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# CUES TO CONTRASTIVE FOCUS IN ROMANIAN

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Abstract

In this study we measured patterns of pitch alignment, pitch range and duration in relation to broad and contrastive focus in Romanian. In declarative sentences with broad focus, speakers place a pitch accent on each lexically stressed syllable with peaks that become progressively lower towards the end of the sentence. In pre-nuclear accents peaks align with the post-tonic syllable. In declarative sentences with contrastive focus, speakers use strategies based on pitch and duration in order to build a maximum contrast between the word under focus and those in pre- and post-focal contexts: an expanded pitch range under focus and a reduced pitch range and shorter stressed syllables in pre- and post-focal contexts. Thus, the flat F0 and shorter segmental durations in pre- and post-focal contexts constitute a background that by contrast, highlights the segmental durations and expanded pitch ranges found under contrastive focus.

## 1. *Introduction*

To our knowledge, there are only a few impressionistic studies on the intonation patterns of declarative sentences in broad (BF) and contrastive focus (CF) in Romanian (Dascalu-Jinga 1998, Winkler-Gobbel 2002, Swerts 2007). Dascalu-Jinga (1998) provides a descriptive overview of Romanian intonation contours using the INTSINT transcription method (Hirst & DiCristo 1998), which shows that the basic broad declarative pattern is a rising-falling one with a declination pattern apparent in longer declaratives. In the case of contrastive focus, which can affect any item of an utterance, there is a positive prominence expressed by a high and/or rising pitch on the stressed syllable of the word under focus.

Winkler-Gobbel (2002) uses the AM model of tonal transcription to claim that in BF utterances, syntactic arguments are associated with bitonal accents (L+H* and H+!H*), whereas verbs may be either de-accented or associated with the default H* accent. Winkler-Gobbel's (2002) primarily syntactic analysis of *p*-movement shows that BF utterances may contain defocused material like in English or German, namely that there is evidence for contextual de-accenting of an internal argument which does not give rise to a narrow focus interpretation. However, Swerts's (2007) empirical study refutes Winkler-Gobbel's results by providing evidence that, like in Italian or Spanish, Romanian also resists de-accentuation inside syntactic constituents. Yet, he observes some cases in which complex noun phrases consisting of an adjective and a noun are completely unaccented. These cases always occur on the first NP in the sentence whereas a final NP almost always gets a single accent on the second focalized word with the first word being de-accented. According to the author, these de-accentuation patterns serve a demarcative function, in that they mark the right edge of a speech unit and cannot be explained on the basis of contrast relations.

This study investigates the intonation patterns of BF and CF in Romanian in declarative sentences with a relatively simple syntactic structure, namely SVO sentences with a subject and object NP and a VP, all consisting of one single constituent. We expect to provide a detailed phonetic description of the pitch contours and segmental durations linked to pitch accents in BF and CF as well as further elucidate the controversial questions on de-accentuation in Romanian.

Although there is controversy on the definitions of broad and contrastive focus (Bolinger 1958, Gussenhoven 1984 among others), we will define broad focus as a carrier of new information, that is, the whole constituent or sentence is previously unknown. Contrastive focus, on the other hand, highlights a subset of the information through a contrast, which implies the exclusion of contextually relevant alternatives. For example, when the sentence '*Mary is coming*' is pronounced as an answer to the question *'What's happening?'* the entire sentence is new information with no specific element emphasized. However, when the same sentence is an answer to the question *'Is Peter coming?'*, '*Mary*' is highlighted by contrastive focus.

Focus has been shown to be marked by means of intonation and syntactic variation. Syntactically, focus can be indicated by word order variation, as in Italian or Spanish, whereas such scrambling is not possible in languages with a fixed word order, such as English. However, when word order is maintained invariable between broad and contrastive focus utterances in languages with free word order, as in the present experiment, speakers use phonetic strategies to distinguish these two types of focus. Romanian allows such distinction between broad and contrastive focus: while the sentence structure remains the same for the two conditions, a modification of intonation indicates a difference in the pragmatic interpretation, as in a) and b):

a) broad focus declarative [What's happening?]
   *Maria vine*. 'Mary is coming'
b) contrastive focus declarative [Is Peter coming?]
   *MARIA vine*. 'It is Mary who is coming.'

