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Effects of Focus Distribution, Pitch Accent and Lexical Stress on the Temporal Organization of Syllables in Dutch

Abstract

In recent developments in phonological theory two independent representations for prosodic prominence are needed in languages such as Dutch and English. A nonculminative autosegmental structure with high and low tones accounts for pitch accents in focused constituents, whereas a culminative metrical structure which is phonetically coded in relative duration accounts for the lexical stress position in a word. The most far-reaching consequence following from this proposal is that relative temporal structure of a word does not change if a pitch accent is shifted to an unstressed syllable. Our results show that, if a pitch accent is shifted (through focus manipulation) from the stressed onto the unstressed syllable, rhyme durations are more or less inverted. Therefore, the assumption of completely independent tonal and metrical structure is largely untenable. However, our results also show a small residual effect of the original stress pattern after the accent shift, which can be accounted for by a metrical grid representation.

1. Theoretical Background

It is a general characteristic of many languages that certain syllables are felt to be more prominent than others, whether in isolated words or in continuous speech. Such prosodically prominent syllables stand out from their

environment due to (among other things) pitch changes, increased vocal effort (intensity), and longer duration.

Publications on prosodics in generative phonology are generally concerned with either metrical structure [Nespor and Vogel, 1986; Baart, 1987; Kager, 1989], or tonal structure

[Pierrehumbert, 1987; Gussenhoven, 1988]. Implicit in such work is the hypothesis that there exists a notion of 'prosodic prominence', and that one representation, be it metrical or autosegmental, will be able to account for all types of prosodic prominence.

More recently, linguists have come to realize that at least two types of abstract prominence structure have to be distinguished: tonal prominence (the abstract representation of pitch accents) and metrical prominence (the abstract representation of temporal organization) [Neijt, 1990].

It is theoretically unclear at this moment whether tonal and metrical prominence structures are independent or interact, and in the latter case, how. The present article explores some of the phonetic consequences of proposals that have been suggested in the phonological literature on possible interactions between tonal and metrical prominence. Less phonologically oriented phoneticians might be inclined to dismiss the need for the present study on the grounds that its results are obvious from everyday experience with speech signals. However, given the apparent ease with which phonologists have come up with a variety of prominence representations with various dependencies among them, we feel an urge for substantive experimentation to provide a factual basis for such theoretical work.

Tonal structure is the succession of high and low tones in a sentence [Gussenhoven, 1988]. If a particular tone is accent-lending, the syllable (or larger unit) carrying the accent is put in focus, i.e., made communicatively important. Phonetically, an accented syllable is characterized by a fast pitch movement (rise, fall or both) [t Hart et al., 1990]. Moreover, all the segments in the accented version of a word are pronounced longer than in the unaccented version, in stressed and unstressed syllables alike [Eefting, 1991].

Metrical structure is predominantly coded in the durational properties of syllable strings [Slootweg, 1988]. The lexically stressed syllable is the metrically most prominent syllable. This syllable has the longest duration (after normalization for inherent segment duration and linear position within the word). Prominence relations among syllables are expressed in one of two ways (or even both): as strong and weak nodes in a tree structure [Kiparsky, 1979] or as a metrical grid [Prince, 1983; Selkirk, 1984]. Most recently, Hayes [1993] argued that the optimal representation of metrical structure is the labeled grid, a compromise between grids and trees. Crucially, however, whether one uses trees or grids, all theories suggest, explicitly or implicitly, that metrical structure accounts for the relative duration of syllables (again disregarding influences of (co-)intrinsic segment duration and preboundary lengthening). 'The metrical grid alignment of a sentence is a representation in terms of which such things as the isochrony of stressed syllables and more generally the relative durations of syllables might be expressed' [Selkirk, 1984, p. 12].

Combining the theoretical views expressed above on the representation of tonal prominence and of metrical prominence, the conclusion seems warranted, and has in fact been advanced by Neijt [1990], that metrical structure determines relative duration of syllables within words and that the only temporal contribution of a pitch accent is linear expansion of the entire word. Data described in Nootboom [1972] support this conclusion. Nootboom varied stress positions in unaccented Dutch three-syllable nonsense words like /paɪpaɪpaɪ/. A stressed syllable was always longer than its unstressed counterpart in the same position. Moreover, when the same words were accented all the constituent syllables were linearly expanded in time. Re-analysis of the data reveals that the relative

syllable duration (percentage of word duration) remains almost identical in the conditions with and without an accent [Martens, 1992].

Neijt [1990] goes one step further by concluding that the contributions of metrical structure and accent to the temporal organization are completely independent. However, this conclusion might be premature. The literature data that were used in support of Neijt's view were exclusively based on experiments in which pitch accents occur on lexically stressed syllables. The conclusion that the relative duration of syllables is independent of accentuation can be based only on speech material with accents on unstressed syllables as well. The validity of this conclusion can only be tested if stress and accent are varied independently. There are three different linguistic views on the relation between duration and tone, each predicting a different outcome of such an experiment:

(1) *No Separate Representations for Meter and Tone; Meter Determines Tone.* According to this view, pitch accents are always placed on the metrically most prominent syllable. Tone structure is not represented on a separate level but it is just another acoustic correlate of metrical structure. This option was put forward by Chomsky and Halle [1968]. However, they based their rules only on neutral utterances whose accents always occur in stressed positions. We will not go into this option any further. The fact that there are constructions in which a contrastive accent is realized on an unstressed syllable [Bolinger, 1961] renders it unviable; this position will therefore not be pursued any further in this article. (The alternative possibility, i.e. a single prominence representation in which the position of pitch accents determines meter, has never been advanced by any linguistic theory.)

(2) *Separate Representations for Meter and Tone; Levels Do Not Interact.* According to

this view, duration and tone structures are represented on separate autonomous prosodic levels [Neijt, 1990]. Metrical constituent structure is reflected by the relative duration of the syllables. Tone structures are generated by the rules and conventions of autosegmental phonology [Gussenhoven, 1988]. Tonal prominence is brought about by a pitch movement on a constituent that places that constituent, or a larger constituent of which it is the prosodic head, in focus [Baart, 1987]. The prediction of this view is that contrastive accents do not affect the relative duration of the syllables, no matter where an accent is placed.

