Discourse Context, Semantic Markers, and Prosodic Cues of Taiwan Min Narrow Focus and Second Occurrence Focus

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Abstract

This study compared the acoustic realization of broad focus, narrow focus, and second occurrence focus in Taiwan Min. Spontaneous interactive conversations describing pictures displayed on a computer screen were analyzed to measure the duration and f0 of words produced with different levels of focus. Results showed that syntagmatically, the normalized duration, but not the f0 range, of target words with narrow and second occurrence focus tended to be greater than pre-focus and post-focus words in the same sentences. Paradigmatically, duration was greater and f0 range wider in medial and final target words with second occurrence focus than in the same targets with narrow focus.

1. Introduction

Generally speaking, new information placed within the domain of focus sensitive operators, such as "even", "only" and "always," receives Narrow Focus (NF). However, the focus status of Second Occurrence Focus (SOF) with old information placed within the domain of focus sensitive operators is less understood. From a discourse perspective, old information should not be focused. However, from a semantic perspective, targets within the domain of focus sensitive operators are focused, even if these targets carry old information. Observe the following example in (1) B of second occurrence focus.

(1) A: Everyone already knew that Mary only eats [vegetables]NF
B: If even [Paul]NF knew that Mary only eats [vegetables]SOF, then he should have suggested a different restaurant (Beaver, Clark, & Flemming., 2007).

In sentence (1) B, narrow focus falls on the word "Paul" which carries new information and is placed within the domain of a focus sensitive operator. The word "vegetable" with old information placed within the domain of a focus sensitive operator receives second occurrence focus (Partee, 1999).

To resolve the debate among discourse, syntactic, and semantic perspectives; acoustic analysis was used to determine whether second occurrence foci carrying nuclear pitch accents are commonly observed among English foci (Ladd, 1996). As use of a pitch accent was not observed in English second occurrence foci in post-nuclear positions, English second occurrence focus was claimed to be 'phonologically invisible' (Partee, 1999). To challenge the notion that second occurrence focus was 'phonologically invisible,' both acoustic and perceptual studies were conducted to explore additional acoustic cues for English second occurrence focus in post-nuclear positions. Acoustic data revealed that English second occurrence foci were marked by syllable lengthening (Beaver et al., 2007). Moreover, perceptually, English listeners were able to perceive second occurrence focus at a performance level of 63% above chance (Beaver et al., 2007). Although English second

occurrence foci in post-nuclear position were not marked by pitch accent, this did not mean that English second occurrence foci in pre-nuclear positions were not marked by pitch accents. In fact, an acoustic study of German revealed that second occurrence focus in pre-nuclear position was marked by both pitch accent and lengthening (Fery & Ishihara, 2009). In sum, second occurrence focus in these intonational languages, was marked by both pitch accent and duration in pre-nuclear position, and marked only by duration in post-nuclear position.

Another study that compared the same targets modified by the focus sensitive operator "only" and other adverbs, revealed that the targets with second occurrence focus and modified by "only" were not necessarily longer than the same targets modified by other adverbs. In other words, in Howell's (2008) study, targets after adverbs, including the focus sensitive operator "only," were all lengthened. Longer duration was not a cue solely for second occurrence focus (Howell, 2008).

Previous studies on focus in tone languages such as Beijing Mandarin revealed that narrow focus was marked by both longer duration and f0 range expansion (Jin, 1996, Xu, 1999). It was found that the duration of narrow focus syllables are longer than broad focus syllables, which in turn are longer than post-focus syllables (Jin, 1996; Xu, 1999). Pan (2007) compared the acoustic cues for broad and narrow focus in Taiwan Min SVO sentences which contained disyllabic subjects and objects, and monosyllabic verbs. It was found that duration of narrow focused syllables was longer than broad focused and defocused syllables. As for the f0 data, paradigmatically, there were significantly effects of focus conditions on the f0 range and the mean f0. That is, the f0 range and mean f0 of the narrow focused subjects tended to be larger than broad focused and pre-focused subjects. Similarly, the f0 range and mean f0 of narrow focused verb/object tended to be larger than the broad focus, pre- or post-focus verb/ object. Comparison between duration and f0 revealed that duration may be a more consistent cue than f0 range expansion and mean f0 increase to mark narrow focus in Taiwan Min (Taiwanese).