Based on patterns from other romance languages, we expect that the interpretations of broad and contrastive focus in Romanian are conveyed by manipulating pitch alignment, pitch range and segmental durations. In Spanish (Face 2002), Italian (D'Imperio 2002), Portuguese (Frota 2002), the peak of the BF pitch accents in pre-nuclear position aligns with the post-tonic syllable, while in CF, the peak is on the stressed syllable. This contrast has been analyzed by some scholars (for example, Beckman et al. 2002 for Spanish) as a phonological contrast between two pitch accents, a late rise L*+H for broad focus and an early rise L+H* for contrastive focus. For European Portuguese, this distinction is marked by an H*+L accent for the focalized word, which contrasts with the H+L* counterpart in the broad declarative utterance, with a similar distinction for Neapolitan Italian (L+H* vs H+L*, in D'Imperio 1997) and Standard Italian (H* vs H+L*, in Avesani & Vayra 2000). Nevertheless, Face (2002) has shown that in Spanish either an L+H* accent or the L*+H pitch accent can be used in BF, the latter accompanied by boundary tones following the contrasted element (H-, L- in the AM model) and a higher F0 peak height.

The existence of an actual F0 pitch range increase for Spanish is highly controversial, with studies that suggest that it is not an acoustic correlate of contrastive focus (Face 2000, 2002), and those which claim that it has a significant role in marking focus by an acoustically more salient accent (De la Mota 1995, 1997). In other languages such as Neapolitan Italian (D'Imperio 2002: 57), a broad focus utterance is characterized by "a relatively shallow F0 variation as opposed to the greater F0 excursion within the narrow focus." Additionally, it has been shown that, as a correlate of the tonal complexity associated with narrow focus, duration also serves as a cue to narrow focus (Prieto & Ortega-Llebaria, this volume).

Duration has also been found to be a relevant phonetic cue to focus. De Jong (2004) discusses the effect of "localized hyperarticulation", by which elements of the speech signal are emphasized in the duration contrast between stressed and unstressed syllables. Empirical studies show that stressed vowels are longer than their unstressed counterparts, as in Dutch (Slujters & van Heuven 1996), in English (Beckman & Edwards 1994) and Italian (Marotta 1995, Kori & Farnetari 1983) among others. This "magnifying effect" extends to focalized contexts, in that contrastive focus elements expand their duration when stressed. Several studies support these claims: Face (2000) for Spanish, De la Mota (1995, 1997) for Italian among others. Chen, in her discussion of focus in Dutch, found both an increase in duration as well as a change in the F0 contour, however acquisition of the durational cues occurred later than the F0 cues (Chen, this volume).

It is apparent from the previously mentioned studies that languages employ several strategies to convey the pragmatic opposition between broad and contrastive focus, although languages differ in their employment of these strategies. In particular, the Romance languages show variations in their use of pitch alignment, pitch range increase, and increased vowel duration in distinguishing BF and CF. Our investigation of these acoustic cues for Romanian will add to the current body of research as well as to the understanding of the principles and variation of pan-Romance intonation. The remainder of this paper is organized as follows. *Section 1* describes the methodology used for the production experiment. In *Section 2*, we present our results, the main effects of focus condition and stress on the measured variables, namely F0 pitch range, F0 peak alignment and stressed vowel duration. Finally, *Section 3* presents and discusses our results, highlighting the acoustic correlates of contrastive focus in Romanian.

## 2 *Methodology*

### 2.1 *Subjects*

Ten female native speakers of Romanian (ages 20-30) recruited in Sibiu, Romania were recorded for this study. Subjects have lived in Sibiu for a period of at least 5 years. These speakers had Romanian as their native tongue, and had schooling in Romanian, for both university education and all studies prior to this. They spoke Romanian with their parents, siblings, family. They spoke and were educated in the standard variety of Romanian. They never studied nor lived abroad for a period of time longer than a few weeks (considered as travel/holiday time). They reported having normal speech and hearing.

