NARROW FOCUS REALIZATION IN THE MONOSYLLABIC LEXICAL PITCH CONTRAST IN EAST NORWEGIAN

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ABSTRACT

The Trøndersk dialect of East Norwegian is rather unusual typologically in that it exhibits a tonal contrast (unmarked vs. circumflex) on monosyllabic words [7, 1, 20]. The goal of the current study was to examine this contrast and how it is impacted by sentential focus. Ten speakers of the Trøndersk dialect were recorded reading target monosyllabic words with these accents embedded in sentences with broad and narrow focus. In broad focus, words with the unmarked accent have an L tone and words with the circumflex accent have a HL contour with a higher F0 maximum and vowel onset than the unmarked contour. In narrow focus, both accents have a wider pitch range and later low tone alignment. Phonologically long vowels were lengthened under narrow focus. This study adds to the literature on the realization of focus in pitch accent languages, and the interaction between prosodically marked focus and lexical accents. **Keywords:** pitch accent, Norwegian, focus

1. INTRODUCTION

Most dialects of Norwegian and Swedish have a lexical tonal accent contrast, whereby the F0 contour of a word can change its meaning [11, 4, 18, 12, 26]. The phonetic realization of the contours differs by dialect [11, 8]. The different accents are referred to as accent 1 and accent 2. The contrast may be in a different tonal makeup (e.g., accent 1 L and accent 2 HL) or in timing (e.g., both HL but accent 2 has a later timing with regard to the segments). The accentual contrast arose from a tonal contrast between monosyllables and polysyllables in Old Norse, when some monosyllables became disyllabic but retained the tonal contour of monosyllables [24, 18]. In the majority of dialects the accent contrast is only found on polysyllabic words [13]. However, a small number of dialects have instances of a tonal contrast surfacing on monosyllabic words, in this case due to apocope (final vowel deletion) [7, 20].

The dialect focused on in the current study is that of the Trøndelag region, an East Norwegian variety spoken in central Norway, which has a tonal accent contrast on monosyllabic words. The contrast is realized as a difference between the circumflex accent and the 'unmarked' accent [1, 20]. Unmarked monosyllabic words in East Norwegian are characterized only by an L tone [6]. The circumflex accent occurs on words in which the final vowel is deleted, but are disyllabic in other varieties of Norwegian. This accent can surface on words that were originally either accent 1 or 2 [1]. A phonetic analysis of a small set of circumflex words found that this accent has a HL contour and a longer vowel and a higher F0 at vowel onset than the unmarked monosyllabic accent [1]. A more recent, large-scale examination of Trøndersk found that the circumflex accent is distinguished in production from the unmarked accent by a wider pitch range, higher F0 at vowel onset, later F0 minimum alignment and lower accent phrase boundary tone [15]. The current study expands on this by examining how pragmatic focus is realized and how it impacts the lexical pitch accent contrast in monosyllabic words in Trøndersk. It also examines some additional acoustic measures, namely, slope of both the F0 rise and fall, and timing of the accent phrase boundary tone. This will not only determine how pragmatic focus affects the F0 contour of the accents, but will also help to elucidate which features of the contrast speakers manipulate to express pragmatic information.

East Norwegian intonation is described by the Trondheim Model [9], as containing intonational phrases which are composed of accent phrases (APs). Each AP is headed by a word with either lexical accent, and any following unstressed words are contained in the same AP [13, 10]. Therefore, the AP begins with a stressed syllable, and contains any number of unstressed syllables, until the right edge of the AP, which is marked by a high boundary tone (H%). Narrow focus in polysyllabic words in East Norwegian causes an even higher F0 in the AP H% tone [23, 18], an earlier AP H% [17, 22, 16], and increased duration of phonologically long segments [16]. Furthermore, narrow focus was found to enhance the accent contrast by involving more

cues (accent 2 having a later timing than accent 1 at more landmarks) than in broad focus [16]. The present study examines whether similar strategies are employed by speakers when implementing focus on monosyllabic words, given that the disyllabic lexical contrast is one of timing while the monosyllabic contrast is based on contour shape differences. We also examine whether the accentual contrast is exaggerated in narrow focus, or whether any F0 changes due to focus diminish the unusual contrast on monosyllables. This is a first study to examine how focus impacts the unmarked versus circumflex lexical contrast in monosyllabic words.

