

# *The too-many-solutions problem in OT in a representational perspective*

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## *III Preparing the grid*

### *Goal of this meeting*

In this session I will prepare the ground for the next two talks. I will discuss a velarisation process that applies in some Ripuarian dialects. I will show that the puzzling relation between tonal structure and segmental structure can best be understood if we adopt an abstract level of representation, the grid. With the grid we can distinguish between two types of empty syllable; those interfering with foot structure, and those not interfering. Empty syllables that do interfere with foot structure are gridded, whereas those that do not are empty at all levels; the segmental level, the tonal level and the grid level. Having shown in this session that we need something like the grid we can use this mode of representation in order to understand the phenomena we will have to deal with in the next two talks: Italian metaphony and West Germanic gemination.

### *Steps in the presentation*

- A paradoxical chain
- A brief sketch of the history of the Limburgish/Rheinish tone accents
- Velarisation; the data
- Analysis of Aachen
- Analysis of Cologne
- Motivating the grid with intonation

### *A paradoxical chain*

In some dialects of the Rheinisch-Limburgish tonal area coronal stops are changed into a velar under Accent 1. Since Accent 1 is phonologically HL this seems to indicate that Low tone implies Velarity:

(1) L → Velar

Some facts suggest that Velarity prefers Voicelessness. Dutch, for instance, lacks velar voiced stops, although it does have stops at the other major places. Also, Blevins (2004) argues that velars tend to devoice earlier in final position than the obstruents at other places of articulation. These facts seem to suggest that Velar implies Voicelessness.

(2) Velar → [-voice]

We also know that Voicelessness favours high tone. This seems to indicate that the following implication also holds:

(3) [-voice] → H

We thus seem to create a paradoxical chain.

L → Velar → [-voice] → H

Here we will argue that the first step of the chain is not correct.

### Sketch of our approach

In polysyllabic forms Accent 2 was changed into Accent 1 if a vowel followed, and the intervocalic consonant was voiced;

In polysyllabic structures velarisation took place;

There is *no causal relation* between Accent 1 and velarisation. The latter happens to apply in an environment where Accent 1 was created.

### A brief sketch of the history of the Limburgish/Rheinish tone accents

Historically, Rheinish/Limburgish dialects developed two distinct ‘accents’. Long mid and long low vowels received Accent 1; long high vowels received Accent 2 (Frings 1913, 1916, Gussenhoven 2000, Schmidt 1986, 2002, de Vaan 1999, Boersma 2006). The following (modern) Limburg forms still show the difference:

(4)	mid and low vowels	high vowels
	jɔ: <sup>1</sup> r ‘year’	f i: <sup>2</sup> n ‘fine’
	pɔ: <sup>1</sup> l ‘pole’	wi: <sup>2</sup> f ‘wife’
	ʃɔ: <sup>1</sup> p ‘sheep’	wi: <sup>2</sup> s ‘wise’
	de: <sup>1</sup> f ‘thief’	hu: <sup>2</sup> s ‘house’
	le: <sup>1</sup> f ‘dear/sweet’	mu: <sup>2</sup> r ‘wall’
	bo: <sup>1</sup> k ‘book’	mu: <sup>2</sup> s ‘mouse’
	do: <sup>1</sup> k ‘cloth’	hy: <sup>2</sup> r ‘hire’
		sty: <sup>2</sup> r ‘wheel’
		vy: <sup>2</sup> r ‘fire’

(5) The low tone of an unstressed syllable spreads to the stressed syllable, a kind of tonal metaphony, or stress dependent harmony. Spreading can only take place through a voiced consonant, sonorant or obstruent.

	stem + suffix		
	underlying representation		at some point in history, but also in synchronic grammars
	H L		H L
	/\		/\
	μ μ μ		μ μ μ
	\ /		\ /
	f i n ə		f i n ə

***Velarisation in Aachen and Cologne; the data***  
***Aachen***

The Aachen data are from Hermanns (1970) and/or Welter (1929, 1933).

