Acoustic correlates of focus in Turkish

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1. Introduction

This experimental study investigates acoustic correlates of verb-adjacent focus in Turkish. The purpose of the study is to find if there are differences in expressing broad, informational, and contrastive focus in simple declarative sentences in this language. In accordance with this purpose, following research questions were created:

Do different types of focus affect;

a) maximum, minimum, range, and average values of F_0 in a focused word,
b) duration of focused word, accented syllable and segments in accented syllable of focused word,
c) peak alignment relative to accented syllable in a focused word, maximum and average intensity of focused word?

2. Background

From a prosodic point of view, focus is usually analysed in two levels: in the first level reffering to focus scope, focus is divided into broad and narrow focus (Ladd 1996). While domain of broad focus usually extends over the whole utterance, the domain of narrow focus is restricted to a single constituent. In the second level, narrow focus is partitioned into narrow-new and contrastive focus. Regarding discourse functions, narrow-new focus presents an extension of the topic in a discourse, while contrastive focus corrects rather than augment a certain part of the topic (Toepel ve Alter 2004). As pointed in Toepel and Alter (2004), this tripartition of focus into broad, narrow-new, and contrastive is useful to capture the interactions of semantic-pragmatic, phonological and phonetic aspects of focus in discourse.

When we look at different languages we can see that particular acoustic correlates play an important role in dividing focus types. Pierrehumbert & Hirschberg (1990) and Oliver & Andreeva (2004) state that the peak alignment occurs earlier in accented syllable in broad and informational foci (H* tone) and occurs lately in accented syllable in contrastive focus (L+H* tones) in English, Bulgarian and Polish. On the other side, according to Grice (1995) and Frota (2000) the peak alignment occurs earlier in broad focus with (H+L*) tones and occurs lately in narrow focus with (H*+L) tones in Palermo Italian. Face (2002) and Smiljanić (2004) indicate that peak alignment in broad focus occurs in post-tonic syllable (L*+H); in contrastive focus peak alignment occurs in tonic (accented) syllable (H*+L) in Spanish and Zagreb Croatian. These explanations show that the peak

alignment has been an important acoustic parameter in defining broad and contrastive focus structure. Beside the peak alignment, in languages like German the peak height, duration and intensity also play a significant role in marking focus types (Baumann et. al 2007; Kügler 2008; Breen et. al 2010).

On marking focus types in Turkish, Ivošević (2011) found that duration and intensity are systematically increased if constituent is narrowly focused, but 'fundamental frequency of informational focus' when compared to relative element in broad focus sentences does not increase. Similarly, İpek (2011) claims that narrow focus does not create significant differences in F_0 values of the focused word in languages like Turkish.

3. Methodology

11 male and 10 female speakers of Standard Turkish participated in the study. All were students at Ankara University, aged between 18 and 27. The recordings were carried out in the Linguistic Laboratory at Ankara University's Brain Research Center. The examiner read out the questions and the participant read the answers written on a computer screen. During recording, Shure PG81 Microphone and Praat 5.2 were used. For acoustic analysis, Praat 5.2 and Adobe Audition 2.0 Softwares were used. Focused elements were not specially marked, and the participants were asked to read the answers as natural as possible. Carrier sentences used in the experiment were declarative sentences with a) default SOV word order with focused object on preverbal element (Table 1), and b) non-default OSV word order with focused subject on preverbal element[1] (Table 2).

Table 1. Focus types with default word order

Broad Focus	Informational Focus	Contrastive Focus
Gezi nasıl geçti? *How was the trip?*	**Gizem'in gözünden hiçbir şey kaçmaz. Bu sefer neyi görmüş?** *Nothing escapes Gizem. What did she see this time?*	**Bu ormanda çok sevimli bir sincap var. Gizem onu gördü mü?** *There is a very cute squirrel in this forest. Did Gizem see it?*
Gizem [yılanı]$_{F}$ gördü. *Gizem saw [the snake]$_{F}$.*	Gizem [YILANI]$_{INF}$ gördü. *Gizem saw [the SNAKE]$_{INF}$*	Gizem [**YILANI**]$_{CONT}$ gördü. *Gizem saw [the **SNAKE**]$_{CONT}$*

1 The preverbal position in both word orders is considered to be a default focus position in Turkish.

Table 2. Focus types with non-default word order

Informational Focus	Contrastive Focus
O patika yolunda hep bir yılan güneşleniyor. Onu çocuklar da gördüler mi? *There is always a snake sunbathing on that pathway. Did children see it?*	**Yılanı Burak mı gördü?** *Did Burak see the snake?*
Yılanı $[GİZEM]_{INF}$ gördü. $[GİZEM]_{INF}$ *saw the snake.*	Yılanı $[\mathbf{GİZEM}]_{CONT}$ gördü. $[\boldsymbol{GİZEM}]_{CONT}$ *saw the snake.*

Acoustic analysis was conducted in a number of steps. First of all, sentences and focused words were segmented manually using a combination of listening, inspection of F_0-tracks, and spectogram. After the segmentation, minimum, maximum, range and average values of F_0 in accented syllable were determined (*Table 3*):

Table 3. Investigated fundamental frequency (F_0) features

F_0	UNITS	DESCRIPTION
Min	Hz	Min F_0 accented syllable
Max	Hz	Max F_0 accented syllable
Range	Hz	Range F_0 accented syllable
Average	Hz	Average F_0 accented syllable

The second analysis was concerned with intensity, namely minimum, mean intensity of focused word, mean intensity of sentence. Also, in order to neutralize the external effects, mean intensity ratio was calculated (*Table 4*):