As in other languages with lexical F0 contrasts on monosyllabic words, it was expected that narrow focus would induce an expanded pitch range [28], and also a higher and earlier AP H%. Based on descriptions of the monosyllabic contrast in broad focus, it was hypothesized that under narrow focus, the circumflex accent would have a later F0 maximum and minimum alignment and the unmarked accent an earlier F0 minimum alignment. Given the previous work that showed exaggerated lexical contrast cues in narrow focus, we expected that narrow focus would enhance the contrast on monosyllabic words.

2. METHODS

2.1. Participants

Participants were 10 native speakers (6 females, 4 males) of the Trøndersk, aged 18-45, from towns south and west of Trondheim. They were recruited at the NTNU (National University of Science and Technology, Trondheim) campus. They filled out a language background questionnaire, ensuring that they grew up speaking Trøndersk at home.

2.2. Materials

The target words were monosyllabic and had either the unmarked accent or the circumflex accent. The words were minimal pairs. There were five target words for each accent, each produced three times, giving 15 tokens per accent per speaker per condition, a total of 600 tokens (5 words x 3 repetitions x 2 accents x 10 speakers X 2 conditions). The vowel was always /i/, to control for intrinsic pitch and duration differences. Only sonorant consonants were on either side of the vowel, for example, *smil* "smile" (unmarked) and *'smile* "to smile" (circumflex) (with the final *e* apocopated.) Some target words contained phonologically long vowels followed by short consonants, and others contained short vowels followed by long consonants.

To compare broad and narrow focus, the target words were placed in different sentence frames. To elicit a broad focus reading on the target word, two words later in the sentence were contrasted with one another. To elicit a narrow focus reading on the target word, this was contrasted with another word later in the sentence. For both sentence types, the target word was preceded by two or three unstressed syllables, which were outside of the AP [19]. They were also followed by two unstressed syllables which would be produced in the same AP. This was done to ensure that the target word did not receive the H% boundary tone that marks the right edge of the AP. Example sentences with the circumflex accent follow, with target words in bold.
Broad focus:
Jeg vil smile i en film, men ikke i et bilde.
"I want to smile in a film, but not in a photo."
Narrow focus:
Jeg vil smile i en film, men ikke fnise.
"I want to smile in a film, but not frown."

2.3. Procedure

Sentences were presented in a randomized order one at a time in slideshow format, with the participant in control of when to move to the next sentence. The sentences were written in the standard Bokmål orthography and in a transcription of Trøndersk. The participants were instructed to read each sentence aloud, in their own dialect, into a microphone while being recorded through the program Audition. Recordings took place in the phonetics laboratory at NTNU. These took 30-45 minutes per participant.

2.4. Measurements and Analysis

The F0 contour of the target words was examined by using the landmarks shown in Figure 1. From these landmarks, a number of pitch and duration measurements were derived (see Table 1).

The measurements were made on the target word, except for AP H%, which was measured on the final syllable in the AP. All F0 timing measurements were relative to target vowel onset, and were divided by the combined duration of the vowel and post-vocalic consonant to control for the effect of speaking rate on F0 alignment. The vowel and following consonant were combined because some target words had V:C and some VC:, so combining these allowed for pooling of timing measures regardless of phonological vowel length. Slope of the initial F0 rise was the difference in pitch between the beginning of the rise and F0 maximum, divided by the duration of

Figure 1: *Unmarked monosyllabic F0 contour of the word 'smil' showing measurement points.* S = beginning of the sentence; B = beginning of F0 rise; C1 = onset of target word; C2 = onset of second consonant (if present); V1 = vowel onset; C3 = onset of post-vocalic consonant; W = end of target word; AP = end of AP; H = F0 maximum, L = F0 minimum; LTP = turning point from f0 minimum; APH = AP boundary tone.