- (6) These forms show that a coronal (nasal) is sometimes velarized. When that happens the long high vowel is shortened.

fi: <sup>2</sup> n	fiŋ <sup>1</sup>	fiŋ <sup>1</sup> ə	‘fine, pred./fem./masc.’
ri: <sup>2</sup> n			‘Rhine’
ʃi: <sup>2</sup> n	ʃiŋ <sup>1</sup>	ʃiŋ <sup>1</sup> ə	‘shine, N.sg./V.1st.p./V.inf.’
wi: <sup>2</sup> n	wiŋ <sup>1</sup>		‘wine, sg./pl.’
bru: <sup>2</sup> n	bruŋ <sup>1</sup>	bruŋ <sup>1</sup> ə	‘brown, pred./fem./masc.’
tsu: <sup>2</sup> n	tsyŋ <sup>1</sup>	tsyŋ <sup>1</sup> ə	‘fence, N.sg./pl./V.inf.’
katu: <sup>2</sup> n	katuŋ <sup>1</sup>	katuŋ <sup>1</sup> ə	‘cotton, A. pred./fem./masc.’

Facts of the type given in (6) have lead people to assume that there is a relation between accentual structure and velarisation, with Accent 1 somehow triggering velarisation.

(7)	piŋ <sup>1</sup>		‘pain’
	liŋ <sup>1</sup>	liŋ <sup>1</sup> ə	‘line, N.sg/V.inf.’
	triŋ <sup>1</sup>		‘Katherine’

- (8) The forms on the left show that non-coronals are not velarized. The forms on the right show that nothing happens if the coronal is intervocalic and follows a short vowel.

fi: <sup>1</sup> məl	‘whining woman’	tsɪn <sup>1</sup> ə	‘tin, A.’
tsi: <sup>1</sup> məl	‘end’	fɛn <sup>1</sup> ək	‘penny’
tsu: <sup>1</sup> məl	‘slow girl’	dæ <sup>1</sup> nə	‘fir, A.’

- (9) The forms on the left show that nothing happens after (historically) long non-high vowels. The forms on the right show that velarization does not apply if the coronal is in final position and follows a short vowel.

leə <sup>1</sup> n	‘bannisters’	kɪn <sup>1</sup>	‘chin’
feə <sup>1</sup> n	‘rancid’	tsɪn <sup>1</sup>	‘tin’
luə <sup>1</sup> n	‘wages’	dɛn <sup>1</sup>	‘threshing floor’
fa: <sup>1</sup> n	‘flag’	dʏn <sup>1</sup>	‘thin’

***Cologne***

The Cologne data are from Hönig (1905) or Frings (1916) or Ségéral and Scheer (2001).

(10) fi: <sup>2</sup> ŋ	fiŋ <sup>1</sup>	fiŋ <sup>1</sup> ə	‘fine, pred./fem./masc.’
ri: <sup>2</sup> ŋ			‘Rhine’
ʃi: <sup>2</sup> ŋ	ʃiŋ <sup>1</sup>	ʃiŋ <sup>1</sup> ə	‘shine, N.sg./V.1st.p./V.inf.’
wi: <sup>2</sup> ŋ	wiŋ <sup>1</sup>		‘wine, sg./pl.’
bru: <sup>2</sup> ŋ	bruŋ <sup>1</sup>	bruŋ <sup>1</sup> ə	‘brown, pred./fem./masc.’
tsu: <sup>2</sup> ŋ	tsyŋ <sup>1</sup>	tsyŋ <sup>1</sup> ə	‘fence, N.sg./pl./V. inf.’
katu: <sup>2</sup> ŋ	katuŋ <sup>1</sup>	katuŋ <sup>1</sup> ə	‘cotton, A. pred./fem./masc.’

In both dialects velarisation also applies in dental clusters after a short vowel. Here are some examples from *Cologne*. (Unfortunately I do not have examples from Aachen).

bʊŋk	‘colorful’	cf. standard German	bunt
pɪŋk	‘pint’	cf. standard German	pintə

As in Aachen, velarisation does not apply in Cologne after a (historically) long non-high vowel.

(11) some differences between the two dialects

<b>Cologne</b>		<b>Aachen</b>	
wik	‘wide’	wi: <sup>2</sup> t	‘wide’
tsik	‘time’	tsi: <sup>2</sup> t	‘time’
huk	‘skin’	hu: <sup>2</sup> t	‘skin’
bruk	‘bride’	bru: <sup>2</sup> t	‘bride’
ʃnig <sup>1</sup> ə	‘cut’	ʃnij <sup>1</sup> ə	‘cut, V’
rig <sup>1</sup> ə	‘ride, V’	rij <sup>1</sup> ə	‘ride, V’
lyg <sup>1</sup> ə	‘ring, V’	luw <sup>1</sup> ə	‘ring, V’
lyk <sup>1</sup>	‘people’	ly: <sup>1</sup>	‘people’