### 2.2 *Materials*

The experiment used the same set of sentences spoken in two different intonations, broad declarative intonation (BF) and contrastive focus intonation (CF). Each utterance has a BF condition and 3 CF conditions, one CF for each of the 3 lexical constituents. The lexical constituents have 2 syllables each, controlling for paroxytonic and oxytonic stress. For example, *O <u>ma</u>ma <u>vin</u>de <u>me</u>re* has paroxytonic stress on each word, while in *Do<u>rel</u> ve<u>dea</u> ma<u>iori</u>,* words have oxytonic stress. In both stress patterns, the number of intervening unstressed syllables was constant. The distinction between the oxytonic and paroxytonic stress patterns was controlled in order to compensate for a possible word boundary crowding effect on the realization of the F0 peak. There are a total of 8 sentences displayed in Table 1 below, and a total of 320 utterances for the study (10subjects x 8sentences x 4conditions).

Paroxytone stress:

| | |
|---|---|
| O **ma**mă **vin**de **me**re. | "A mother sells apples" |
| Un **mi**re **ve**de **ma**rea. | "A groom sees the sea" |
| O **no**ră **ve**de **no**rul. | "A daughter-in-law sees the cloud" |
| Un **re**ge **lin**ge **mie**rea. | "A king licks the honey" |

Oxytone stress:

| | | |
|---|---|---|
| | Do**rel** ve**dea** ma**iori**. | “Dorel was seeing mayors” |
| | Io**nel** do**rea** mə**rar**. | “Ionel was wanting dill” |
| | Ni**nel** vin**dea** a**luni**. | “Ninel was selling hazelnut trees” |
| | Ma**rian** lin**gea** ma**giun**. | “Marian was licking preserves” |

**Table 1.** The eight sentences used for the study

All sentences are declarative utterances. Each one was spoken with broad or contrastive focus intonation. To elicit broad focus intonations, the subjects were instructed to read a statement presented to them as an answer to the question ‘*What’s happening*’ or ‘*What happened*’. To elicit contrastive focus, speakers were asked questions by the first author where one of the constituents of the sentence was replaced with another word. For example, after the subject has read the broad focus declarative ‘*O mama vinde mere’,* they were asked *‘O sora vinde mere?’* and they answered ‘*Nu, o MAMA vinde mere’* with contrastive focus on *MAMA* (as seen in Table 2). Since each sentence had three words, contextualizing questions were built to make each one of them be under contrastive focus.

| | | |
|---|---|---|
| Broad focus: | | |
| Utterance read: | O mamă vinde mere. | “A mother sells apples.” |
| | | |
| Contrastive Focus: | | |
| *Question1:* | *O sora vinde mere?* | “A sister sells apples?” |
| Response—Focus in word 1: | O **mama** vinde mere. | “A **mother** sells apples.” |
| | | |
| *Question2:* | *O mama cumpara mere?* | “A mother buys apples?” |
| Response—Focus in word 2: | O mama **vinde** mere. | “A mother **sells** apples.” |
| | | |
| *Question3:* | *O mama vinde pere?* | “A mother sells pears?” |
| Response—Focus in word 3: | O mama vinde **mere**. | “A mother sells **apples**.” |

**Table 2. Sample of a declarative sentence with broad focus and contrastive focus.** The questions asked to elicit these declarative sentences are in italics while words under contrastive focus are in bolded letters.

### 2.3 *Recordings*

The declarative utterances were randomized and presented to the subjects. They were instructed to read the broad focus declaratives displayed on note-cards. Based on the information given in the broad focus utterance, the first author posed 3 questions that triggered responses with contrastive focus on each of the lexical constituents of the broad focus declarative (see *Table 1* for examples). This methodology, in line with other previous intonation research, was designed to create a corpus that closely resembles a natural exchange. No other specific instructions as to the nature and purpose of the experiment were given to the informants.

