

THE PROSODY OF BROAD AND NARROW FOCUS IN ENGLISH: TWO EXPERIMENTS

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ABSTRACT

In English, the focus of a sentence is an important factor in determining the prosody of an utterance. Some linguistic analyses of focus [9][10][11] claim that (1) prosodic representation of focus is determined by pitch accents, (2) the distribution of pitch accents is determined by the size of the focus constituent, and (3) one prosodic realization may be ambiguous for several focus constituents. In this study, two experiments were conducted to test the interaction of focus with certain structures: verb phrases and noun phrases. Duration and f0 measurements within these phrases were analyzed, and a prosodic analysis was conducted. Results show that speakers tend to distinguish broad and narrow focus using several prosodic strategies, where different pitch accent types and patterns within the phrases signal the different focus conditions.

1. INTRODUCTION

Focus, in linguistic terms, refers to a property of a syntactic constituent that evokes a set of alternatives for the semantic/pragmatic interpretation of an utterance in its discourse context. Focus is implemented in the phonology by the pattern of nuclear and prenuclear accents, perhaps by phonological phrasing as well, and this is ultimately realized in the phonetics by the f0 contour of the utterance and durational cues for increased prominence [4][5].

Broad focus and narrow focus refers to the size of the syntactic constituent in question - narrow foci may be as small as individual words, broad foci are larger constituents. Several linguistic theories predict that under some circumstances, broad and narrow focus are identical, in terms of prominence [6][9][10][11]. One example which has been much discussed in the literature are verb phrases (VP) with argument complements; it is claimed that these structures are ambiguous for broad focus (on the entire VP) and narrow focus (on the argument). This is in contrast to VPs containing adjuncts, where broad and narrow focus are thought to be distinct [6][9][10][11].

- (1) Verb-Argument Structure
Q: What was he doing? A: He was meeting an ADVISOR
Q: Who was he meeting? A: He was meeting an ADVISOR
- (2) Verb-Adjunct Structure
Q: What was he doing? A: He was HIDING in the ALLEY
Q: Where was he hiding? A: He was hiding in the ALLEY

Some perceptual experiments support this distinction [3][6], although there is evidence that verbs may be optionally prominent under broad focus [3]. However, little data on the production of prosody within these structures is available - the only study of

broad focus the author is aware of [4] didn't control for different argument structures within VP; it is not clear how to interpret the differences found here.

Noun phrases (NPs) are another structure that may be ambiguous for broad and narrow focus; according to some researchers [10] a modifier of a noun, such as an adjective, need not be accented. To date, no empirical studies of speech production have tested these structures for ambiguity or have investigated the details of their prosody.

2. MATERIALS AND METHODS

2.1 Sentence Materials

2.1.1 First Experiment - VP focus

Eight basic sentences with four different verbs were constructed. Each verb appeared once followed by an argument NP (3a,c,e,g), once by an adjunct PP (3b,d,f,h):

- (3)(a) I think they were betting their allowance
- (b) I think they were betting at the dog track
- (c) I think he was eating a banana
- (d) I think he was eating at the diner
- (e) I think he was hiding a revolver
- (f) I think he was hiding in the alley
- (g) I think they were meeting an advisor
- (h) I think they were meeting in the lobby

Each sentence was matched with three focus priming questions; one question prompted for broad focus, another for narrow focus on verb, and a third on the final noun:

- (4) Q1: What were they doing? BROAD
Q2: Where were they meeting? NARROW-FINAL.
Q3: What were they doing in the lobby NARROW-VERB
Answer: *I think they were meeting in the lobby.*

2.1.2 Second Experiment - NP focus

The following four sentences were constructed; each sentence ended with a noun phrase containing one adjective modifier:

- (5)(a) They were wearing grey socks.
- (b) They were wearing green shorts.
- (c) They were wearing blue shirts.
- (d) They were wearing brown shoes.

As in the previous experiment, each sentence was matched with three focus priming questions: broad focus on the NP, narrow focus on the adjective, and a narrow focus on the final noun.

2.2 Subjects and Procedure

For both experiments, fifteen subjects, eleven male and four female, all employees of ASEL or graduate students from the University of Delaware, participated in the study. All were native speakers of American English and were without speech or hearing impairments.