### *Analysis of Aachen*

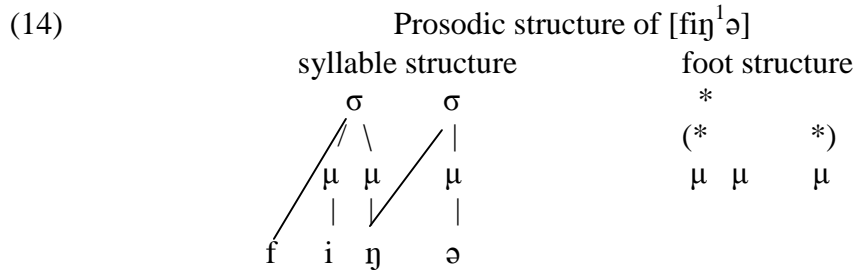
(12)	stem	stem + suffix
	H	H L
	/ \	/ \
	μ μ	μ μ μ
	\ /	\ /
	f i n	f i n ə

Underlying /fi:<sup>2</sup>n/ remains unchanged in Aachen. Underlying /fi:<sup>2</sup>n+ə/ is changed into [fiŋ<sup>1</sup>ə]. Notice that two segmental processes apply: velarisation and shortening. A third change applies at the tonal level. The branching high tone becomes non-branching. This is a consequence of the low tone of the suffix that must spread in order to get linked to the stressed syllable.

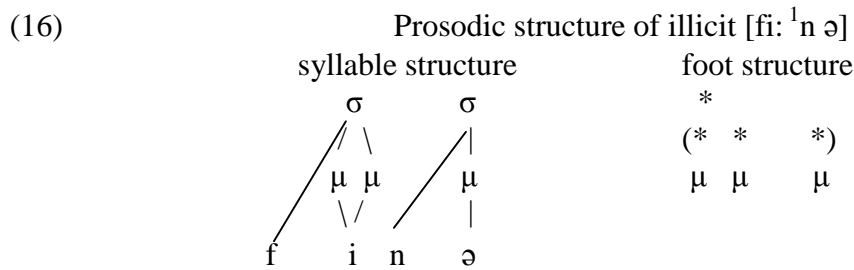
(13) Strategy:

Suppose that /fi:<sup>2</sup>n+ə/ would remain unchanged at the segmental level. That would create an *uneven trochee*. We propose the following analysis:

- the vowel is shortened in order to create an even trochee;
- moras must be preserved;
- the nasal must spread to occupy the mora left by the shortened vowel;
- a nasal in ***weak*** coda position must be Velar (on velarisation in function of CODAWEAKENING cf. Van Oostendorp 2000, 2001).



(15) We assume that consonants do not allow a mora to project a gridmark. Under this assumption shortening (accompanied by velarisation) changes an uneven trochee into an even one. The structure in (14) is more harmonic than the one in (16).



So, the idea is that the **grid determines what an even or uneven trochee is**, not the number of moras. If the number of moras would be counted, then the transition from (16) to (14) would not be a harmonic improvement.

(17) To guarantee that Trochaic shortening *must* be accompanied by velarisation we propose: CODAWEAKENING » \*UNEVENTROCHEE (cf. (29) for the *necessity* of this ranking).

To ensure that Trochaic shortening *can* be accompanied by velarisation we must have: \*UNEVENTROCHEE » MAX(Cor).

The grammar of Velarisation, therefore, is as follows:

CODAWEAKENING » \*UNEVENTROCHEE » MAX(Cor).

(18) CODAWEAKENING » \*UNEVENTROCHEE » MAX(Cor)

$\mu\mu \mu$ fi : nə	CODA WEAKENING	*UNEVEN TROCHEE	MAX(Cor)
* (* *) $\mu\mu \mu$ fi n ə	*!		
* (* *) $\mu\mu \mu$ fi ŋ ə			*
* (* **) $\mu\mu \mu$ fi: nə		*!	

The two Ripuarian dialects we are considering here (Aachen and Cologne) are in many respects innovative. Let us compare them with the most conservative dialects of the region. These are the dialects of the adjacent Limburg region (in the Netherlands).