The recording of the utterances was performed using a vacuum-tube microphone and the Praat software. Each utterance was isolated in the Praat software and partitioned in syllables as well as their respective vocalic and consonantal constituents.

### 2.4 *Measurements*

After marking all syllables in each sentence by looking at spectrograms and F2 movements in Praat, we measured durations, pitch range and pitch alignment. Due to pitch track failure as a result of creaky voice at the end of the sentence, the pitch changes that took place in the third constituent (word 3) of BF sentences could not be measured.

2.4.1 *Duration.* Syllables were segmented in vowels and consonants. The segments were manually labeled, with particular attention to the second formants. A sample of the data was cross-checked by a second researcher to ensure consistency. A Praat script extracted the durations of all vowels in milliseconds, as well as the duration for the syllable rhymes.

2.4.2. *Pitch range.* F0 pitch range (Hz) was calculated by subtracting the minimum F0 value (valley) from the F0 subsequent maximum value (peak), as seen in Figure 1 below. The peak and the valley are associated with the stressed target syllable—potential recipient of the pitch accent for that specific lexical word. Using a Praat script, the F0 peak and valley values were extracted and marked automatically.

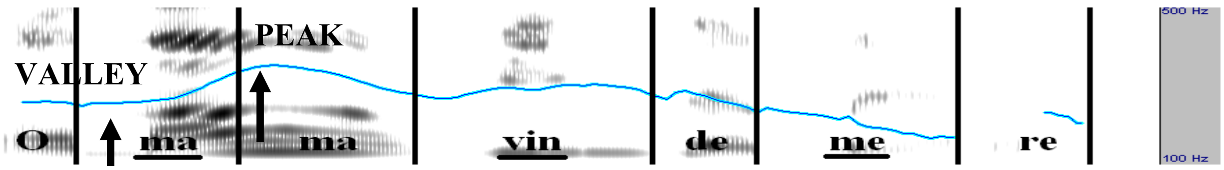


**Figure 1: F0 peak and valley associated with the stressed syllable.** In the broad declarative utterance '*O mama vinde mere'* 'A mother sells apples' each stressed syllable has a pitch accent. For example the stressed 'ma' is associated with a valley and a peak.

2.4.3 *Pitch alignment.* We defined pitch alignment as the distance from the peak of the pitch accent to the syllable boundary. In order to normalize duration, we divided the distance from the vowel onset to the F0 peak (d1 in Figure 2) to the total rhyme duration (d2 in Figure 2), calculated as a percent of the rhyme duration. Thus, peak alignment results appear as d1/d2 x100 percentage values. A value under 100 shows that the peak is aligned within the stressed syllable while a value higher than 100 is related to a post-tonic alignment.

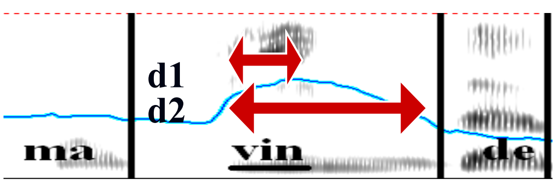


**Figure 2: Example of the F0 pitch track with d1 and d1 measurements.** D1 is the distance from the vowel onset to F0 peak and d2 represents the total rhyme duration measured from the vowel onset to the end of the syllable.

2.5 *Statistics*

We compared measurements of duration, pitch range and pitch alignment on each of the sentence constituents in BF declaratives with those in CF sentences. For the alignment data, the last accented word of the BF and CF utterances (i.e. nuclear accent) was not considered for this study because speakers tended to have a creaky voice at the end of the sentence preventing the extraction of accurate pitch values the crowding effect at the end of the utterance. We compared the pitch range of the first constituent, i.e. first word in the sentence, when the sentences are produced with a broad focus intonation (Figure 3a), with cases when there was a contrastive focus on this constituent (Figure 3b), and when this same constituent was pre-focal in sentences where contrastive focus was placed on the second or third constituent (Figure 3c). Similar comparisons were performed for vowel duration and pitch alignment, with the latter not having comparisons for the nuclear accent, as described above.