(3) *Separate Representations for Meter and Tone; Tone Determines Meter.* This view suggests that pitch accents are able to change not only absolute duration, but also the relative duration structure of words. Tone and duration therefore have separate prosodic levels but are not independent: lexically unstressed syllables carrying a pitch accent have to be made metrically prominent. This view predicts that the relative duration of syllables within a word is affected by shifting the accent onto an unstressed syllable. Selkirk [1984] endorses this view. In her opinion the metrical level accounts for the prominence relations and rhythmic organization of the various constituents. The assignment of a pitch accent, which may even be assigned to a weak syllable as in *cof-FEE* vs. *cofFIN*, changes the metrical structure: 'an accented syllable is more prominent (on the grid) than any syllable that is not associated with a pitch accent' [Selkirk, 1984, p. 152].

The main aim of our experiment is to choose between the remaining views (2) and (3). It is therefore necessary to know what happens to the relative duration of syllables when a (narrow-focus) accent is realized on a lexically unstressed syllable.

Accentuation is used to focus [Ladd, 1980; Baart, 1987], i.e., to highlight a word, a part of

a word or a word group. If the accent is on the prosodic head of the word group, it can highlight the whole word group ('broad focus' or 'integrative focus' or just the word containing the accent ('narrow focus')). Normally a pitch accent is assigned to the stressed syllable of such a prosodic head. A pitch accent on an unstressed syllable is found only when syllables rather than morphemes are being contrasted. Consider the following example (accented syllables in capitals, material in focus in square brackets, [...]_{+F}):

- (1) I said 'cof[FIN]_{+F}', not 'cof[FEE]_{+F}'.

In order to choose between the views described above, we get speakers to produce pitch accents on stressed and unstressed syllables. In the latter case the presence of a pitch accent always has to be interpreted in metalinguistic terms. We compare the duration of words with an accent on the unstressed syllable, with words with an accent on the stressed syllable. An accent on the stressed syllable can express a narrow focus on this syllable, necessarily with a metalinguistic interpretation:

- (2) Did you say '[COF]_{+F}fin' or '[MUF]_{+F}fin'?
I said '[COF]_{+F}fin'.

If the same contrast is made in a sentence as in (3) where *a* is added, we can still speak of a metalinguistic situation. However, depending on the situation in which the sentence is uttered, the contrastive accent on the stressed syllable can also express focus on the word, rather than on the syllable, as in (4). In this latter case we do no longer speak of a metalinguistic situation. Selkirk [1984, p. 271] states 'Perhaps the generalization is that pitch accents can be assigned to anything of word level or below, but that a pitch-accent-bearing element is only interpreted along the lines of a normal focused constituent when it has an identifiable separate meaning (i.e. is at least a morpheme [Sluijter

and Van Heuven]). When the pitch-accent-bearing element cannot be interpreted in this way, the presence of a pitch accent is interpreted instead in metalinguistic terms.'

- (3) I bought a [COFfin]_{+F}.
Did you say you bought a '[COF]_{+F}fin' or a '[MUF]_{+F}fin'?
I bought a '[COF]_{+F}fin'.
- (4) Did you buy a [COFfin]_{+F} or a [MUFfin]_{+F}?
I bought a [COFfin]_{+F}.

An accent on the stressed syllable can also express a broader focus on the whole word, whether used metalinguistically or interpreted along the lines of a normal focused constituent. For example, in (5) the whole word is in focus in a metalinguistic statement, whereas in (6) [as in (4)] the whole word is in focus in a normal focused constituent.

- (5) Did you say '[COFfee]_{+F} or '[TEA]_{+F}?
I said '[COFfee]_{+F}.
- (6) Did you eat a [MUFfin]_{+F} or a [HAMBURGER]_{+F}?
I ate a [MUFfin]_{+F}.

As was mentioned above we shall compare the temporal structure of words with an accent on the stressed syllable with the temporal structure of words with an accent on the unstressed syllable. Since accenting an unstressed syllable in a word is only possible in a metalinguistic statement, we used metalinguistic utterances for both conditions.

Although at first sight this type of speech data seems to be highly stylized and contrived, we have to face the fact that there is no other way to test the validity of the phonological theories mentioned above. We agree that it takes special circumstances for an accent to focus only on the lexically stressed or unstressed syllable, but metalinguistic statements may be of great communicative importance. For example, when talking in a noisy environment or

over a bad telephone line, listeners might miss a part of the message, e.g. a syllable crucial to the understanding of the message. In fact, there has been a recent surge of attention for this type of construction [Spring and Erickson, 1992; Van Heuven, 1994]. A conversation of the type: 'Did you say "thirty", or "thirteen"?' is therefore very well conceivable in the circumstances mentioned above.

We assume that there are no systematic acoustic differences in phonetic realization (in terms of duration and pitch) between constituents with a narrow-focus accent as in (2) and (3), placing the lexically stressed syllable in focus on the one hand, and constituents with an accent placing the whole word in focus as in (4), (5) and (6) on the other. We further assume that there are no differences between metalinguistically used accents as in (2), (3) and (5) as opposed to the accents used in (4) and (6). In order to obtain post-hoc support for these assumptions, the present article addresses a secondary methodological issue: if we find no difference in the durational pattern of words, forming part of a metalinguistic statement or a normal statement (3) and (5) versus (4) and (6), and no difference in either perception and/or phonetic realization of accents with different focal scope (3) versus (5), we shall accept that the above-mentioned phonological views can legitimately be tested on the basis of contrastive accents on individual syllables in metalinguistic statements. It would seem reasonable to assume that narrow focus on one syllable would prompt the speaker to lengthen this syllable relative to an identical syllable that forms part of a word that is focused entirely. However, there is no difference in the phonological representation of these two constructions. Therefore, on the basis of the phonological representations we do not expect a difference in acoustic realization.

Finally, the rhyme part of the syllable (including vowel and final consonants, but ex-

cluding initial consonants) is generally accepted as the linguistically relevant part for stress assignment in quantity-sensitive languages like Dutch and English [Van der Hulst, 1984]. It is therefore conceivable that the results will be more meaningful if we consider rhyme duration, rather than syllable duration, thereby removing an irrelevant source of variation introduced by the duration of the onset (i.e. initial consonants).

In summary, we focus on the following specific research question:

(i) Does the relative duration of a syllable (rhyme) in a word change when an accent is realized on an unstressed syllable of that word? In a production experiment we examined what happens to the (relative) duration of whole syllables and rhymes if the pitch accent is shifted from the stressed to the unstressed syllable.

Secondly, there is a methodological issue that we can split up in two specific questions that address the postulated exceptional status of the metalinguistic use of contrastive accents as opposed to normal focused constituents:

(ii) Is it true that there are no (duration) differences between constituents that form part of a metalinguistic statement and normally focused constituents?