(19) In Limburg the structure in (16) is just fine. We propose that in Limburg dialects the constraint against uneven trochees is lower ranked than the constraint against moraic consonants. This blocks vowel shortening. *What is fine in Aachen is bad in Limburg.*

(20) Aachen ranking:  $*\text{UNEVENTROCHEE} \gg C_\mu$                       Limburg ranking  
 $C_\mu \gg * \text{UNEVENTROCHEE}$

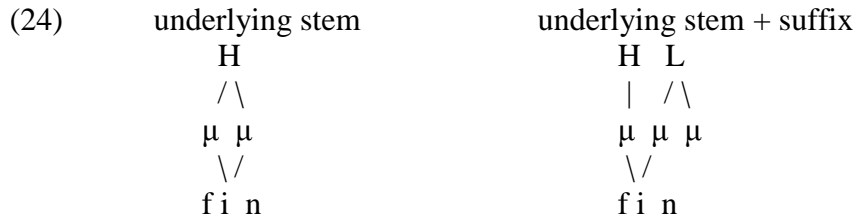
(21)  $*\text{UNEVENTROCHEE} \gg C_\mu$

$\mu\mu \mu$ fi : nə	$*\text{UNEVEN}$ TROCHEE	$C_\mu$
* (* *) $\mu\mu \mu$ ↵ fi η ə		*
* (* * *) $\mu\mu \mu$ fi : n ə	*!	

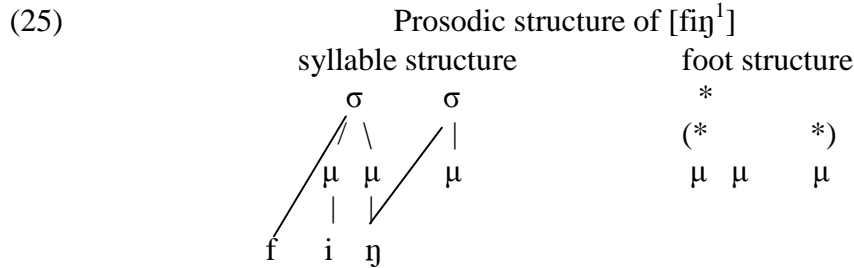
(22)  $C_\mu \gg * \text{UNEVENTROCHEE}$

$\mu\mu \mu$ fi : nə	$C_\mu$	$*\text{UNEVEN}$ TROCHEE
* (* *) $\mu\mu \mu$ fi η ə	*!	
* (* * *) ↵ $\mu\mu \mu$ fi : n ə		*

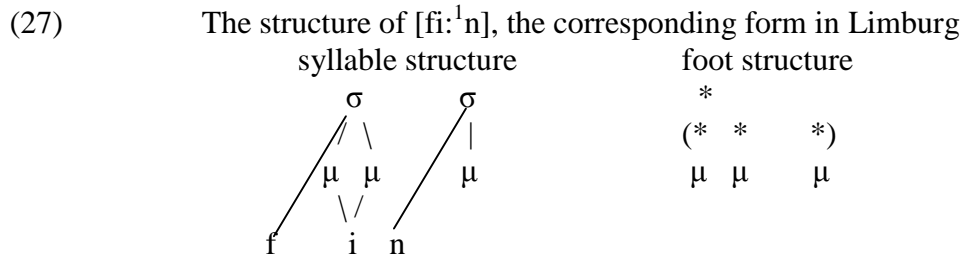
(23) What explains the shortening in *fiη<sup>1</sup>*? Historically, forms of this type had a schwa. We propose that in these forms there still is a low tone suffix. Underlyingly we have the representation:



The following prosodic structure is built:



(26) In Limburg there is no vowel shortening, although there IS a tonal change. We thus get [fi:<sup>1</sup>n] in Limburg. At the underlying level Limburg is identical to Aachen; both Limburg and Aachen have a suffix WITH tone, but WITHOUT segmental content. The ranking  $C_\mu \gg *UNEVENTROCHEE$  explains why there is no vowel shortening in Limburg.



(28) Why no shortening in [fi:<sup>1</sup>məl]?

Answer: Only coronals can be changed into velars; underlying labials cannot lose their place. We express this with the ranking:  $MAX(Labial) \gg *UNEVENTROCHEE$

(29) CODAWEAKENING,  $MAX(Lab) \gg *UNEVENTROCHEE$

μμ μ fi : məl	CODA WEAKENING	MAX(Lab)	*UNEVEN TROCHEE
* (* *) μμ μ fi m əl	*!		
* (* * *) μ μ μ fi : məl			*
* (* *) μμ μ fi η əl		*!	