Table 4. Investigated intensity features

INTENSITY	UNITS	DESCRIPTION
Max intensity	dB	Max dB in focused word
Mean intensity	dB	Mean intensity of focused word
Mean sentence	dB	Mean intensity of sentence
Mean intensity ratio		Mean intensity of focused word/mean intensity of sentence

The third analysis was concerned with duration. After locating the previously mentioned onset, nucleus and coda points, duration of a) word, b) accented syllable, c) onset of accented syllable, d) nucleus of accented syllable, d) coda of accented syllable, e) F_0 peak time, and F_0 peak alignment were calculated (*Table 5*):

Table 5. Investigated duration features

DURATION	UNITS	DESCRIPTION
Word	s	Word duration
Accented syllable	s	Duration of accented syllable
Onset of accented syllable	s	Beginning of nucleus (N_B) – Beginning of accented syllable (S_B)
Nucleus of accented syllable	s	**1. Open Syllable:** End of the syllable (S_E) - Beginning of nucleus (N_B) **2. Closed Syllable:** Beginning of coda (C_B) - Beginning of nucleus (N_B)
Coda of accented syllable	s	End of the syllable (S_E) - Beginning of coda (C_B)
F_0 peak time	s	F_0 peak time in accented syllable of focused word
F_0 peak alignment		F_0 peak time in accented syllable of focused word divided by duration of accented syllable

To find out if there are significant differences between the values of acoustic correlates in different focus types, ANOVA (repeated measures) with Bonferroni correction and Paired Samples Tests were used with the help of PASW Statistics 18.00 Software. The significance level was $p < 0.05$.

4. Results

4.1 Default Word Order

According to the obtained results, acoustic correlates like minimum, maximum, range, average F_0 do not differ between focus types in default word order. RM ANOVA and Bonferroni correction displayed no significant difference in any parameter of F_0. Average F_0 values of focus in default word order are shown in *Table 6* below:

Table 6. F_0 values of focus types in default word order

F_0	yılanı$_F$	YILANI$_{INF}$	**YILANI$_{CONT}$**
Min	168,05	164,22	166,35
Max	193,75	194,78	196,88
Range	25,1	33,83	30,05

Average	179,85	179,89	186,71

However, the results concerning duration showed a different trend. Here it was found that duration plays a significant role in dividing broad from informational focus. The post-hoc test using the Bonferroni correction revealed that in informational focus word duration significantly increases (p=.005). Contrastive focus also showed higher but not statistically significant values when compared to broad focus. No significant difference between informational and contrastive focus was found. Average durational values of focus in default word order are shown in the *Table 7* below:

Table 7. Duration values of focus types in default word order

DURATION	yılanı$_{F}$	YILANI$_{INF}$	**YILANI$_{CONT}$**
Word	0,335	0,385	0,361
Accented syllable	0,115	0,151	0,132
Onset	0,057	0,062	0,063
Nucleus	0,058	0,089	0,069
Peak time	0,054	0,084	0,062
Peak alignment	0,470	0,553	0,551

Similar to results related to fundamental frequency, the results concerning intensity did not show any significant difference in any intensity parameter:

Table 8. Intensity values of focus types in default word order

INTENSITY	yılanı$_{F}$	YILANI$_{INF}$	**YILANI$_{CONT}$**
Max	70,99	73,4	71,46
Mean	68,45	70,58	68,43
Mean Sentence	67,67	68,22	66,8
Mean Ratio	1,01	1,034	1,023

4.2. Non-default word order

In non-default word order cases where Paired Sampled Tests were used, no significant difference in any parameter of F_0 between the informational and the contrastive focused subject was found.

Table 9. F_0 values of focus types in non-default word order

F_0	GİZEM$_{INF}$	**GİZEM$_{CONT}$**
Min	163,5	154,42
Max	202,2	196
Range	38,2	34,64

Average	176,85	173,16

The results concerning duration also did not show any significant difference in any examined parameter. In *Table 10*, we can see that values are rather similarly distributed:

Table 10. Duration values of focus types in non-default word order

DURATION	GİZEM$_{INF}$	**GİZEM**$_{CONT}$
Word	0,387	0,379
Accented syllable	0,289	0,281
Onset	0,079	0,078
Nucleus	0,117	0,110
Coda	0,094	0,093
Peak time	0,146	0,120
Peak alignment	0,498	0,431

The results concerning intensity also showed the same trend, i.e. no significant difference was found in any parameter. The mean ratio is slightly higher in contrastive focus but does not approach significance level.

Table 11. Intensity values of focus types in non-default word order

INTENSITY	GİZEM$_{INF}$	**GİZEM**$_{CONT}$
Max	72,44	71,57
Mean	68,33	67,17
Mean Sentence	67,43	65,4
Mean Ratio	1,013	1,026

6. Conclusion

This preliminary study investigated acoustic marking of different focus types in Turkish. The results obtained in this study showed that, in comparison with broad focus, word duration was the only acoustic parameter in the expression of informational focus for the subjects in this study. Similar to other studies dealing with acoustic properties of focus in Turkish, F_0 did not play a significant role in defining focus types. The lack of any acoustic difference between informational and contrastive foci in this study indicates that these distinct categories do not exist at phonetic-acoustic levels in Turkish. To represent the main parameters for phonetic-acoustic level of focusing strategy in Turkish, ‘non-adjacent focus’ should be investigated and compared with ‘verb-adjacent focus’ in a further research.

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