So far, there have been no studies on second occurrence focus in tone languages. This study expands the previous study on Taiwan Min narrow and broad foci to second occurrence focus. If duration is the major cue signaling narrow focus, then what kind of acoustic cue can be used to mark second occurrence focus in Taiwan Min? It is hypothesized that instead of using a new acoustic cue to mark second occurrence focus, both duration lengthening and f0 worked together to distinguish narrow focus from second occurrence focus.

2. Methods

2.1. Speakers

Three males, CCW, LYC, and LHH, and one female, LYW, native Taiwan Min speakers participated in the experiments. They were students at the National Chiao Tung University at the time of recording. Speaker LHH did not participate in the recording of sentences with either broad focus or second occurrence focus on the phrase. In addition to Taiwan Min, speakers spoke Mandarin and English.

2.2. Corpus

The structure of target sentences was "(at) N1's X side, there is an N2." The focus sensitive operator "only" was placed in four positions, before either N1 ("at only N1's X side, there is an N2."); X side ("at N1's ONLY X side, there is an N2."), N2 ("at N1's X side, there is ONLY an N2.") or the phrase "(at) N1's X side, there is an N2" (ONLY at N1's X side, there is an N2).

The five targets for N1 were disyllabic words with 53 + 33, 53+ 53, 31 + 13, 53 +13, and 55 + 55 tonal combinations. The four targets for X side were "top", "bottom", "left", and "right" in Taiwan Min. The seven targets for N2 were monosyllabic words carrying each of the seven Taiwan Min lexical tones, 55, 13, 33, 31, 53, 5, and 3.

Target sentences produced with second occurrence focus were elicited through interactive conversations between an experimenter and each speaker. Within the conversation, the experimenter asked the first question to elicit a first answer with narrow focus located on either N1, X side, or N2, or the phrase "at N1's X side, there is a N2." After the first answer, the experimenter asked a second question to elicit a second answer using the Taiwan Min equivalent of "only" (chi-u, 只有) before second occurrence focused N1, X side, and N2 targets, or entire phrase. The following are some examples of interactive conversations eliciting narrow focus, broad focus, and second occurrence focus on target words and phrases.

(2) English translation of conversations with narrow focus and second occurrence focus on N1, "pickle." The corresponding screen display is shown in Figure 1:

Question 1 Experimenter:
在什麼的左邊有蟲。
Romanization: ti siaN mih e to peng u tang
Gloss: at what left side have worm
"At which object's left side is there a worm?"

Answer 1 Speaker:
在醬菜跟樹林的左邊有蟲。
Romanization: (chi u) ti chiuN chhai kah chhiu na e to peng u tang
Gloss: (only) at pickle and forest left side have worm
"There are worms (Only) at [pickle's and the forest's]NF left side."

Question 2 Experimenter:
在四邊的圖裡面 什麼的左邊有蟲。
Romanization: ti si peng e to lai te siaN mih e to peng u tang
Gloss: at four side picture inside what left side have worm
"Among the peripheral pictures, at what object's left side is there a worm?"

Answer 2 Speaker:
在左邊和右邊的圖裡面只有樹林的左邊有蟲。
Romanization: ti to peng kah chiaN peng e to lai te chi u chhiu na e to peng u tang
Gloss: at left side and right side picture inside only forest left side have worm
"Among the [left and right]NF pictures, there are worms at ONLY the [pickle's]SOF left side."

By matching the five N1 targets with the four X side targets, and the eight N2 targets, there were 140 target sentences (5 N1 target × 4 X side targets × 7 N2 targets). The 140 sentences were produced with either narrow or second occurrence focus on N1, X side, N2, or entire phrase; broad focus on the phrase, N1+ X side + N2; or second occurrence focus on the phrase. Thus there were altogether eight focus conditions, namely narrow focus on N1, X side, N2, broad focus on phrase, second occurrence on N1, X side, N2, and phrase. All together there were 1120 sentences (140 target sentences × 8 focus conditions). Each of the sentences was repeated three times, whereas sentences carrying second occurrence focus on the entire phrase were repeated four times (Figure 1).