(iii) Is it true that there is no difference in either perception and/or phonetic realization in terms of duration and pitch, between a contrastive (narrow-focus) accent on the lexically stressed syllable and an integrative accent on that syllable placing the whole word in focus?

The first methodological question was investigated in a production study in which speakers uttered sentences with normally focused constituents as in (4) and (6), and sentences with the same words in metalinguistic statements as in (3) and (5).

The second methodological question was investigated in a production study in which we varied the scope of the accent. In a subsequent

perception experiment, we examined if listeners were able to determine the focus domain of an accent as intended by the speaker.

2. Methods

2.1 Materials

2.1.1 Focus Conditions

As explained above in section 1, an accent on the prosodic head of the word group can highlight the whole word group ('broad focus' or 'integrative focus') or just the word containing the accent ('narrow focus'). In this study we applied the phonological distinction between narrow and broad focus on a lower level in the linguistic hierarchy: in our experiment, words and individual syllables were placed in either narrow or broad focus. When, in our material, a whole word is placed in focus, we use the term broad focus. Such broad focus is expressed by an integrative accent on the lexically stressed syllable of that word. Obviously, the lexically stressed syllable is considered here as the prosodic head of the word [Van Heuven, 1994]. If only one syllable in a polysyllabic word is placed in focus, expressed by a pitch accent on that syllable, we use the term narrow focus.

We need four experimental focus conditions to answer our questions. A condition in which no accent is realized on the target word was adopted as the baseline condition (no-focus condition: NF). The methodological question (iii) compares the phonetic realization of accents that differ in focal scope. Therefore, we needed a condition with an integrative accent on the target (broad-focus condition: BF) and a condition with a narrow-focus accent on the stressed syllable (stressed focus: SF). To answer the main question of this article we needed a condition in which an accent is realized on the unstressed syllable (unstressed focus: UF) to compare it with conditions BF and SF. As explained above, the relevant comparisons can only be made if target words or parts thereof are spoken in metalinguistic contrasts. To obtain the four focus conditions needed the following question-answer pairs were used yielding stimulus set I (accented syllables in capitals, material in focus in [square brackets]_{±F}; example target word: *portiek* 'doorway', finally stressed):

Set I: Metalinguistic Use of Contrasts

No focus on target (NF): focus on a word other than the target word, e.g.:

Q. Heb je portiek [geZEGD]_{±F} of [geSCHREven]_{±F}?
/hɛp jə pɔrti:k χəzɛχt ɔf χəsχreivə[n]/
'Have your doorway said or written down?'

A. Ik heb portiek [geZEGD]_{±F}
/ɪk hɛp pɔrti:k χəzɛχt/
'I have doorway said'

Broad focus on target (BF), expressed by an integrative accent on its lexically stressed syllable. The target word was contrasted with a word taken from the same semantical field, e.g.:

Q. Heb je [porTIEK]_{±F} of [DEUR]_{±F} gezegd?
/hɛp jə pɔrti:k ɔf dœr χəzɛχt/
'Have your doorway or door said?'

A. Ik heb [porTIEK]_{±F} gezegd.

Narrow focus on lexically stressed syllable (SF), expressed by a narrow-focus accent. The target word was contrasted with a word with an identical unstressed and a different stressed syllable, e.g.:

Q. Heb je por[TIEK]_{±F} of port[TAAL]_{±F} gezegd?
/hɛp jə pɔrti:k ɔf pɔrtal χəzɛχt/
'Have your doorway or porch said?'

A. Ik heb por[TIEK]_{±F} gezegd.

Narrow focus on unstressed syllable (UF), expressed by a narrow-focus accent. The target word was contrasted with a word with an identical stressed and a different unstressed syllable, e.g.:

Q. Heb je [POR]_{±F}ti:ek of [PLAS]_{±F}ti:ek gezegd?
/hɛp jə pɔrti:k ɔf plɑsti:k χəzɛχt/
'Have your doorway or sculpture said?'

A. Ik heb [POR]_{±F}ti:ek gezegd.

To answer the methodological question (ii) we used focus conditions NF, SF and BF, and changed the sentences to linguistic rather than metalinguistic statements by adding the indefinite article *een* /ən/ 'a' to the target words so that these functioned as the heads of noun phrases and by changing the verbs. The following question-answer pairs were used yielding stimulus set II:

Set II Linguistic Use of Contrasts

No focus on target (NF), e.g.

Q Heb je een portiek [geZIEN]_{+F} of
[geSCHILde]_{+F}?
/hɛp jə ən pɔrtɪk χəzɪn of χəsχɪldɛ/
'Have you a doorway seen or painted?'

A Ik heb een portiek [geZIEN]_{+F}
/ɪk hɛp ən pɔrtɪk χəzɪn/
'I have a doorway seen'

Focus on target (BF) e.g.

Q Heb je een [poiTIEK]_{+F} of een [DEUR]_{+I}
gezien?
/hɛp jə ən pɔrtɪk of ən dœr χəzɪn/
'Have you a doorway or a door seen?'

A Ik heb een [poiTIEK]_{+I} gezien

Focus on target but contrasted words only differ
in their lexically stressed syllable (SF) e.g.

Q Heb je een [porTIEK]_{+F} of een [porTAAL]_{+F}
gezien?
/hɛp jə ən pɔrtɪk of ən pɔrtal χəzɪn/
'Have you a doorway or a porch seen?'

A Ik heb een [porTIEK]_{+I} gezien

We used two words, final stressed *portiek* 'doorway' and initial stressed *bloknot* 'notepad'. It was not possible in all cases to embed all the target words in exactly the same sentence, because of differences in meaning. Moreover, the indefinite article *een* could not be added to all the target words and to all the words with which the target words were contrasted (For instance, the indefinite article cannot be combined with a mass noun such as *soldij* 'soldiers's wages'). We assume that *portiek* and *bloknot* do not differ in their behavior from the other target words and that we can base our conclusion on the results of these two words.

2.1.2 Stress Position and Rhyme Structure

The position of the stressed syllable in Dutch disyllabic simplex words depends on the complexity of the rhyme of the final syllable. If the final syllable contains a long vowel and at least one final consonant (superheavy syllable, cf. Kager [1989]), it is regularly

stressed. If the final syllable is open (light), stress regularly falls on the first syllable. As a consequence it is impossible to come up with segmentally identical structures differing in regular stress position. In such minimal stress pairs, one stress position will have to be marked as an exception. Since we also want to compare different stress positions across identical syllable structures, we need a 2x2 factorial design for our lexical material, as exemplified in table 1. Each cell in this stimulus matrix was filled with 2 or 3 lexical instantiations. The total metalinguistic set I consisted of 44 question-answer stimuli (4 focus conditions x 11 words). The linguistic contrasts in set II comprised 6 question-answer stimuli (3 focus conditions x 2 words).