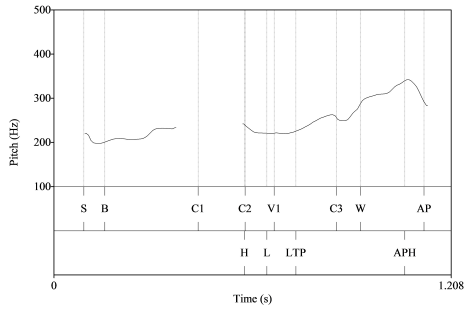

Table 1: *Variables*

Variables
F0 maximum
F0 minimum
F0 height at vowel onset
Slope of the rise
F0 maximum timing
F0 minimum timing
Slope of the fall
AP H% height
AP H% timing from AP boundary
Boundary slope
Vowel duration
Postvocalic consonant duration

this contour. The difference in height from the F0 maximum (H) to the following L was divided by the time between the two tonal targets to derive the slope of the F0 fall. Boundary slope was the difference in pitch between the turning point of the F0 minimum and the following AP boundary H tone (H%), divided by the duration between these two points. Statistical tests consisted of a mixed model multiple linear regression analysis, conducted using the *lmerTest* package in R [27]. The independent variables were accent (unmarked or circumflex) and focus condition (broad or narrow focus) and the dependent variables were each of the 12 measures above. Speaker and word were included as random factors. The reference level for accent was the unmarked accent, and for focus condition was broad focus. Significant interactions between factors were examined further with pairwise posthoc tests using the *lsmeans* package.

3. RESULTS

Figure 2 shows the average broad and narrow focus contours for the two accents for one female speaker.

Figure 2: *Average, time-normalized F0 contour for monosyllabic words comparing broad and narrow focus for one speaker. The timepoints represent ten equal steps across the duration of the word.*

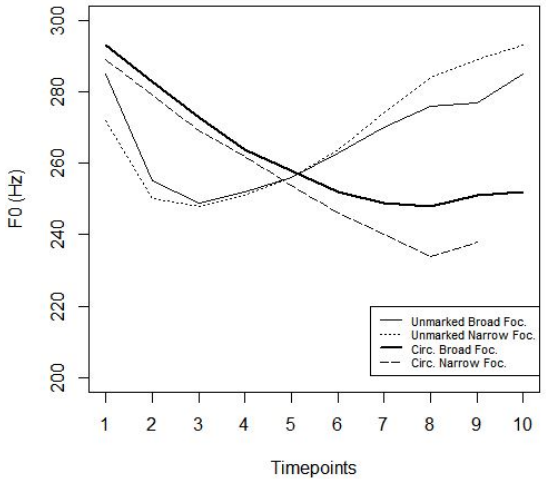

Table 3 shows the significant statistical results for each duration and pitch dependent measure. The results showed a significant effect of accent type on F0 maximum and minimum and their alignment, vowel onset, slope of the fall and AP H% height. The circumflex accent had a higher F0 at vowel onset and F0 maximum, lower F0 minimum, later alignment of both F0 maximum and minimum tonal targets and shallower slope between these targets than the unmarked accent. Focus condition significantly affected the slope of the rise, F0 maximum and minimum alignment, AP H% height and timing, boundary slope and vowel and consonant duration. Narrow focus induced a later F0 minimum alignment, steeper boundary slope and slope of the rise, and earlier AP H% timing for both accents. Furthermore, the circumflex accent had a higher AP H% tone than when in broad focus. The unmarked accent had a later F0 maximum alignment than in broad focus.