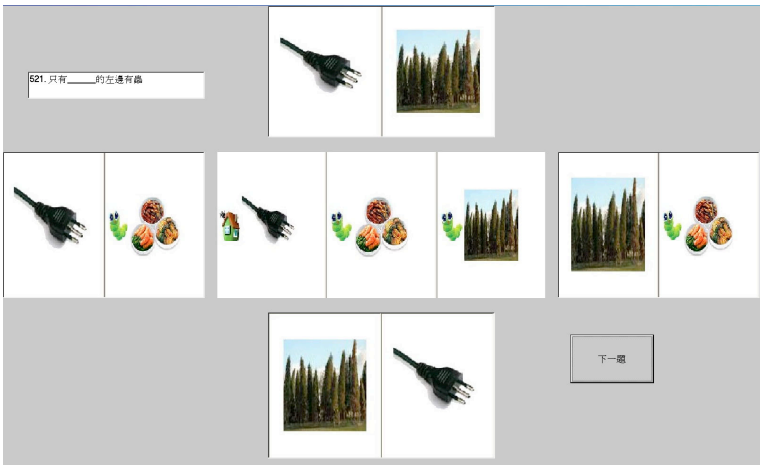

Figure 1: Examples of pictures eliciting narrow and second occurrence focus on N1.

2.3. Procedure

The experiment took place in a sound treated room at the phonetics lab of the National Chiao Tung University. During the experiment, both the experimenter and the speaker were present in the lab. The experimenter first hit a key on the keyboard to display the center picture. Then the experimenter asked the first question regarding the center picture. After the speaker replied with the first answer containing narrow focus on target words, the experimenter hit the key again to display an additional four pictures in the corners of the screen (Figure 1). After the display of these pictures, the experimenter asked the second question to elicit a second response with second occurrence focus on targets.

2.4. Instrumentation

A program was designed to display pictures at the center and in four corners of the screen and to elicit the above mentioned sentences. Speakers' productions were picked up by an AKG HSD 200 head-mounted microphone then recorded by a SONY CD deck. The acoustic signals were saved to wave format. The duration data were obtained with Praat, whereas the f0 data were obtained with EMU.

2.5. Data analysis

The times at the onset and offset of the target N1, X side, and N2 were taken, as were the f0 peaks and valleys. As the current experiment used semi-spontaneous speech which allow the speaker to rephrase their utterances as long a the word order of "at N1's X side, there is N2" is maintained, data variation caused by variations in number of syllables, instrinsic syllable

duration, speech rate must be taken into consideration. For example, the N1 and X side targets were of two syllables and the N2 targets were monosyllabic, the durations of targets were normalized so that syntagmatic comparisons could be made.
To eliminate duration differences caused by differences in number of syllables between N1, X side, and N2 targets, function (3) was used to calculate the percentile of individual N1 duration within the entire duration range for N1. For each speaker, first the duration range for N1 was calculated first (MAXspeakerX_n1 - MINspeakerX_n1). Using the minimal duration of N1 as the reference point, the relative duration of each N1 target words with reference to the minimal N1 duration (XspeakerX_n1 - MINspeakerX_n1) was then calculated. By dividing the duration of each N1 relative to the minimal N1 target, the entire range for N1 duration, the percentile of each N1 duration within the entire N1 duration range was derived. In other words, the AdjstXspeakerX_n1 is the percentile of individual N1 duration within the entire range of N1 duration produced by the same speaker.
Similarly function (4) was used to derive the percentile of each X side target duration within the entire range of duration for X side target. There were all together eight functions for adjusting N1 and X side durations into percentile (1 N1 target × 4 speakers + 1 Xside target × 4 speakers)

(3) AdjstXspeakerX_n1 = (XspeakerX_n1 - MINspeakerX_n1) / (MAXspeakerX_n1 - MINspeakerX_n1)

(4) AdjstX speakerX_side = (X speakerX_side - MINspeakerX _side) / (MAXspeakerX_side - MINspeakerX_side)

As for the percentile of N2 duraiton, since the monosyllabic N2 targets carried unchecked, 55, 13, 53, 31, 33, and check tones, 5 and 3 which were shorter than unchecked tones, the duration normalization process should take the intrinsic duration difference between checked and unchecked tones into consideration. Thus, in stead of calculating one duration range for all N2 targets, N2 duration ranges were calculated individually for each of the seven N2 targets carrying seven different tones (MAXspeakerX_n2_toneX - MINspeakerX_n2_toneX). After calculating the seven duration ranges for N2, the duration of individual N2 relative to the minimal N2 target carrying the same tone (X speakerX_n2_toneX - MINspeakerX_n2_toneX) were then divided with the duration range of N2 with the same tone to arrive at the percentile for individual N2 target. In other words, the adjusted duration (AdjsdtX speakerX_n2_toneX) was the percentile of individual N2 target duration relative to the N2 duration range carrying the same tone produced by the same.

