zo: ¹ da]	‘soda’	[aʏæn ¹ da]	‘agenda’
[so: ¹ fa]	‘sofa’	[væran ¹ da]	‘verandah’

12 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. I have listed them in (6b), under the heading ‘apparent exceptions’. The reason for this will become clear as I 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).

(6) b. *Apparent exceptions*

[ɑl ² fa]	‘alfa’	[sɪr ² ka]	‘circa’
[mal ² ta]	‘Malta’	[kɔn ² tra]	‘contra’
[dæl ² ta]	‘delta’	[pɑm ² pa]	‘pampas’
[aɔr ² ta]	‘aorta’	[ɪŋ ² ka]	‘Inca’

c. *True exceptions*

[pɑn ² da]	‘panda’
[pɪn ² da]	‘peanut’

If a vowel is mid, then the immediately preceding syllable has a strong preference for Accent 1. I was able to compile 37 forms with this structure. Of these, 30 obey the generalization; 10 of them are listed below. Seven forms do not obey the regularity. Again, the great majority of them has a closed stressed syllable, and a voiceless consonant in the onset of the following syllable. I 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 1*

[ka:¹no]	‘canoe’	[po:¹lo]	‘polo’
[pia:¹no]	‘piano’	[yi:¹ro]	‘giro’
[me:¹tro]	‘metro’	[pɔ:¹no]	‘porno’
[ve:¹to]	‘veto’	[tʏr¹bo]	‘turbo’
[mi:¹ra]	girl’s name	[sal¹vo]	‘salvo’

b. *Apparent exceptions*

[sal²to]	‘somersault’	[maŋ²ko]	‘shortcoming’
[kɔ:n²to]	‘account’	[ʃam²po]	‘shampoo’
[fran²ko]	‘Franco’	[tæm²po]	‘tempo’

c. *True exceptions*

[sal²do]	‘balance’
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Let us now move on to the words with penult stress ending in closed syllables. I managed to compile 67 forms with this structure. The majority of these forms, viz. 54, have Accent 1 on the penult syllable. In (8a) we present 10 instances of this pattern. There are 13 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. I have listed them in (8b). There are therefore 2 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 favors Accent 1*

[ja:¹nʏs]	‘Janus’	[nø:¹trɔn]	‘neutron’
[e:¹pɔs]	‘epic’	[ju:¹das]	‘Judas’
[li:se:¹jʏm]	‘kind of high school’	[høndu:¹ras]	‘Honduras’
[lo:¹tʏs]	‘lotus’	[kʏr¹zɔr]	‘cursor’
[mø:¹tɔr]	‘motor’	[kʏr¹zʏs]	‘course’

b. *Apparent exceptions*

[abɔ:²tʏs]	‘abortion’	[maŋ²ko]	‘shortcoming’
[kɔ:²pʏs]	‘corpus’	[kam²pʏs]	‘campus’
[sɪ:²kʏs]	‘circus’	[sæn²trʏm]	‘center’
[hæ:²pæs]	‘herpes’	[pam²pʏs]	‘Pampus’
[hɔ:²tʏs]	‘hortus’	[ɣɪbral²tar]	‘Gibraltar’
[bal²kan]	‘Balkans’		

c. *True exceptions*

[klito:²rɪs]	‘clitoris’	[sme:²rɪs]	‘policeman’
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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.

It seems clear, then, that there are four important regularities. These are listed in (9).

- (9) a. A non-high vowel requires Accent 1 in the preceding syllable;
 b. A high vowel requires Accent 2 in the preceding syllable;
 c. A final closed syllable requires Accent 1 in the preceding syllable;
 d. A closed syllable followed by a voiceless consonant in onset position requires Accent 2.