2.2 Subjects and Procedure

The subjects for the production study were two phonetically trained native speakers of Dutch (one male, i.e. the second author, and one female, staff member of the Department of Linguistics/Phonetics of Leiden University). The speakers were recorded individually in a sound-insulated recording booth using a Sennheiser MKH-416 directional condenser microphone and a Revox B77 MKII tape recorder.

The stimuli of both stimulus sets were randomized and presented on six sheets of paper. Focus positions were underlined and had to be realized with an accent. It was not really necessary to mark the focus positions, since the position of accents was completely guided by the stimulus context. Speakers read all the question-answer pairs twice.

2.3 Acoustic Analysis and Measurements

Our data analysis is restricted to the answers of the question-answer pairs. The answers contain only a single rise-fall pitch configuration (so-called 'pointed hat' configuration [L&A in the intonation grammar of Dutch] [t Hart et al., 1990]). Two phonetically trained listeners (i.e. the present authors) verified the location and the realization of the accents. There was no disagreement on this point and every utterance could be used for further analysis.

The 176 target sentences of set I (11 target words x 4 focus conditions x 2 speakers x 2 repetitions) and 24 target sentences of set II (2 target words x 3 focus conditions x 2 speakers x 2 repetitions) were then digitized (10 kHz sampling frequency, 12 bit amplitude resolution, 4.8 kHz low-pass filtering, 96 dB/oct roll off) on a VAX/VMS computer. The digital wave

Table 1. Structure of the four word types used in experiment

	Initial stress		Final stress	
	<i>regular</i>		<i>exception</i>	
VC VV	versie	'version'	pigmee	'pigmy'
	/verzi:/		/piχmez/	
	pasta	'paste'	soldij	'pay'
	/pastaz/		/sɔldei/	
	saldo	'balance'	kandij	'candy'
	/saldoz/		/kandei/	
	Initial stress		Final stress	
	<i>exception</i>		<i>regular</i>	
VC VVC	potlood	'pencil'	portiek	'doorway'
	/pɔtloɔz/		/pɔrti:k/	
	bloknoot	'notepad'	parkiet	'parakeet'
	/blɔknɔ:t/		/parki:t/	
		fontein	fountain'	
		/fɔntein/		

form was analyzed into 18 LPC coefficients (256-point analysis window, 10 ms time shift) F_0 was determined using the method of subharmonic summation [Hermes, 1988], followed by an automatic tracking procedure. The F_0 curves were stylized (by the first author) into a minimal series of straight lines, such that the resynthesized pitch contour sounded identical to the (resynthesized) original. The perceptual identity of originals and stylizations was independently verified by the second author, who agreed with the first author's decisions in all cases. The excursion size in semitones (ST), F_0 slope (ST/s), duration (ms) of the accent lending pitch rise and pitch fall were determined in condition BF (focus on the word) and SF (focus on the stressed syllable only) of set I. Furthermore we determined the location of the rise onset relative to the vowel onset (ms), the location of the peak relative to the vowel onset and the location of the fall offset relative to the vowel onset in these conditions of set I.

Syllable and rhyme durations were measured in all conditions of both stimulus sets using the high resolution waveform editor SESAM [Broeder, 1990]. Segmentation boundaries were determined in a straightforward fashion by the visual criteria described in Van Zanten et al. [1991]. Relative syllable duration ($S\%_i$) was expressed as a percentage, for each syllable, by dividing its absolute duration (S_1 or S_2) by the word duration ($S_1 + S_2$).

$$S\%_i = (S_i / (S_1 + S_2)) \times 100$$

where $i = 1, 2$

Relative rhyme duration ($R\%_i$) was calculated by applying the same procedure to the duration of the rhyme portions.

$$R\%_i = (R_i / (R_1 + R_2)) \times 100$$

where $i = 1, 2$

3. Results

3.1 Global Presentation

Three-way analyses of variance were performed on both absolute and relative syllable and rhyme durations of the 176 target sentences of set I with focus and word type as fixed factors and speaker as a random factor, and with repetitions and lexical instantiations as repeated measures.

In table 2a mean absolute and relative syllable durations are broken down for the three independent variables speaker, word type and focus condition. In table 2b mean absolute and

Table 2a. Mean duration (in ms) of stressed and unstressed syllables and relative duration of stressed syllable (in % of word duration) per speaker, word type (see table 1) and focus condition

	Stressed syllable	Unstressed syllable	% stressed syllable
Speaker			
1	246 (47)	215 (51)	54 (9)
2	257 (43)	209 (54)	56 (8)
Word type			
VC-vv	266 (36)	184 (50)	60 (7)
vc-VV	218 (35)	254 (46)	46 (6)
VC-vvc	281 (42)	209 (34)	57 (5)
vc-VVC	251 (44)	201 (47)	56 (7)
Focus condition			
NF	221 (37)	170 (37)	57 (8)
BF	273 (42)	204 (33)	57 (6)
SF	277 (41)	202 (36)	58 (6)
UF	235 (33)	273 (41)	46 (7)

NF = No focus, no accent; BF = broad focus, integrative accent on stressed syllable; SF = narrow focus on stressed syllable, accent on stressed syllable; UF = narrow focus on unstressed syllable, accent on unstressed syllable. Standard deviations in parentheses.

Table 2b. Mean duration (in ms) of stressed and unstressed rhymes and relative duration of stressed rhyme (in % of total rhyme duration) per speaker, word type (see table 1) and focus condition

	Stressed rhyme	Unstressed rhyme	% stressed rhyme
Speaker			
1	156 (30)	128 (35)	55 (8)
2	159 (36)	123 (41)	57 (9)
Word type			
VC-vv	154 (20)	117 (36)	57 (8)
vc-VV	167 (29)	138 (36)	55 (9)
VC-vvc	160 (20)	158 (24)	50 (5)
vc-VVC	151 (49)	100 (29)	60 (9)
Focus condition			
NF	140 (28)	99 (28)	59 (8)
BF	166 (32)	123 (33)	58 (8)
SF	173 (32)	119 (31)	60 (7)
UF	152 (31)	162 (31)	49 (7)

For abbreviations see table 2a. Standard deviations in parentheses.

relative rhyme durations are broken down for the three independent variables.