(5) AdjsdtX speakerX_n2_toneX = (X speakerX_n2_toneX - MINspeakerX_n2_toneX) / (MAXspeakerX_n2_toneX - MINspeakerX_n2_toneX)

Besdies adjusting the duration according to number of syllables, the speech rate must be taken into consideration as well. To normalize for speech rate, for each utterance, the individual percentile for N1, X side, and N2 targets within the utterance were added up (AdjstXspeakerX_n1 + AdjstX speakerX_side + AdjsdtX speakerX_n2_toneX). Then the N1 duration percentile for that utterance was divided by the added up duration percentiles to derive the portion of N1 duration within the " at N1's Xide, there is N2." For each speaker, function (6) was used to calculate the portion of N1 duration within the phrase. Function (7) was used to calculate the portion of X side duration within the phrase, whereas function (8)

was used to calculate the portion of N2 duration within the phrase. As the speech rate goes up or slow down the duration of all targets within the same utterance shortened or lengthened all together, thus the normalized duration NormlXn1, NormlXxside, and NormlXn2 were the duration ratios of each target within a phrase. The normalized duration ratio fall between 0 and 1.

(6) NormlXn1 = AdjstXspeakerX_n1 / (AdjstXspeakerX_n1 + AdjstX speakerX_side + AdjsdtX speakerX_n2_toneX)

(7) NormlXside = AdjstX speakerX_side / (AdjstXspeakerX_n1 + AdjstX speakerX_side + AdjsdtX speakerX_n2_toneX)

(8) NormlXn2 = AdjsdtX speakerX_n2_toneX / (AdjstXspeakerX_n1 + AdjstX speakerX_side + AdjsdtX speakerX_n2_toneX)

After duration normalization, eight one-way ANOVA's (targets) were used to analyze the normalized duration ratio of three targets, N1, Xside, and N2 under each of the eight focus conditions (nf on N1, nf on Xside, nf on N2, bf on phrase, sof on N1, sof on X side, sof on N2, sof on phrase).

3. Results

3.1. Duration

Figure 2 includes the syntagmatically normalized mean duration of targets from sentences with either broad focus or narrow focus on either N1, X side, and N2. There was a significant effect of target word on durations in sentences with narrow focus on N1, X side, N2 targets, or broad focus on the entire phrase (N1: $F(2, 5031) = 144.82$, $P < .01$; X side: $F(2, 5037) = 526.96$, $p < .01$; N2: $F(2, 5037) = 389.53$, $p < .01$; phrase: $F(2, 5004) = 36.30$, $p < .01$) . Post-hoc Duncan test showed that in sentences with narrow focus on N1, the durations of N1 target words were significantly longer than N2 target words, which in turn was significantly longer than X side targets. For sentences with narrow focus on X side target, post-hoc Duncan test showed that the duration of the X side target words were significantly longer than N1 target words, but were significantly shorter than the N2 target words. For sentences with narrow focus on N2 targets, post-hoc Duncan test showed that the duration of the N2 target words were significantly longer than the duration of X side target words which in turn was significantly longer than the N1 target words from the same sentences. For sentences with broad focus on the entire phrase " at N1's X side, there is a N2," post-hoc Duncan test showed that the duration of the X side target words was significantly longer than the duration of the N2 target words which in turn was significantly longer than the N2 target words.

In sum, beside sentences with narrow focus son the X side target, the durations of narrow focused N1 and N2 target words were longer than pre-focused or post-focused words from the same sentences.