We can legitimately conclude, then, that the tonal quality of the preceding syllable is determined by the quality of the vowel and the closed nature of the syllable. In my view this is problematic for a purely lexical tonal approach. By this I mean any theory that is based on the premise that the tonal accents are to be represented with tones *only*. 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 tones. Theories of this type have difficulties with the regularities formulated in (9), because in these theories it is not possible to relate the quality of a vowel and the structure of a syllable *directly* to the tonal properties of the preceding 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 claim that the lexical contrast between the two accents can also be described in terms of prosodic constituency. This again entails that the Limburgian tonal accents are not really tonal, in the sense that they emerge out of the interaction between lexical tones and intonational tones. Instead of this, they are intonational tones whose distribution is determined by a word's prosodic structure.

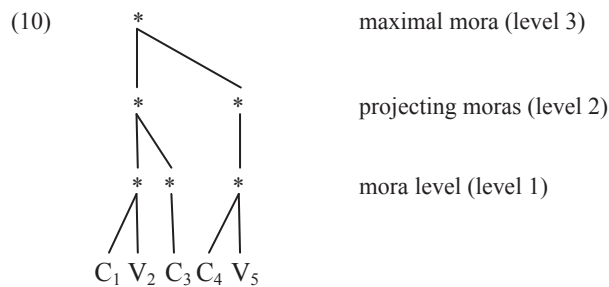
In the next section I will show that it is possible to explain the generalizations in (9) in terms of prosodic constituents.

4 A foot-based generative analysis of the tonal accents

In this section I propose an analysis of the tonal accents in terms of foot structure. My claim is that Accent 1 is a monosyllabic trochee, whereas Accent 2 is a bisyllabic trochee. Before I start my analysis I will have to say a

few words about the representations I will be working with.

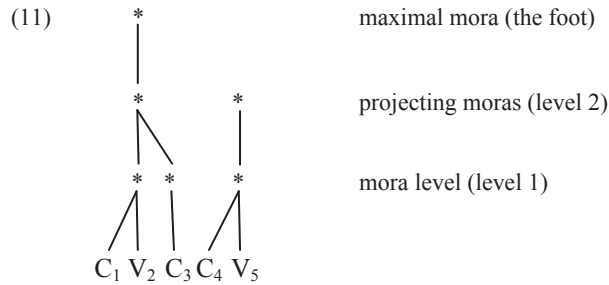
Basically, I assume the theory of stress proposed in Halle & Vergnaud (1987). In this theory, prosodic structure is expressed by asterisks that are assigned metrical structure (that is, each asterisk constitutes a constituent with a head, and, if it branches, also a dependent). There is one important difference between Halle and Vergnaud's representations and the ones I will be working with. Halle and Vergnaud assume that syllables are located in a separate dimension. I assume that they are integrated in the same dimension where feet are located. Also, moras participate in this dimension, where they constitute the lowest level. Let me make this clear with a schematic example.



The root nodes, which I represent by C and V, have to be dominated by moras. These are right-headed constituents, and they are located at the basic level, or the mora level.

The second level is the level with the 'projecting' moras. In the representation in (10) the postvocalic consonant does not project to level 2. It therefore occupies a dependent position in the constituent whose head is the mora dominating the first two root nodes. The constituents of the projecting level are right-headed. At the next level, it is decided where the stresses, or the feet, are located. In (10), the constituent dominating the first three root nodes is the head of the constituent in which the constituent containing C₄ and C₅ is located. This is the structure of a bisyllabic trochee. It is a foot containing three moras, and the first two moras are located in the head position of the foot.

Compare this with another parsing that is theoretically possible. Suppose that the postvocalic consonant does project higher up, to the second level. I propose that in that case our hypothetical example receives the following representation:



Here the postvocalic consonant occupies a mora that is the head of a constituent that is located at level 2. The constituent immediately dominating the consonant is a dependent at level 2, not a head. At level 3 a trochee is built. Now, the trochee dominates two positions at level 2. It cannot incorporate the final level 2 constituent because feet are maximally binary; they can maximally contain two positions at the level immediately below. Essentially, then, the configuration in (11) is an even trochee.

For the Limburgian dialects we need both feet. In fact, the bisyllabic trochee will phonetically be realized as Accent 2, whereas the monosyllabic trochee will be realized as Accent 1.