ANOVAS with the factors of stress (oxytone and paroxytone words), sentence intonation (broad focus declaratives, and 3 contrastive focus conditions one for each sentence constituent) were performed on each set of measurements on each word. Post-hoc tests were performed on each significant factor. For the alignment results, a paired t-test was performed, comparing the alignment for broad focus and contrastive focus in the two stress conditions (oxytone and paroxytone).

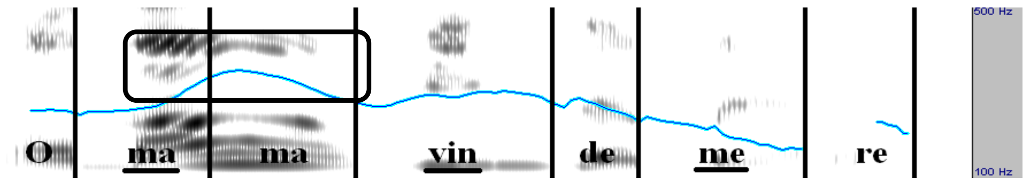

**Figure 3a: Sentence** '*O mama vinde mere'* in broad focus. Mama bears a pitch accent.

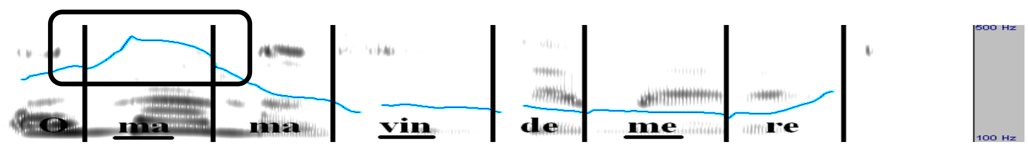

**Figure 3b: Sentence** '*O MAMA vinde mere',* with contrastive focus on *MAMA*.

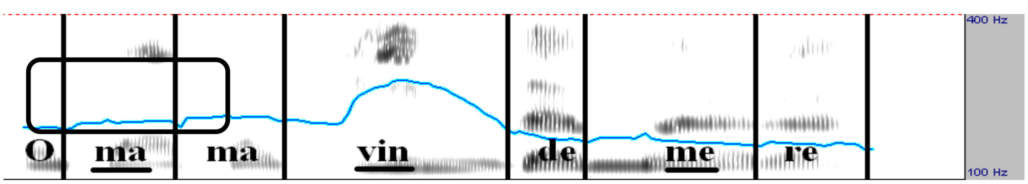

**Figure 3c:** Sentence *'O mama VINDE mere'* with contrastive focus on 'vinde' and de-accentuation on 'mama'.

## 3. *Results*

### 3.1 *Pitch range*

The graph in Figure 4 shows the mean pitch ranges of the pitch accents placed on the first (in dark grey), second (in black), and third constituents (in light grey) of the target sentences when they are spoken in a broad focus intonation, and with a contrastive focus on the first, second or third words. In the broad focus declarative sentences, pitch accents show a progressively smaller range in each word (means for word 1: 71 Hz, for word 2: 33Hz, for word 3: 11 Hz). However, in sentences with contrastive focus, the largest pitch range is placed on the accents that express contrastive focus and their means are larger than those in broad focus showing that pitch range expands in CF. For example, when word 1 is in contrastive focus, its pitch range is 58Hz larger than the pitch range of the same word in broad focus. The mean difference in word 2 between contrastive and broad focus is 58Hz, and for word 3 is 62Hz.