Although the difference between the relative syllable duration of speakers 1 and 2 was statistically significant [$F(1, 174)=7.0, p=0.009$], there were no other statistically significant main effects or interactions involving the speaker factor.

The effect of word type on the absolute and relative duration of stressed and unstressed syllables and rhymes is predominantly due to the differences in syllable structure of the stressed and unstressed syllables of the four word types, and to the differences in stress position among the four word types [stressed syllable duration:

$F(3, 172)=9.7, p=0.047$; unstressed syllable duration: $F(3, 172)=34.4, p=0.008$; relative syllable duration: $F(3, 172)=17.6, p=0.021$; stressed rhyme duration: $F<1$; unstressed rhyme duration: $F(3, 172)=21.4, p=0.016$; relative rhyme duration: $F(3, 172)=2.2, n.s.$].

Focus distribution also affects the absolute duration of both rhymes and syllables. Syllables and rhymes in condition NF are always shorter than the same syllables and rhymes in conditions BF and SF. These latter two focus conditions have virtually the same durations. For each dependent variable, the difference in duration between the focus conditions is significant [stressed syllable duration: $F(3,$

Table 3. Rhyme and syllable durations (in ms) of the first (1) and second (2) syllable per word type (see table 1) and focus condition

Word type	Focus condition	Rhyme, ms			Syllable, ms		
		syllable 1	syllable 2	% stressed syllable	syllable 1	syllable 2	% stressed syllable
VC-vv (VERsie)	NF	147	80	65	240	131	65
	BF	162	121	58	291	179	62
	SF	165	115	59	291	178	62
	UF	140	154	48	243	247	50
VC-vvc (POTlood)	NF	151	128	54	252	166	60
	BF	169	160	51	309	207	60
	SF	168	160	51	307	207	60
	UF	150	183	45	256	254	50
vv-VV (PIGMEE)	NF	119	136	54	210	182	46
	BF	131	177	58	243	241	50
	SF	122	193	61	247	246	50
	UF	182	163	47	317	200	39
vc-VVC (porTIEK)	NF	79	130	62	170	220	57
	BF	92	155	62	187	264	58
	SF	91	165	63	177	274	61
	UF	135	155	53	269	247	48

The relative duration of the stressed syllable and of its rhyme is presented under ‘%’. The gray shading indicates the parts of the table where data of the stressed syllable are presented.

172)=53.6, $p=0.004$; unstressed syllable duration: $F(3, 172)=85.7$, $p=0.002$; relative syllable duration: $F(3, 172)=80.3$, $p=0.002$; stressed rhyme duration: $F(3, 172)=41.4$, $p=0.006$; unstressed rhyme duration: $F(3, 172)=72.2$, $p=0.003$; relative rhyme duration: $F(3, 172)=66.9$, $p=0.003$].

Given the significant interactions between focus and word type we shall examine the influence of focus on the duration structure of words for each word type separately [unstressed syllable duration: $F(9, 160)=6.0$, $p=0.007$; unstressed rhyme duration: $F(9, 160)=7.9$, $p=0.003$; stressed rhyme duration: $F(9, 160)=4.0$, $p=0.024$; relative rhyme duration: $F(9, 160)=23.4$, $p<0.001$, stressed syllable duration and relative syllable duration

were not significant: $F<1$ and $F(9, 160)=3.1$, $p=0.053$, respectively].

Table 3 presents mean absolute and relative rhyme and syllable durations collapsed over speakers, but broken down by word type and further by focus condition. We performed one-way analyses of variance on absolute and relative rhyme and syllable duration with focus condition as a fixed factor. Focus condition caused a significant effect on all the dependent variables, for all word types (all cases: $p<0.05$). Newman-Keuls range tests ($\alpha=0.05$) were used to make pairwise post-hoc comparisons between the means.

The presence or absence of an accent affects the duration of both stressed and unstressed syllables and rhymes. Normally ac-

cented words (condition BF) have significantly longer syllables than unaccented words (condition NF), in accordance with the earlier findings of Eefting [1991]. Crucially, however, the presence or absence of an accent does not systematically affect the *relative* duration of either rhymes or syllables. Newman-Keuls post-hoc analyses on S%₁ and R%₁ systematically group conditions NF, BF and SF together. The relative duration of the syllables is preserved if an accent is placed on the stressed syllable. These results confirm the view, explained in the general introduction, that metrical structure determines relative duration and that the only temporal contribution of an accent on the stressed syllable is linear time expansion.

The results answering our main research question will be discussed below in section 3.3. The results answering our methodological questions will be discussed separately, in sections 3.2 (question iii) and section 3.4 (question ii).

3.2 *Narrow-Focus versus Integrative Accents on the Lexically Stressed Syllable*

There is no difference in temporal organization of the syllables between the condition in which a narrow-focus (contrastive) accent was realized on the stressed syllable and the condition with an integrative (normal) accent on the same stressed syllable. Table 3 shows that syllable and rhyme durations, and therefore also onset durations, are identical for these conditions (BF versus SF). There is never more than a (statistically insignificant) mean difference of 14 ms between any rhyme or syllable pair. Therefore the narrow focus that a speaker wants to express on the stressed syllable is not realized by lengthening that syllable or changing its buildup relative to the same syllable with an integrative broad-focus accent. Obvi-

ously, the temporal structure is identical in both conditions.

Three-way analyses of variance were also performed on the excursion size (ST), duration (ms) and F₀ slope (ST/s) of the rise/fall configuration and on the location of the rise onset, peak and the fall offset relative to the vowel onset with focus condition (only two levels in these analyses) and word type as fixed factors and speakers as a random factor.

In table 4a mean excursion size (ST), duration (ms), F₀ slope (ST/s) of both pitch rise and pitch fall are broken down by speaker, word type and focus condition. In table 4b the location of the rise onset, the peak and the fall offset relative to the vowel onset are broken down for speaker, word type and focus condition.

Table 4a shows that there is no difference between speakers in the duration of the rise and the fall (both cases: F<1). Speaker 1 has somewhat larger excursion sizes of the pitch rise [F(1, 75)=13.0, p=0.001], whereas speaker 2 has a somewhat higher excursion size of the fall [F(1, 75)=3.0, p=0.09]. As a result, the rises of speaker 1 are steeper than those of speaker 2 [F(1, 76)=12.7, p=0.001]. The falls of speaker 2 are somewhat steeper than those of speaker 1 [F(1, 75)=14.0, p=<0.001].