The subjects were recorded reading a sequence of the target sentences and fillers in several blocks (6 for experiment 1 and 4 for experiment 2); within each block the sentences and fillers were randomized, each subject receiving different random presentations. For every sentence, the focus priming question was presented binaurally (via headphones) and the target sentence was presented visually (on an EMS touch screen panel). The entire experiment was controlled by software residing on a GV386 PC compatible. Subjects were instructed to read the target sentence as a response to the preceding question. The recordings were made in a sound dampened booth; both speech and electroglottograph (EGG) data were recorded.

2.3 Analysis

The speech and EGG recordings were digitized at 16kHz with appropriate prefiltering. For every sentence, the speech and EGG data were incorporated into one multichannel waveform file. In the first experiment, four sentence repetitions were analyzed, and three repetitions were analyzed for the second experiment; in both cases, the first occurrence of each sentence was discarded, as were any examples with speech errors or disfluencies. Using a waveform editor, the durations of the final noun and verb or adjective were marked and measured. Pitch tracking software was used to determine the Fo contour of each sentence, and the results were post-processed to produce a peak Fo for the relevant words. The Peak Fo and duration values were normalized to reduce the interspeaker variance; each value was multiplied by the grand mean of the measurement (for all talkers and conditions) divided by the mean over all conditions for each talker.

Within subjects repeated measures ANOVA were performed on the subject and verb durations and normalized Fo. Planned comparisons (orthogonal Helmert contrast codes) were used to determine the significant effects. The contrast code FOCUS1 compared the narrow focus on a non-final word against the other condition, and FOCUS2 compared broad focus against narrow final focus. In experiment 1, an additional contrast code (ARG) compared argument structure conditions (arguments vs. adjuncts)

A prosodic analysis of the corpus was also conducted by the author. Pitch accents were identified, according to the TOBI standard.

3. RESULTS

Tables 1 and 2 present the results of the statistical analyses for both experiments. The f0 and duration measurements are presented in Table 3 and figures 1-2 for experiment 1, and in Table 6 and figures 3-4 for experiment 2. The pitch accent distributions are presented in Tables 4-5 for the first experiment and Tables 7-8 for the second experiment.

Table 1: Exp 1 ANOVA Results

	Verb F0 F(1,14) Pr > F	Noun F0 F(1,14) Pr > F	Verb D F(1,14) Pr > F	Noun D F(1,14) Pr > F
FOCUS1	38.55 * (0.0001)	79.21 * (0.001)	47.52 * (0.0001)	72.40 * (0.0001)
FOCUS2	10.59 * (0.0058)	15.91 * (0.0013)	32.97 * (0.0001)	13.20 * (0.0027)
ARG	12.80 * (0.003)	1.80 (0.20)	15.08 * (0.0017)	41.53 * (0.0001)

interactions FOCUS1*ARG, FOCUS2*ARG not significant

Table 2: Exp 2 ANOVA Results

	Adj F0 F(1,14) Pr > F	Noun F0 F(1,14) Pr > F	Verb D F(1,14) Pr > F	Noun D F(1,14) Pr > F
FOCUS1	17.67 * (0.0009)	41.11 * (0.0001)	13.53 * (0.0025)	67.10 * (0.0001)
FOCUS2	6.27 * (0.0253)	9.27 * (0.0087)	4.07 (0.063)	3.69 * (0.075)

Table 3: VP Focus measurements

Focus	Arg Str.	Peak F0 Hz (verb)	Peak F0 Hz (noun)	Syll. (verb) ms	Syll. (noun) ms
NARR-N	ARG	134 (17)	174 (23)	192 (38)	262 (44)
NARR-N	ADJ	139 (17)	171 (21)	197 (40)	247 (31)
BROAD	ARG	140 (15)	166 (19)	207 (37)	260 (46)
BROAD	ADJ	145 (15)	164 (17)	218 (44)	233 (32)
NARR-V	ARG	172 (22)	114 (19)	229 (39)	241 (45)
NARR-V	ADJ	175 (21)	115 (22)	236 (39)	218 (31)