When exactly will these two feet be used? My main hypothesis is that the shorter trochee is used when it is not possible to parse an unstressed syllable in the foot. This is a consequence of the high sonority of the unstressed syllable, or the fact that the syllable is closed. The longer trochee is used when it *is* possible to parse the unstressed syllable in the foot. This foot can therefore become bisyllabic. Let us now see how this works.

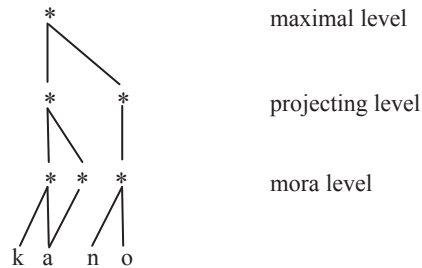
In the generative literature on stress it is well documented that vowels of low sonority, e.g. high vowels and central vowels, avoid stress. Conversely, vowels of relatively high sonority tend to attract stress. Sources where these phenomena are put into a theoretical perspective are De Lacy (2002, 2004, 2006) and Kenstowicz (1997, 2004). One of the constraints formulated in the generative theory of stress is the following (cf. in particular De Lacy's work):

- (12) *NON-HEAD/HIGH-SON
 A segment of high sonority should not be exclusively linked to a mora that is dominated by a foot's dependent.

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.

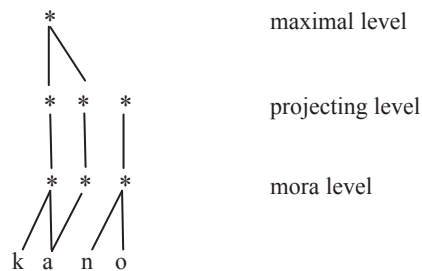
Let us look at the form [ka:¹no] 'canoe'. This word is one of the forms listed in (7), all showing the same tendency: non-high vowels prefer Accent 1 in the preceding syllable. This is the tendency formulated in (9a). Suppose that this word had a bisyllabic foot. It would then look as follows:

(13) (*incorrect*) representation of [ka:¹no]



In this form the final syllable contains a vowel of relatively high sonority. Due to *NON-HEAD/HIGH-SON (12), this vowel cannot occupy a dependent syllable in a foot, so the structure in (13) violates *NON-HEAD/HIGH-SON. Now the preceding syllable receives *two* asterisks at the intermediate level. It receives two constituents of this type because the foot is subject to the Minimal Size constraint. This constraint requires that a foot have two daughters. In this way a second, projecting mora must be created, in order to carry the daughter asterisk required by Minimal Size. The representation in (14) satisfies all relevant constraints.

(14) (*correct*) representation of [ka:¹no]

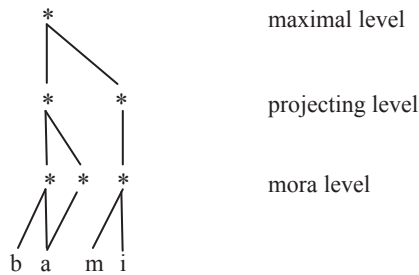


Although the long vowel *a* occupies a position in the dependent of the foot, it also occupies a position that is a head at all levels of the foot. This is a simple consequence of the fact that, as a long vowel, it is doubly linked to the two moras at the lowest level, and one of these moras is not a dependent at any level. In sum, the stressed vowel is not *exclusively* linked to a foot's dependent.

I have explained Accent 1 in words ending in a highly sonorant vowel in the following way. Vowels of high sonority avoid a position in which they are linked to a foot's dependent position. They are therefore not parsed in a foot. The remaining part of the foot becomes bipositional, due to the constraint Minimal Size. Let us now turn to the words ending in a high vowel.