Table 4b shows that there are no differences between speakers for the location of the rise onset, peak and fall offset relative to the vowel onset [rise: F(1, 77)=1.13, p=0.229, peak: F(1, 77)=3.53, p=0.065, and fall: F<1].

No systematic influence of word type was found on any of the dependent variables (all relevant comparisons: insignificant). Crucially, there were absolutely no differences between the two focus conditions (all relevant comparisons: F<1). The interactions between speaker and word type were significant for the slope of the rise and the fall [F(3, 70)=4.2, p=0.009 and F(3, 69)=19.4, p=0.001] and for the excursion size of the fall [F(3, 71)=4.0, p=0.011].

Table 4a. Mean excursion size (in ST), duration (in ms) and F₀ slope (in ST/s) of the accent-lending pitch rise (I) and pitch fall (A) per speaker, word type (only the rhyme part of the syllables is indicated, stress position in capitals) and focus condition

	Duration I	Duration A	Excursion I	Excursion A	Slope I	Slope A
Speaker						
1	185 (23)	227 (42)	9.6 (1.8)	11.5 (1.8)	53 (14)	52 (7)
2	190 (45)	223 (53)	7.9 (2.5)	12.0 (2.4)	43 (12)	56 (14)
Word type						
VC-vv	199 (26)	243 (48)	8.5 (1.3)	11.7 (1.9)	43 (7)	49 (8)
vc-VV	196 (11)	194 (25)	7.9 (1.6)	10.4 (0.9)	40 (8)	54 (7)
VC-vvc	175 (65)	219 (32)	9.8 (3.2)	11.8 (2.4)	54 (13)	64 (16)
vc-VVC	178 (24)	246 (54)	9.4 (2.4)	13.7 (1.8)	58 (16)	49 (7)
Focus condition						
BF	188 (31)	225 (47)	8.8 (2.1)	11.5 (2.0)	48 (14)	52 (10)
SF	186 (38)	225 (48)	8.8 (2.5)	12.0 (2.1)	48 (14)	54 (12)

Standard deviations in parentheses.

There were significant interactions between focus and word type for the duration of the fall [$F(3, 69)=41.9, p=0.006$] and the location of the pitch peak [$F(3, 71)=111.1, p=0.001$]. The remaining interactions were all insignificant. Because of the fact that there are no significant main effects of the factor focus, there is no need to examine the influence of focus on the shape and the duration of the pitch movements for each word type separately.

Generally speaking then, there is no influence of focus on the shape, the location and the duration of the pitch movements expressing an integrative accent or a narrow-focus accent.

In order to determine if there were no other likely acoustic properties expressing the differences between integrative accents and narrow-focus accents, we also ran a perception experiment in which listeners were asked to differentiate between narrow-focus accent and integrative focus accents. This experiment is reported in section 4.

3.3 Narrow Focus on Stressed Syllable versus Narrow Focus on Unstressed Syllable

Our crucial research question concerns the claim that duration structure will not be influenced by any type of accentuation. The relevant results are presented in table 3: condition SF versus UF. Shifting the accent from the lexically stressed syllable to the unstressed syllable changes both the absolute *and* relative duration of the two syllables and rhymes involved. In all cases the relative rhyme duration of the stressed syllable decreases by about 10 percentage points relative to the rhyme of the stressed syllable in the other focus conditions.

We therefore conclude that duration structure changes under the influence of a contrastive accent, and we reject the hypothesis that duration structure will not be influenced by any type of accentuation: Neijt's [1990] theory does not describe the facts. However, it would

Table 4b. Mean location of the onset of the accent-lending pitch rise (Location rise), the pitch peak (Location peak) and pitch fall (Location fall) relative to the vowel onset (in ms) per speaker, word type (only the rhyme part of the syllables is indicated, stress position in capitals) and focus condition

	Location rise	Location peak	Location fall
Speaker			
I	-136 (38)	49 (32)	276 (34)
1	-130 (55)	59 (33)	283 (42)
Word type			
VC-vv	-165 (46)	35 (30)	276 (42)
vc-VV	-114 (26)	82 (30)	277 (43)
VC-vvc	-119 (69)	56 (20)	275 (29)
vc-VVC	-138 (32)	39 (26)	285 (36)
Focus			
BF	-132 (37)	56 (29)	281 (44)
SF	-135 (54)	51 (36)	277 (31)

Standard deviations in parentheses.

be premature to immediately adopt Selkirk's [1984] theory in its entirety: let us again consider the relative duration structure of words with a narrow-focus accent on the stressed syllable and words with a narrow-focus accent on the unstressed syllable. We derive a straightforward prediction from Selkirk's [1984] theory described in the introduction: 'A syllable associated with a pitch accent is more prominent (on the grid) than any syllable that is not associated with a pitch accent' [Selkirk, 1984, p. 152] and '...a syllable associated with a pitch accent has at least a fourth-level grid alignment...' [Selkirk, 1984, p. 190]. Accenting an unstressed syllable shifts metrical prominence onto that syllable (condition UF). The metrical grid structure of initial stressed *versie* changes from (7a) to (7b):

(7a)		7b)	‡
	‡	‡	‡
	‡	‡	‡
	‡	‡	‡
	ver sie	ver sie	
	condition NF	condition UF	

Accenting the syllable which is lexically stressed, indicated by a third-level grid alignment, gives this syllable a fourth-level grid alignment, i.e., the metrical grid structure of final stressed *pigmeë* with an accent on the stressed syllable changes from (8a) to (8b):

(8a)		(8b)	‡
	‡	‡	‡
	‡	‡	‡
	‡	‡	‡
	pig mee	pig mee	
	condition NF	condition BF/SF	

The resulting relative duration structures of words with an identical segmental buildup, differing in stress position but with an accent on the same syllable as in (7b) condition UF and (8b) condition SF, should not be identical. We expect the lexical stress position to remain visible in (7b): the relative duration of the initial syllable in (7b) is larger than the relative duration of the initial syllable in (8b). The relevant data are presented in table 5 (the shading in this table is used to indicate the accent position, in contradistinction with the use of the shading in table 3). T tests were carried out for each word type separately to test the significance of the differences in mean relative syllable and rhyme duration between the two focus conditions UF and SF.