In contrast to the expanded pitch accent range in CF, pitch accents on words adjacent to those that bear contrastive focus show a reduced pitch range reaching in some cases values close to 0Hz., especially in post-focal contexts. For example, in sentences where contrastive focus is placed in word 1, the pitch range in post-focal contexts has a mean of 5Hz in word 2 and 1Hz in word 3 showing a strong tendency to complete de-accentuation. These post-focal contexts, for the purpose of this study defined as those constituents occurring immediately after the contrastive focus elements, were compared with accents in similar sentence position in broad focus. These reduced pitch accents not only have a smaller pitch range to that of their adjacent contrastive focus, but also to the pitch ranges of accents in broad focus, i.e., they reduced by 28Hz in word 2 and by 10Hz in word 3.

In Pre-focal contexts, again defined as those constituents immediately following the contrastive focus elements, we also observe a reduction of the pitch range. For example, when contrastive focus is in word 3, the pre-focal accents in word 1 and word 2 have mean pitch ranges of 35 Hz and 17 Hz respectively. Pitch accents on the same words have a pitch range of 71 Hz and 31 Hz respectively when realized in broad focus sentences.

Thus, while Romanian speakers placed a pitch accent in each word of the broad focus sentences, in sentences with contrastive focus, speakers produced a pitch accent with an expanded pitch range on the contrasted word, and reduced the pitch range of accents in pre- and post-focal position, this reduction being especially visible in post-focal positions.

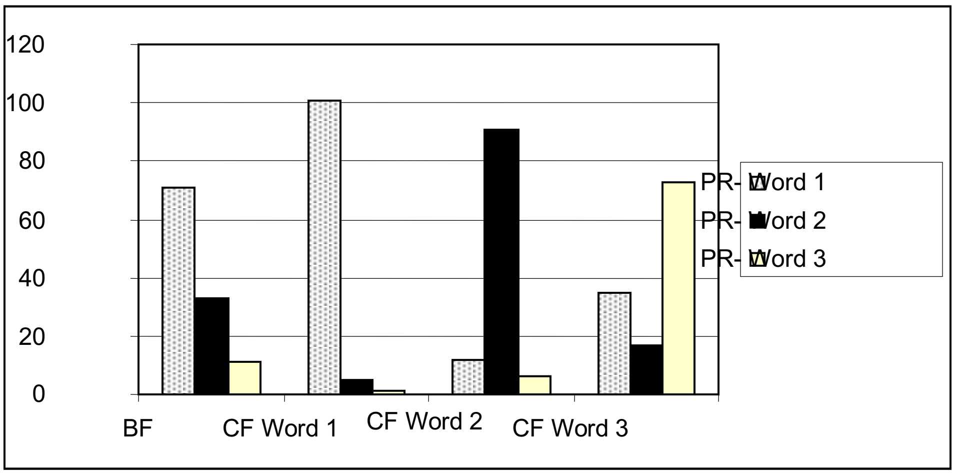


**Figure 4: Mean pitch range values for each word in the sentence spoken with broad focus (BF) and contrastive focus (CF).** Pitch range 1 refers to the pitch range in the first word of the sentence, pitch range 2 to the pitch range in the second word, and pitch range 3 to the third word. Contrastive focus can be placed on the first word (CF word 1), second (CF word 2) and third words (CF word 3).

The differences in range reduction between pitch accents in pre- and post-focal position are due to the patterns displayed below in Figure 5a, 5b, and 5c. In pre-focal position, speakers produce a flat F0 from the beginning of the sentence until it reaches the onset of the stressed syllable of the word with contrastive focus, where F0 increases abruptly (Figure 5a). This flat F0 contour was realized in 60% of the examined pre-focal tokens. Another possibility is for speakers to only reduce the second pitch accent of the utterance (5b), where a pitch accent is visible for the first pre-focal word whereas the pitch accent for the second word, immediately preceding the CF, is flattened. They may also produce an F0 that increases progressively from the beginning of the sentence until the peak of the pitch accent with CF (5c). Since this increment is progressive, it is difficult to distinguish pre-focal pitch accents. In spite of the above variability in the realization of the pre-focal intonation contours, there is a clear reduction of pitch accents in these contexts which may reach a completely flat F0.