(30) Why no velarisation in [kɪn<sup>1</sup>]? One possible approach is to say that this is not a weak-enough coda; it is a dependent in a *monosyllabic* stressed syllable. This distinguishes it from a coda in a ‘bisyllabic’ form, like *fiŋ*<sup>1</sup>. Here the coda must be weaker. We have to assume, then, that there is an array of weak positions, and in Aachen (and also Cologne) only *weak codas in bisyllabic forms are sufficiently weak to allow velarisation*.

(31) Why doesn’t velarisation apply in [tsɪn<sup>1</sup>ə]? This seems clear, because in forms of this type the intervocalic consonant does not occupy the coda at all. The stressed vowel is short, so there is no violation of \*UNEVENTROCHEE. Hence there is no need to shorten the vowel. Therefore, there is no mora coming loose, which needs to be filled by the intervocalic consonant.

(32) Why doesn’t velarisation apply after a (historically) long non-high vowel? A form like *feə*<sup>1</sup>*n* in Aachen, for instance, would not change its coronal, not even in the fem. Here we can do no better than to say that non-high vowels like to be bimoraic.

An informal version of this constraint:

(33) Non-high → two moras

Obviously, this constraint must dominate \*UNEVENTROCHEE, otherwise long non-high vowels would be shortened in the appropriate environment. On the other hand, it must be dominated by DEP-mora, otherwise all non-high short vowels would become long. We will not work out the details (perhaps you can do that yourself).

(34) Conclusion so far:

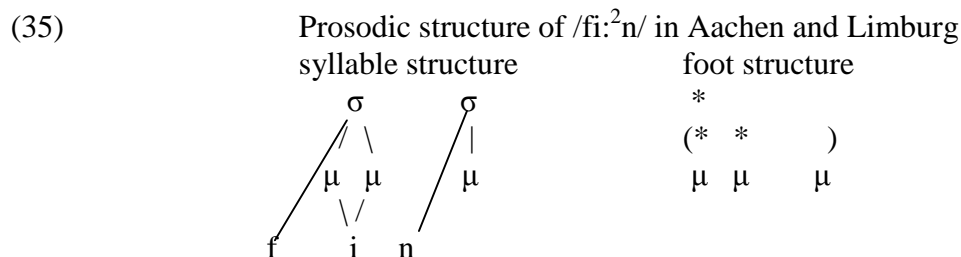
Velarisation has nothing to do with tonal structure. It is triggered by the tendency to create even trochees. In the environment where Velarisation applies Accent 1 happens to be present. There is no causal relation between Accent 1 and Velarisation, contra Frings (1916). *This breaks the paradoxical chain*.

### Analysis of Cologne

In Cologne velarisation also applies under Accent 2! This is a big difference with Aachen.

How do we handle velarisation in this environment in Cologne?

We assume that superheavy syllables are bisyllabic, really. The syllable structure of /fi:<sup>2</sup>n/ in Aachen and Limburg:



(36) We propose that in these dialects *empty syllables do not interact with foot structure*. We will express this with the grid; *empty syllables are not represented on the grid*. This is a

consequence of the fact that gridded positions must be relatively sonorous. Here the following two constraints are relevant:

- (37) a)  $\mu_{\text{HEAD}} \rightarrow *$   
 A head-mora must have a gridmark
- b)  $* \rightarrow \text{RN}$   
 A gridmark must have a root node

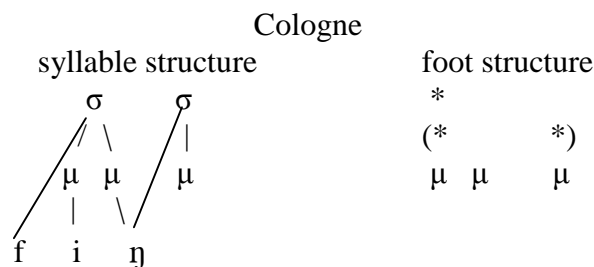
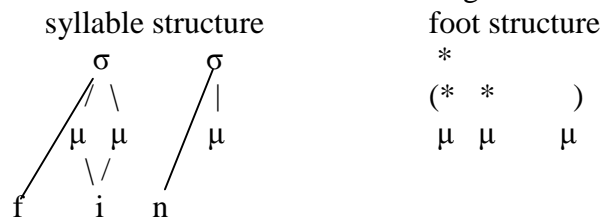
Aachen/Limburg versus Cologne rankings;	
Aachen/Limburg	Cologne
$* \rightarrow \text{RN} \gg \mu_{\text{HEAD}} \rightarrow *$	$\mu_{\text{HEAD}} \rightarrow * \gg * \rightarrow \text{RN}$