Figure 1

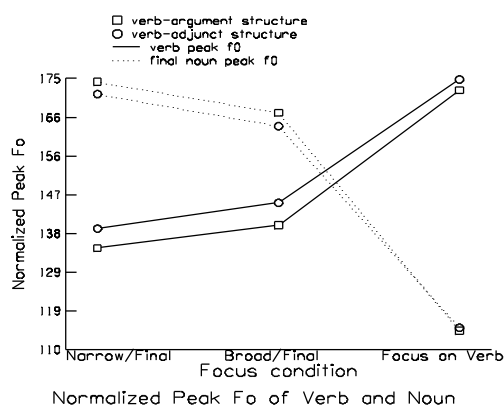


Figure 2

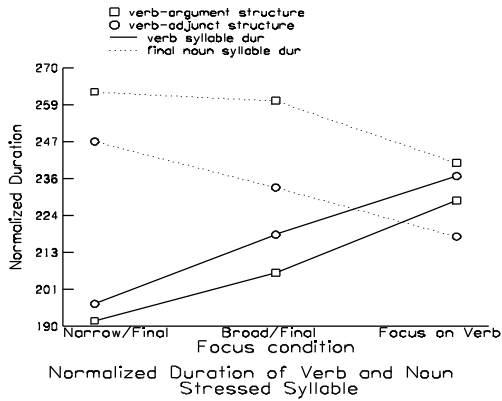


Figure 3

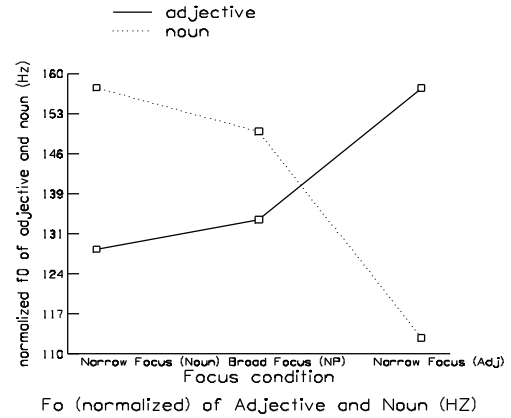


Figure 4

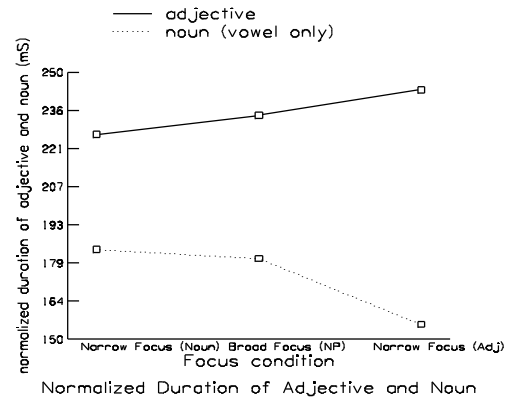


Table 4: Pitch Accents on Verb (%)

Focus	Arg Str.	L+H*	H*	!H*	none
NARR-N	ARG	0.4	30.4	11.7	57.5
NARR-N	ADJ	2.0	25.4	15.4	57.1
BROAD	ARG	3.3	42.5	19.2	35.0
BROAD	ADJ	10.0	47.9	25.0	17.1
NARR-V	ARG	87.9	11.3	0.4	0.4
NARR-V	ADJ	90.4	8.8	0.4	0.4

Pitch accents on the verb in the narrow final focus condition were always followed by a L- boundary tone. Non-final pitch accents were occasionally followed by a L- boundary tone:

NARR-N/ARG (0.5%), NARR-N/ADJ (2%)
 BROAD/ARG (2%), BROAD-ADJ (12%)

Table 5: Pitch Accents on Noun (%)

Focus	Arg. Str.	L+H*	H*	!H*	none
NARR-N	ARG	52.1	34.2	13.8	0.0
NARR-N	ADJ	50.0	30.4	19.2	0.4
BROAD	ARG	16.7	63.3	19.2	0.8
BROAD	ADJ	11.3	63.3	25.4	0.0
NARR-V	ARG	0.0	0.0	0.4	99.6
NARR-V	ADJ	0.0	0.0	0.4	99.6

Pitch accents in this position, when present, were followed by a L- boundary tone.