In contrast to pre-focal contexts, speakers consistently produce the mirror image of (5a) in post-focal contexts. They drop the pitch abruptly after the CF pitch accent, producing a flat F0 until the end of the sentence, as evidenced in Graph 1 where the post-focal pitch range for CF 1 are considerably reduced.

**Pitch range 1** **Pitch range 2** **Pitch range 3**

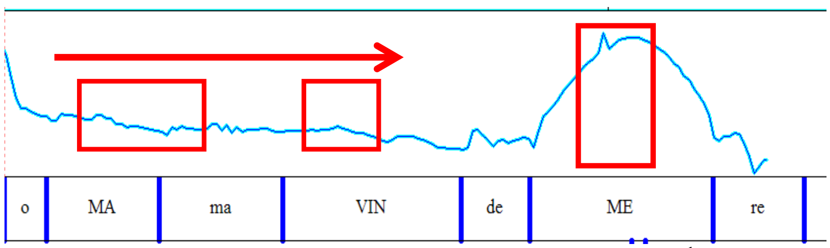

**Figure 5a:** example of pre-focal reduction of 'pitch range 2'; 3rd word '*mere*' in contrastive focus;

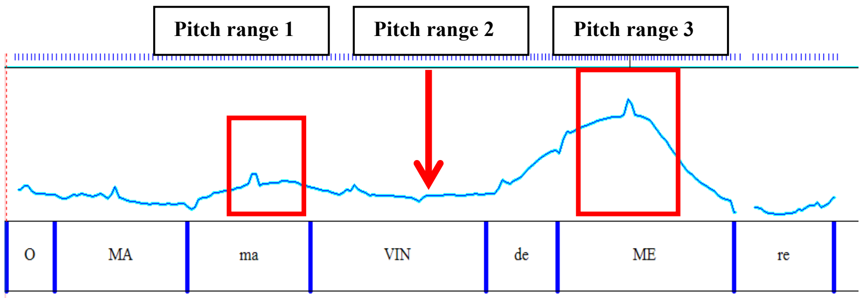

**Figure 5b:** lack of pre-focal reduction for 'pitch range 1', with a pre-focal 'pitch range 2' reduction, with lack of pitch movement associated with the stressed syllable *'vin'*; 3rd word *'mere'* in contrastive focus;

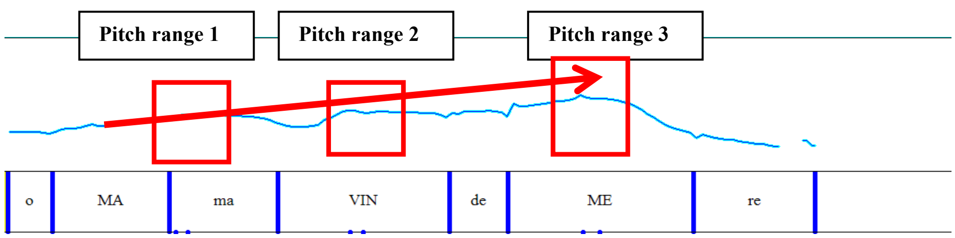

**Figure 5c:** lack of pre-focal reduction for 'pitch range 1', with interpolation for 'pitch range 2, with pitch movement visible for the stressed syllable *'vin'*; 3rd word *'mere'* in contrastive focus;

An ANOVA with the factors of word (word 1, word 2, word 3) and sentence intonation (broad focus, CF in word 1, CF in word 2, CF in word 3) showed that the differences in pitch range between BF and CF were significant in each word position (Pitch range in word 1: $F(3, 292)=135$ $p<0.001$, pitch range in word 2: $F(3, 292)=136$ $p<0.001$, pitch range in word 3: $F(3, 212)=119$ $p<0.001$). Multiple Comparisons with the Bonferroni adjustment confirm that on the one hand, pitch accents in CF have significantly higher pitch ranges than those in BF. On the other hand, they show that pitch ranges in pre- and post-focal accents in CF sentences are significantly reduced when compared to those in BF. Therefore, pitch range differentiates pitch accents in BF from those in CF by increasing the range of those pitch accents in CF and reducing the range of pitch accents in pre- and post-focal positions in CF.