The results for the relative syllable durations of the VC-VV words suggest that metrical structure adapts to the location of the accent, without leaving a trace of the lexical stress position because the relative syllable

Table 5. Mean relative syllable and rhyme durations (in %) of the syllables in condition SF and UF

Word type	Focus condition	Example	% duration syllables	% duration rhymes
Accent on first syllable				
VC-VV	SF	[ver] _{+F} +stress sie	62–38	59–41
	UF	[pig] _{+F} +stress mec	61–39	53–47
VC-VVC	SF	[pot] _{+F} +stress lood	60–40	52–48
	UF	[por] _{+F} +stress tiek	52–48	47–53
Accent on second syllable				
VC-VV	UF	ver +stress [sie] _{+F}	50–50	48–52
	SF	pig +stress [mee] _{+F}	50–50	39–61
VC-VVC	UF	pot +stress [lood] _{+F}	50–50	45–55
	SF	por +stress [tiek] _{+F}	39–61	38–62

Gray shading indicates the accented syllable; +stress indicates the lexical stress position of the words.

durations of initial stressed *versie* with an accent on either the initial (62–38%) or the final syllable (50–50%) are identical to the relative syllable durations of identically accented but finally stressed *pigme* (61–39% and 50–50%, respectively) [$t(46)=0.018$, $p=0.43$]. However, the results of the VC-VVC words suggest that originally stressed syllables preserve some of their original duration: de-accented but stressed syllables such as *tiek* (*portiek*) and *pot* (*potlood*) are longer (48 and 50%, respectively) than lexically unstressed syllables such as *lood* and *por* (40 and 39%, respectively) [$t(38)=6.8$, $p<0.001$]. Moreover, if we con-

sider rhyme duration only, i.e. the relevant part for stress assignment, all the stressed, unaccented rhymes, including the VC-VV word type, retain a relatively longer stressed syllable and therefore preserve some of their metrical prominence relative to the unstressed, unaccented rhymes [VC-VV words: $t(46)=4.46$, $p<0.001$; VC-VVC words: $t(38)=3.25$, $p=0.002$].

There is no guarantee, a priori, that the residual effect of abstract stress on de-accented syllables is not a by-product of differences in inherent duration of the accidental segment structure of the target syllables involved. To

check for the possibility of artefact due to inherent duration we ran a control study. The two speakers who produced the speech material for the present experiment also recorded the 22 target syllables as monosyllabic nonsense items embedded in accented position in two fixed carrier phrases, one allowing accurate segmentation of final vowels and sonorants, the other allowing optimal segmentation of final obstruents. Relevant syllable and rhyme durations were measured for both speakers. Subsequent analyses of variance revealed that there were no systematic differences in either syllable or rhyme durations (absolute nor relative) between the four lexical word types, nor any interaction between speaker and word type. Therefore, differences in inherent segment duration between the four lexical types cannot explain away the residual effect of abstract stress.

3.4 Normal Focused Constituents versus Metalinguistically Interpreted Constituents

In the results described above we based our conclusions on the use of target words in metalinguistic contrasts. In this section we shall address the question as to whether it is true that speakers make no (durational) differences between constituents that form part of a metalinguistic statement and normally focused constituents. We compared the absolute syllable and rhyme duration of the target words in normal focused constituents (set II) and in metalinguistically interpreted utterances (the equivalent subset of sentences in set I). Table 6 presents the mean syllable and rhyme durations collapsed over focus conditions but broken down for speaker, word type and linguistic status.

Three-way analyses of variance were performed on the absolute syllable and rhyme durations with word type and linguistic status as

fixed factors and speaker as a random factor. In general, speaker 1 has longer initial syllables and rhymes [syllable 1: $F(1, 46)=9.2$, $p=0.004$; rhyme 1: $F(1, 46)=94.1$, $p<0.001$], whereas speaker 2 has somewhat longer second syllables [$F(1, 46)=8.1$, $p=0.007$], but only slightly (insignificantly) longer rhyme durations [$F(1, 46)=2.0$, n.s.].

There were significant differences between the two word types, due to differences in stress position: stressed syllables and rhymes are longer than unstressed ones.

On average, the first syllable of *bloknoot* and *portiek* in the normal focused constituents is 31 ms shorter than in the metalinguistic statements [$F(1, 46)=288.9$, $p=0.004$]. The rhyme duration of the first syllable, however, is identical in both conditions ($F<1$). The difference in syllable duration is therefore caused by a difference in onset duration. This is a result of the segmentation of these items. In the metalinguistic utterances, the onsets *bl* and *p* formed one segment (a geminate) with the final consonant of the first part of the carrier phrase: *heb* 'have'. This last consonant adapts its voicing to the following stop consonant, and is pronounced as either *p* or *b*. It is impossible to determine a syllable boundary within the geminate *bb* or *pp*. This segment, however, is characterized by a longer duration than a single consonant. This conclusion is confirmed by the fact that the syllable and rhyme durations of the second syllable are identical in both conditions [syllable 2: $F<1$; rhyme 2: $F(1, 46)=2.0$, $p=0.17$]. In sum, we conclude that there are no durational differences between words that form part of normal focused constituents and of metalinguistically interpreted utterances. We therefore assume that we can legitimately base the answer to our main research question on metalinguistically interpreted utterances. Before we move on to our general conclusion, we will first discuss the perception experiment in which listeners

Table 6. Mean duration (in ms) of stressed and unstressed syllables and rhymes per speaker, word and linguistic status (metalinguistic vs. normal focused constituents)

	Syllable 1	Syllable 2	Rhyme 1	Rhyme 2
Speaker				
1	249 (50)	205 (24)	149 (32)	132 (25)
2	219 (50)	230 (34)	107 (34)	141 (28)
Word type				
vc VVC	200 (41)	224 (28)	99 (28)	121 (19)
VC-vvc	267 (39)	211 (34)	157 (23)	151 (24)
Linguistic status				
Metalinguistic	249 (52)	216 (37)	129 (40)	132 (29)
Normal	218 (47)	219 (26)	127 (39)	140 (23)
Standard deviations in parentheses				

were asked to differentiate between narrow-focus accents and integrative-focus accents. This experiment is reported in the next section.

4. Perception Experiment

4.1 Objective

In the perception experiment we want to answer the question as to whether it is true that there is no difference in perception between a narrow-focus accent on the lexically stressed syllable and an integrative accent on that syllable placing the whole word in focus. As was mentioned in section 3.2, we did not find any differences in the duration of syllables, whether absolute or relative, nor in the shape, location or duration of the pitch movements. In order to find out if no perceptually relevant properties expressing the difference between a contrastive and an integrative accent were overlooked, we performed a perception study.