Consider a form like [ba:²mi] ‘noodle, which is one of the forms listed in (5). These forms illustrate the generalization in (9b). I propose that this word has the following representation:

(15) representation of [ba:²mi]



This representation satisfies *NON-HEAD/HIGH-SON, for the simple reason that it does not apply to a segment of relatively low sonority. Therefore, even though the high vowel occupies a dependent position, this does not lead to a violation of *NON-HEAD/HIGH-SON. Our explanation of the regularity in (9b), then, is as follows. High vowels prefer Accent 2 in the preceding syllable, because a high vowel can occupy a dependent position.

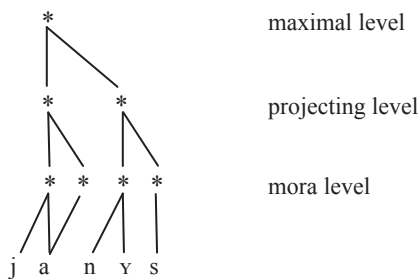
I have shown that closed syllables favour Accent 1 in the preceding syllable. I have formulated this tendency in (9c). A form like [ja:¹nys] ‘Janus’, appearing in (8), instantiates this tendency. One of the oldest constraints of the generative theory of stress is a constraint excluding branching constituents from a dependent position. It is one of the cornerstones of the theory of stress developed in Hayes (1980).

(16) QUANTITYSENSITIVITY (QS)

If a constituent at the projecting level branches, then it may not occupy a dependent position in the foot.

Now consider the representation of the word ‘Janus’, given in (17).

(17) representation of [ja:¹nys]



The vowel [y] is a high, lax vowel. As far as *NON-HEAD/HIGH-SON is concerned, this vowel could therefore be located in a dependent position. And yet, in the representation in (17) it does not. This is a consequence of the constraint QS. The final consonant requires a mora, creating a branching constituent. Due to QS, this branching constituent should not occupy a dependent position in the foot. Not being allowed in a dependent position, the branching constituent cannot be parsed at the level of the foot. It can therefore only be parsed at the two lower levels. The preceding syllable receives *two* asterisks above the moras, because of Minimal Size.

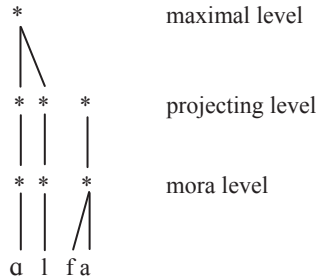
I now have explained the regularities formulated in (9a-c). The central hypothesis is that in the Limburgian dialects two constraints are very important: *NON-HEAD/HIGH-SON, which excludes vowels of relatively high sonority from a dependent position, and QS, which excludes branching constituents from a dependent position in the foot. In the case of the posttonic high vowels *one branching* projecting constituent is created to the left of the stressed syllable, as shown in (15). 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 stressed syllable, as shown in (14) and (17).

This leaves us with the tendency we have formulated in (9d). I have shown that words with a stressed closed syllable which is followed by a voiceless onset always have Accent 2. A representative example is [ɑl²fɑ] ‘alpha’, appearing in (6a). This tendency is so strong that it overrules any other tendency. Stated differently, in closed syllables that are followed by an onset, Accent 1 is only allowed if the onset contains a voiced consonant, as in [kʏr¹zɔr] ‘cursor’ (8), for instance.

Words like [ɑl²fɑ], with Accent 2 in a closed penult position, must have a representation similar to [ba:²mi] (15), and they exclude a representation similar to the one of [ka:¹no] (14). The latter representation is the one we expect, because the final vowel in [ɑl²fɑ] is highly sonorous.