Table 6:

Focus	Peak Fo Adj (Hz)	Peak Fo Noun (Hz)	Duration Adj ms	Duration Noun (vow) ms
NARR-N	129 (15)	158 (19)	227 (42)	184 (46)
BROAD	134 (13)	150 (18)	234 (45)	180 (46)
NARR-A	158 (19)	113 (19)	243 (48)	156 (35)

Table 7: Pitch Accents on Adjective

Focus	L+H*	H*	!H*	none
NARR-N	0.0	21.7	13.3	65.0
BROAD	0.0	21.1	43.9	35.0
NARR-A	58.9	35.6	5.6	0.0

Pitch accents in the NARR-A condition were followed by a L- boundary tone.

Table 8: Pitch Accents on Noun

Focus	L+H*	H*	!H*	none
NARR-N	15.0	69.4	15.0	0.6
BROAD	1.1	53.9	43.3	1.7
NARR-A	0.0	2.2	0.0	97.8

Pitch accents in this position, when present, were followed by a L- boundary tone.

4. DISCUSSION

In both experiments, broad focus is distinguished from both the early and the final narrow focus conditions. Acoustic and prosodic differences were observed on both the final and the

nonfinal positions. The strong effect for the narrow early focus was expected, since the non-final word should carry a nuclear accent and the final word should be part of the post focal tail in this condition. Greater acoustic prominence of early nuclear accents has been found in some other studies [1][4]. This prominence may be due to the strong preference for the L+H* accent in this position. In addition, a nuclear accent, if either H*, !H*, or L+H*, is expected to be acoustically more prominent than the same accent type in a prenuclear position [1].

Broad and narrow final focus were distinguished by most of the talkers. Prenuclear accents (either H* or !H*) were present more frequently under broad focus, and some speakers tended to mark the final word with the L+H* accent under narrow focus. In experiment 1, there were some differences in the frequency and type of prenuclear accents between the two broad focus conditions. The verb was accented in 85% of the cases where it was followed by an adjunct, compared to 65% when followed by an argument. The L- boundary tone was present for about 12% of the broad focus/adjunct cases, compared to 2% for broad focus/argument condition. The phrase tone may be an additional cue in marking the prenuclear position as being more prominent [2]. The trends in the accent data provide some support for the linguistic theories of [6][9][10][11].

There was a considerable amount of variability in the realization of the different focus conditions, however. In experiment 1, virtually all the possible combinations of !H*, H*, and L+H* were observed on the verb and the final noun, with a few patterns being predominant. The most common pattern for narrow final focus was an unaccented verb followed by a L+H*L-L% nuclear accent (39.6% argument, 37.1% adjunct), and the second most common pattern was an unaccented verb and a H*L-L% nuclear accent (14.6% argument, 13.3% adjunct). Different accent patterns were preferred for broad focus. The most common pattern for VPs followed by arguments was a H* accented verb with a H*L-L% nuclear accent (36.8%), followed by all downstepped (!H*) accents within the VP (18.8%). Broad focus verbs followed by adjuncts were most commonly marked by a H*, H*L-L% sequence (30.9%) or a downstepped pattern (25%).

Patterns of accent variability in the second experiment were similar to the first; broad focus was most commonly realized by downstepping accents within the NP (43.3%) and high accents (20.0%). Narrow final focus was most commonly realized by a single nuclear accent (H*L-L% 75.2%; L+H*L-L% - 21.4%).

One unexpected finding was the frequent accenting of 'given' prenuclear words; for narrow final focus about 40% of the non-final words were accented (H* or !H*). 'Given' lexical items are usually predicted to be deaccented [9][10][11], but some studies [2][7] suggest that such accents may be appropriate in certain contexts, for example, as the initial accent in an intonational phrase. These accents were not usually initial, however; in experiment 1, "think" was accented 97% of the time, and in the second experiment, "wearing" was accented 52% of the time when the nuclear accent was final.

5. CONCLUSIONS

This study has shown that speakers tend to distinguish broad and narrow focus within verb-argument structures and noun phrases. In the first experiment, some of the speakers made prosodic distinctions for the type of argument structure within a broad focus. Speakers used more than one strategy for realizing these focus distinctions. Some of the patterns are compatible with the linguistic theories of [6][9][10][11], but one of the main predictions, the ambiguity of broad and narrow focus, was not evident from the study of these speech productions.

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