(38) Aachen/Limburg contra Cologne

- In Aachen/Limburg empty syllables do not project a gridmark. Hence, they do not interfere with foot structure. Therefore, empty syllables do not create an uneven trochee after a long vowel.
- In Cologne *empty syllables do project a gridmark*. Hence, they do interfere with foot structure. Consequently, there is pressure to create an even trochee.

(A note of warning: if you have attended my first class you might notice that Cologne is an ‘impossible system’. Study the handout of the fourth session of my first class to see the problem. I admit I do not know how to solve this).

(39) Prosodic structure of /fi:<sup>2</sup>n/ in Aachen/Limburg and Cologne



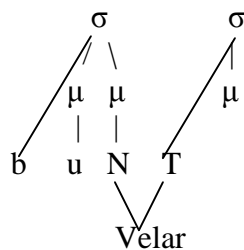
(40) For Cologne one other ranking is crucial:  $\mu_{\text{HEAD}} \rightarrow * \gg C_{\mu}$ . This ranking ensures that empty syllables induce vowel shortening (and velarisation).

$\mu_{\text{HEAD}} \rightarrow * \gg C_{\mu}$		
$\mu\mu$ fi : n	$\mu_{\text{HEAD}} \rightarrow *$	$C_{\mu}$
* (* * ) $\mu \mu \mu$ fi : n	*!	
* (* *) ☞ $\mu\mu \mu$ fi $\eta$		*

(41) Notice that empty syllables with a Low tone *do have a root node*, because there is a tone. Therefore, in Aachen/Limburg an empty syllable of this type does project a gridmark. Only in Aachen does this lead to shortening and velarisation (cf. (26)).

(42) Why do dental clusters velarize, as in *bunt* (standard German)  $\rightarrow$  *buŋk* (Cologne)? Forms of this type are bisyllabic, really, with the second syllable being empty. In such an environment the coda consonant is so weak that velarisation is required. Since the place features of the coda must be licensed by the onset, the latter must give up its place features, and velarize too.

(43) The syllable structure of [buŋk]



### Conclusions:

- i. There is no causal relation between tonal/accental structure and velarisation. This allows us to get rid of the paradoxical chain.
- ii. The major difference between Aachen and Cologne is explained in terms of the relation between syllable structure and the grid dimension. In Aachen empty syllables do not project on the grid, unless they have a tone (so that they are not really empty), whereas in Cologne they do project on the grid.
- iii. In fact there are three types of 'inaudible' syllables: a) those that have tone (and also project on the grid), b) those that do not have tone, but do project on the grid (as in Cologne), c) those that do not have tone, and do not project on the grid (as in Aachen).
- iv. Velarisation is a process applying in weak codas. These are the codas that are followed by another syllable (which might be empty).
- v. Velarized consonants are essentially geminates (or partial geminates in the case of consonant clusters), a conclusion that also has been reached by Ségéral and Scheer.

### Motivating the grid with intonation

Recall from (4) that high vowels create Accent 2, whereas low and mid vowels create Accent 1. Assume the constraint:

(44) \* → Open

Now high vowels avoid a gridmark. On the grid Accent 1 and Accent 2 are as follows:

(45)	Mid and Low vowels	High vowels
	*	
	* *	*
	VV	VV

In the Northwest (of the tone area) each gridposition can be an independent tone bearing unit. In declaration Accent 1 is realized as HL and Accent 2 as Level High.

(46)	The tonal representation in declaration (Northwest)
	*
	* *
	VV
	H L

*
VV
\ /
H

In question intonation both accents receive a LH melody, but in the case of Accent 1 this melody is tautosyllabic; in the case of Accent 2 it is bisyllabic.

(47)	The tonal representation in questions
	*
	* *
	VV
	L H
	ʃɔ <sup>1</sup> pə ‘sheep (pl)?’

*	*
VV	V
\ /	
L	H
h u u z <sup>2</sup> ər ‘house (pl)?’	