Suppose [ɑl²fɑ] were to have Accent 1. It would then have the following representation:

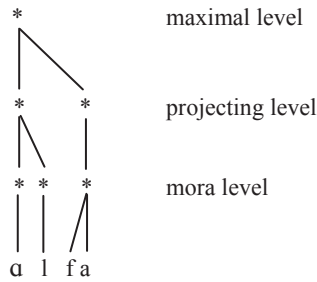
(18) (incorrect) phonological representation of [a²fa]



Apparently, a sonorant consonant in the coda position only allows a mora in the head position at the projecting level if it is followed by a voiced onset (Van Oostendorp 2005). Let us assume that sonorant consonants at the head level 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 (9d) 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 a head mora. This implies that Accent 1 is not possible. The representation of [a²fa], then, must be as follows:

(19) (correct) representation of [a²fa]



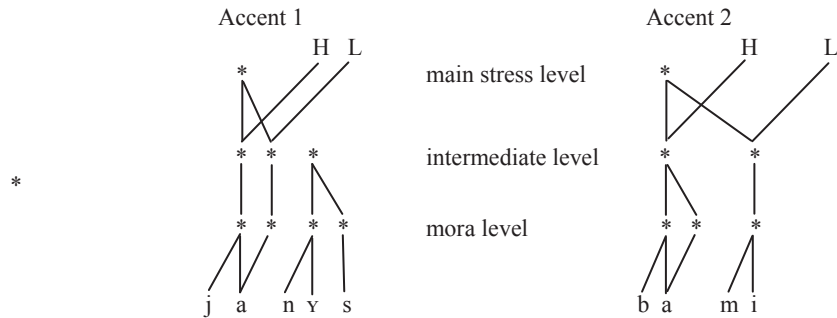
The foot now dominates the highly sonorous vowel in the unstressed position. The vowel must be dominated by the foot because of Minimal Size, which means that the foot must have two daughters. Since the sonorant consonant cannot constitute a daughter of the foot, the vowel [a] must function as a daughter. In order to ensure that a foot dominates a highly

sonorous vowel in unstressed position we have to rank the constraint *NON-HEAD/ HIGH-SON below two other constraints: the constraint which requires that a sonorant consonant in head position be licensed by Voice, and the constraint which requires that a foot be minimally binary.

Having explained the difference between Accent 1 (two non-branching constituents at the projecting level) and Accent 2 (one branching constituent at the projecting 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 lexical tone. To account for this difference we just have to say that the declarative melody HL is carried by the asterisks at the projecting level. This yields the tonal difference between Accent 1 and Accent 2. We illustrate this with the representations in (20).

(20) *tonal difference between Accent 1 and Accent 2 in declaratives*

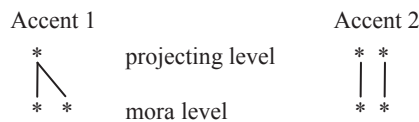


In [ja:¹nys] the two tones of the declarative melody are both assigned to the long vowel, creating a falling pitch phonetically. In the case of [ba:²mi], however, the two tones of the declarative melody are assigned to two different vowels, located in separate syllables. The first vowel carries the high tone, creating a level high tone phonetically. The second vowel carries the low tone of the declarative melody.

I have now explained all the facts of the preceding section in terms of prosodic constituents. An important conclusion is that Accent 1 contains two non-branching constituents at the projecting level, whereas Accent 2 contains one branching constituent at the projecting level. To explain the facts of the preceding section it is not necessary to refer to tone. In fact, the most important tendencies formulated in (9a-c) cannot possibly be explained in terms of tones only, because tones cannot directly refer to properties of the preceding 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:

(21) *Accent 1 and Accent 2 at the underlying level, expressing lexical contrasts*



In the phonology of borrowings we need these representations to account for the rather rare exceptions to the general patterns. In the phonology of native items, which I haven't explored due to lack of space, we need them to express the contrast between Accent 1 and Accent 2 before a schwa, and in monosyllabic words.

5 Conclusion

I have shown that the distribution of the tonal accents is often predictable. If a stressed syllable is followed by a high vowel, then it favors 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 in terms of tones only. They can only be explained with prosodic constituents. Concretely I have proposed that Accent 1 is a (phonetic) syllable containing two non-branching constituents at the projecting level, whereas Accent 2 is a (phonetic) syllable containing one branching constituent at the projecting level. These representations are necessary to account for the regularities we can observe. If they are needed on independent grounds it is also possible to use them to express the lexical contrast. Lexical tones are therefore superfluous.

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