4.2 Method

We used both versions of the 11 sentence pairs of both speakers, yielding a total of 44 sentence pairs taken from the production study. A stimulus consisted of a pair of two identical sentences, only differing in the type of accent that was realized on the stressed syllable (integrative, condition BF or contrastive, condition SF, see section 2). The pairs were grouped in four blocks, two blocks for each speaker. One block consisted of all stimuli uttered as the first repetition, the other block contained the second repetitions. In half of the stimuli the integrative accent version preceded the narrow-focus version, in the other half of the stimuli the order was the reverse. Stimuli with these two orderings followed each other at random. The four blocks were presented in 24 different orders.

Twenty-four subjects listened to the stimuli in 24 different orders. Two more subjects listened to an order that was already presented to another subject. Each subject was tested individually in a sound insulated booth. Stimuli were presented over good quality headphones. The subjects' task was to compare the members of each of the sentence pairs and to determine which one of the two was the answer to the question in which syllables were contrasted (narrow-focus accent). The difference was illustrated by several written examples. An ordered list of stimuli was presented on line to the subjects. They had to press keys to make a pair of utterances audible. They marked

their judgments on an answer sheet. Within one trial, subjects could listen to each stimulus as often as they felt necessary.

4.3 Results and Discussion

In table 7 the responses are presented per speaker. On average, 52% of the utterance pairs were judged correctly. A binomial test showed that this frequency distribution does not differ from chance ($z=1.39$, $p=0.16$). Post-hoc analysis revealed that overall the listeners did not perform better on speaker 1 than on speaker 2 (53 vs. 51% correct responses, $\chi^2=0.5$, $df=1$, $p=0.48$). We conclude that listeners do not hear any differences between a narrow-focus accent on the stressed syllable (placing that syllable in narrow focus), and an integrative accent on the stressed syllable (placing the whole word in focus).

5. General Discussion

In this study we examined the contributions of lexical stress and contrastive focus as realized by a pitch accent to the duration structure of words. Neijt [1990] described the relation between duration and tone by assuming two independent levels for durational and tonal prominence. She claimed that relative durational structure, reflecting metrical structure, is invariant. Selkirk [1984], however, claimed that accents are able to change not only absolute duration, but also the relative duration structure of words. Tone and duration are represented on separate prosodic levels but are not independent: lexically unstressed syllables carrying a pitch accent have to be made metrically prominent. This view predicts that the relative duration of syllables within a word is affected by shifting the accent onto an unstressed syllable. The consequences of these

Table 7. Absolute and relative frequency of ‘correct’ and ‘false’ responses collapsed over subjects for speaker 1 and speaker 2 and collapsed over both speakers (total)

Stimulus	Responses	
	correct	false
Speaker 1	304 (53%)	268 (47%)
Speaker 2	292 (51%)	280 (49%)
Total	596 (52%)	548 (48%)

accounts were investigated in the present experiment addressing the following main research question:

(i) Does the relative duration of a syllable (rhyme) in a word change when an accent is realized on an unstressed syllable of that word? We tested the above-mentioned phonological views on the basis of contrastive accents on individual syllables in metalinguistic statements. This was done on the assumption that there are no acoustic differences in phonetic realization in terms of duration and pitch between a constituent with a contrastive metalinguistically used narrow-focus accent placing the lexically stressed syllable in focus on the one hand, and a normal focused constituent with an accent placing the whole word in focus on the other. In order to obtain post-hoc support for this assumption, we also addressed two secondary methodological issues:

(ii) Is it true that there are no (durational) differences between constituents that form part of a metalinguistic statement, and normally focused constituents?

(iii) Is it true that there is no difference, in either perception and/or phonetic realization in terms of duration and pitch, between a con-

trastive (narrow-focus) accent on the lexically stressed syllable, and an integrative accent on that syllable placing the whole word in focus?

It was shown that the absolute duration is influenced by the realization of an accent. The unaccented version of a syllable (or the rhyme within it) is shorter than the accented version, which finding is in agreement with earlier results [Nootboom, 1972; Eefting, 1991]. However, the *relative* duration structure of a word does not change due to word focus accent on that word. These results confirm the view, described in the general introduction, that metrical structure determines relative duration and that the only temporal contribution of an accent on the stressed syllable in Dutch, and presumably for related languages as well, is linear time expansion of the entire word. This assumption was also confirmed by earlier work of Nootboom [1972], Martens [1992] and Sloomweg [1988].

Our results indicate no acoustic difference between a narrow-focus accent on the stressed syllable and an integrative word accent on the stressed syllable. Speakers do not place syllables in narrow focus by changing either absolute or relative durations. Accent placement does influence the absolute duration of the entire word but placing the stressed syllable in narrow focus does not have an extra effect on the duration change. Notice that the same effect has been reported earlier for larger constituents. Placing a word in narrow focus has no consequences for the temporal organization of the word group relative to the same word group in broad focus with an integrative accent on the same word [Eefting, 1991]. Thus it seems that focus domains are generally not marked by temporal means. Moreover, a detailed F_0 analysis of the data revealed that the conditions also had exactly the same shape and timing of the pitch accent. Furthermore, an additional perception experiment showed that listeners were utterly unable to detect any

differences between narrow-focus and integrative accents on the same target words. Our results also indicate no durational difference between words in normal focused constituents and words in metalinguistically interpreted utterances.

In answer to our methodological questions (ii) and (iii), we therefore conclude that there are no acoustic differences in phonetic realization in terms of duration and pitch between a constituent with a contrastive metalinguistically used narrow-focus accent placing the lexically stressed syllable in focus on the one hand, and a normal focused constituent with an accent placing the whole word in focus on the other. Consequently, we accept our use of narrow-focus accents in metalinguistic statements as valid under the assumption that metalinguistic utterances do not differ from linguistic utterances (i.e. normal speech) in terms of phonetic prosodic behavior.

As for the main research question (i), we found the following result: the relative duration of syllables changes in words with a narrow-focus accent on the unstressed syllable. Moving the accent from the stressed to the unstressed syllable leads to a transfer of relative duration from the stressed syllable to the unstressed syllable by about ten percentage points. From these results we conclude that metrical structure as reflected in relative syllable and rhyme duration is largely, but not completely, obliterated under different accent conditions. However, there is a small, but significant, residual effect of stress position, reflecting the original metrical structure.

Selkirk's [1984] theory, therefore, is closer to the facts than Neijt's [1990]: metrical structure, as reflected in the relative syllable/rhyme duration changes under the influence of accentuation: accentuation determines metrical structure. Moreover, Selkirk's theory is able to account for the admittedly small, residual effect of lexical stress position.

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