4. DISCUSSION

Similar to [15] and [1], a wider pitch range and later pitch contour timing were found to differentiate the circumflex accent from the unmarked accent. The current results also revealed that the circumflex accent had a later alignment of both F0 maximum and F0 minimum and no difference in AP H% tone compared to the unmarked accent. This is unlike pre-

Table 2: *Statistical results for each duration (msec) and F0 (semitones) measure examining the effect of Accent type (unmarked or circumflex) and Focus condition (broad or narrow). (L and S refer to long and short.)*

Measure	Coef.	t-val.	*p*-val.
Accent			
F0 Max.	1.2	5.9	0.001*
F0 Min.	-0.5	-2.9	0.01*
F0 Vowel onset	2.1	7.7	0.001*
F0 max alignment	0.2	3.3	0.01*
F0 min alignment	0.34	5.2	0.001*
Slope of fall	-0.01	-3	0.01*
AP H% height	-1	-2.6	0.05*
Focus condition			
Slope of rise	0.007	2.9	0.01*
F0 max alignment	-0.19	-4.2	0.001*
F0 min alignment	0.02	0.3	0.01*
AP H% height	0.7	2.3	0.05*
Boundary slope	0.02	6.7	0.001*
Vowel dur. (L)	32.3	5	0.001*
AP H% timing	20.4	2.3	0.05*
Cons. dur. (S)	15.3	3.5	0.001*
Interactions			
F0 max alignment	0.15	2.7	0.01*
AP H% height	1.9	4.9	0.001*
V dur. (S)	21.4	2.5	0.05*

vious work [15] which found a later F0 minimum alignment and a lower AP H% tone in the circumflex accent. This difference likely arose from the larger dataset examined here which allowed a direct comparison of the broad and narrow focus patterns.

In terms of the shapes of each accent, the unmarked accent has an early F0 minimum or L tone, and gradually rises from there to the AP H% tone. The circumflex accent has a HL contour, which means it has the same contour as what has been described for both of the disyllabic accents [16]. The circumflex accent thus has a later L than the unmarked monosyllabic accent.

With regard to the expression of pragmatic focus, the results revealed that narrow focus affected F0 minimum alignment, boundary slope, slope of the rise and AP H% timing for both accents. Compared to broad focus, the circumflex accent had a higher AP H% tone and the unmarked accent a later F0 maximum alignment. The expected higher AP H% tone was only found for circumflex words. The higher AP H% tone is in line with the description of narrow focus in East Norwegian, whereby another H tone is added to the AP H% tone, increasing its height [23, 10, 18]. The reasons for this only occurring in the circumflex accent are unclear.

Previous work on disyllabic words found that the accent contrast was enhanced through exaggerated F0 cues in narrow focus [16]. In the monosyllabic contrast, the pairwise comparison revealed that in narrow focus, the accents differed from one another in a subset of the measures that differentiated them in broad focus. In narrow focus, the accents differed significantly in F0 maximum height and timing and in slope from H to L, but not in F0 minimum height or timing or vowel onset. However, for the measures that differed between the accents in both focus conditions, the magnitude of the difference between them was larger in the narrow focus condition. The monosyllabic accent contrast is therefore enhanced, although only for a subset of cues. Perception tests need to be conducted to determine whether these broad-to-narrow focus modifications lead to improved accent identification.

Focus was also found to affect segment durations, with phonologically long vowels lengthened and phonologically short consonants shortened. This was similar to the findings for disyllabic words [16], and previous work on Swedish [4, 3, 5, 14]. Phonologically short vowels were also lengthened in focused circumflex words. Surprisingly, short vowels and long consonants were not lengthened in narrow focus in words with the unmarked accent (although the number of VC: tokens was much smaller than V:C words).

In addition to the finding that narrow focus modified some F0 cues, examination of the accent contrast in narrow focus revealed that some acoustic characteristics remained unchanged. F0 minimum height and timing and vowel onset height differed between the accents but were not affected by focus. Although a perception experiment would be necessary to determine which characteristics are necessary for each accent to be perceived, these findings suggest that the circumflex accent has to maintain a stable F0 minimum to be distinguished from the unmarked accent.

5. CONCLUSION

The effects of narrow focus on F0 alignment and segment length are in line with previous work in languages both with and without lexical pitch contrasts [21, 28, 2, 25]. This investigation provides novel insight into the effect of narrow focus on the monosyllabic lexical pitch accent contrast, a typologically unusual prosodic feature, in Trøndersk. Acoustic analyses revealed consistent differences across the two accents and that narrow focus was expressed through the same cues that are used to express the lexical contrast.

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