Figure 2 also shows syntagmatic comparisons of normalized mean durations for targets from sentences with second occurrence focus on either N1, X side, or N2 targets. When the second occurrence focus was on N1 target words, there was a significant effect of target word on duration for sentences with second occurrence focus on N1, X side, N2, and phrase (N1: $F(2, 5031) = 86.45$, $p < .01$; X side: $F(2, 5034) = 812.81$, $p < .01$; N2: $F(2, 5031) = 2040.68$, $p < .01$; phrase: $F(2, 5022) = 160.15$, $p < .01$). Post-hoc Duncan test showed that when the

second occurrence focus was on the N1 target, the duration of N2 target was significantly longer than the duration of X side targets, which in turn was significantly longer than the duration of N1 targets. When the second occurrence focus was on X side, post-hoc Duncan tests showed that the duration of X side targets was significantly longer than the duration of N2 targets, which in turn was significantly longer than the N1 targets. When the second occurrence focus was on the N2 targets, Duncan tests showed that the duration of N2 target words was significantly longer than the duration of X side target words, which in turn were longer than the duration of N1 target words. When the second occurrence focus was on the entire "N1 + X side + N2" phrase, post-hoc Duncan tests indicated that the duration of X side targets was longer than the duration of N1 and N2 targets. However, the duration of N1 and N2 target words in sentences with second occurrence focus on the entire phrase did not significantly differ.

In sum, beside in sentences with second occurrence focus on the N1 target, the duration of second occurrence focused X side and N2 target words were longest in sentences. When the second occurrence focus was on the entire phrase, the durations of the X side target words were longer than the N1 or N2 target words.

Figure 3 shows the results of paradigmatic comparisons among the normalized mean durations of N1, X side, and N2 targets with broad focus, narrow focus, and second occurrence focus averaged across all sentences. The durations of Xside and N2 targets under second occurrence focus tended to be longest compared with the same target words under other focus conditions.

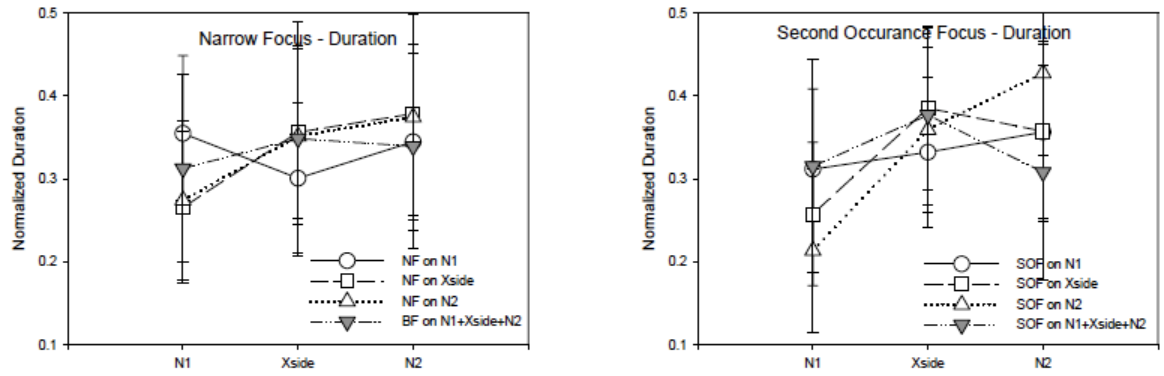

Figure 2: *Normalized mean durations of sentences with narrow focus and second occurrence focus on N1, X side, and N2 targets.*

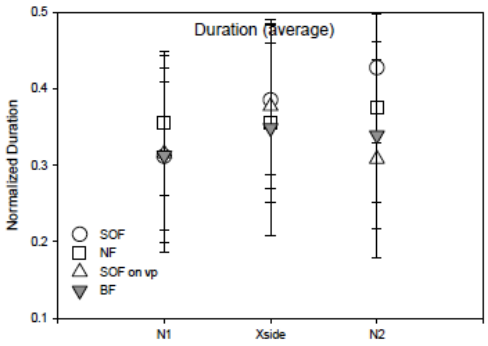

Figure 3: *Average durations of narrow focused, second occurrence focused, and broad focused N1, X side, and N2 targets.*

3.2. F0 range

Figure 4 and 5 show syntagmatic comparisons of speaker LYW's mean f0 range of targets produced with narrow focus and second occurrence focus on target words and phrases. In these productions, the mean f0 range of X side targets was always greater than the mean f0 range of preceding N1 targets, and the following N2 targets which had the smallest range. In other words, the f0 range did not vary according to the locations of the narrow focus or second occurrence focus.

As shown in Figure 6, paradigmatically, the average f0 range of narrow focused N1 or X side targets was larger than those same targets under second occurrence focus. However, the mean f0 range of N2 targets under narrow focus and second occurrence focus did not differ. This is most likely due to the final lowering and declination of f0. Thus, the f0 range of narrow focused N2 was similar to that of second occurrence focused N2.

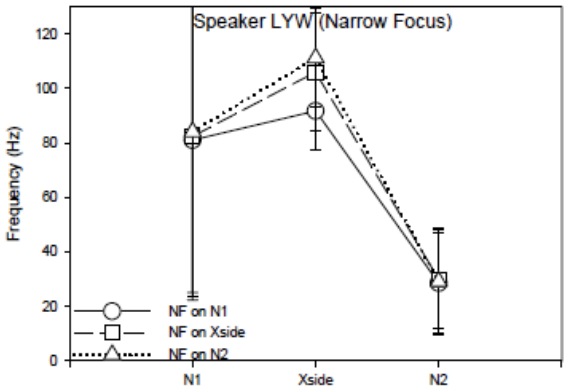

Figure 4: *F0 range for sentences with narrow focus on N1, X side, or N2.*

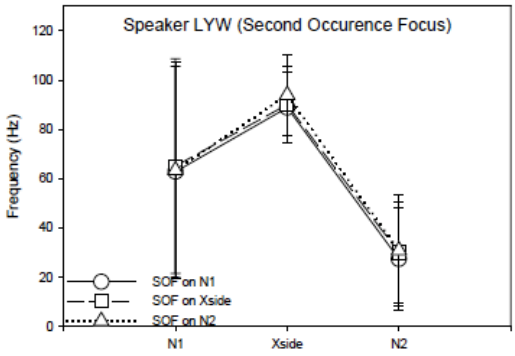

Figure 5: *F0 range for sentences with second occurrence focus on N1, X side, or N2.*

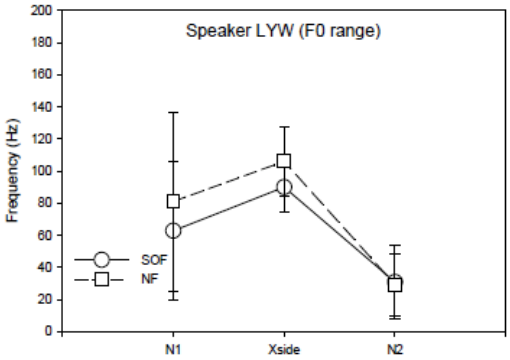

Figure 6: *Average F0 range across narrow focused N1, X side, and N2 targets and across second occurrence focused N1, X side, and N2 targets.*

4. Discussion

Syntagmatically, there was a trend for the durations of the lexical items under narrow focus or second occurrence focus to be longer than pre-focused or post-focused words in the same sentences. However, the f0 range did not vary according to location of narrow focus or second occurrence focus. Paradigmatically, only in X side and N2 targets was there a trend for the second occurrence focused targets to be longer then X side and N2 target under narrow and broad focus. However, the f0 range of the narrow focused N1 and X side targets was greater than second occurrence focused N1 and X side targets. In sum, duration and f0 range acted in a complementary manner to mark second occurrence focus and narrow focus. Syntagmatically, duration was used to distinguish narrow focused and second occurrence focused targets from pre-focused and post-focused targets. Paradigmatically, f0 range was used to distinguish second occurrence from narrow focus.

A previous acoustic study on narrow focus in Taiwan Min showed that duration was a more consistent cue than f0 in distinguishing narrow focus from broad focus (Pan, 2007). The present study again replicated these results by showing that duration is syntagmatically an acoustic cue that marks both narrow focus and second occurrence focus from defocused

targets. Furthermore, beside duration, the present study discovered that in non-final positions, f0 range is used to distinguish narrow focus from second occurrence focus.

In English post-nuclear position, duration marks second occurrence focus (Beaver et al., 2007) and in German, duration and pitch changes marks pre-nuclear second occurrence focus (Fery and Ishihara, 2009). The current study on Taiwan Min, a tone language, indicates that both duration and f0 ranges are effective cues for marking second occurrence focus in syntagmatic and paradigmatic manner respectively. Further studies are necessary to explore how second occurrence focus is acoustically realized in pre-narrow-focus positions.

Acknowledgments

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