### 3.2 *F0 peak alignment*

In Figure 6, the peak alignment of the BF pitch accents with respect to the syllable boundary is compared to that of CF pitch accents. Recall that 100% represents the end of the stressed syllable, so that values above 100 indicate that the peak is aligned with the post-tonic syllable while values below 100 show that the peak is within the stressed syllable. Peaks of CF pitch accents tend to be aligned earlier in the stressed syllable than those of BF pitch accents, which align closer to the syllable boundary or even in the post-tonic syllable. This variation in the peak alignment of BF accents seems to be related to stress and word boundaries.

The stimuli, designed to include both paroxytone and oxytone tokens, allowed for an examination of this possible boundary effect. The post-tonic alignment is more frequent in paroxytone than in oxytone words, showing that post-tonic alignment is more likely to occur if it does not cross a word boundary. Nevertheless, the earlier peak alignment of CF accents does not seem to be affected by this variation in the peak alignment of BF pitch accents. Thus, pitch alignment, like pitch range, may differentiate the two types of accents in Romanian.

Results from the paired t-test show that there is a statistically significant difference in the alignment of BF as compared to CF for word 1 and word 2 (2-tailed significance $p<0.001$ in all cases) confirming the earlier alignment of CF pitch accents. As discussed in section 2.1 above, the BF alignment for the 3rd word was not considered due to pitch track errors and thus not included in our calculations.

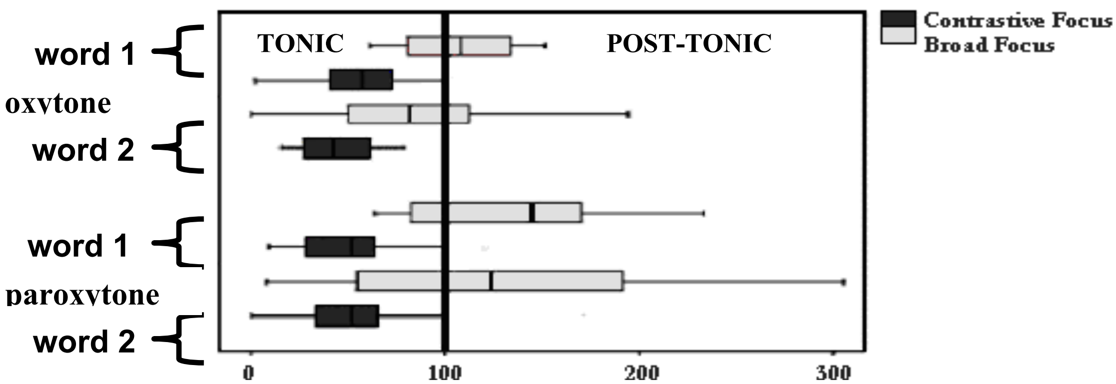


**Figure 6: F0 peak alignment for broad (BF) and contrastive focus (CF) with respect to the syllable rhyme.** Since a value of 100% represents the rightmost boundary of the stressed syllable, values under 100% represent peaks aligned within the rhyme of the stressed syllable, while values over 100% refer to peaks that align with the post-tonic syllable.

### 3.3 *Duration*

In order to examine a possible effect of pitch range on duration, we compared the duration of the stressed vowels in BF, CF and de-accented contexts. For example, we compared the duration of the stressed vowel *a* in *mama* (the underlined vowel in Table 3 below) when it receives a BF pitch accent (sentence 1 in Table 3), when it receives a CF pitch accent (sentence 2), and when it is de-accented as in sentences 3 and 4. Similar comparisons were performed on the stressed vowels of words 2 and 3 for both paroxytone and oxytone words. Since comparisons were performed on the same word across different contexts, variation of syllabic structure among target words did not bias our results. That is, duration differences were not computed between the stressed syllables of vin-de and ve-de, but between ‘vin’ in vin-de across different intonation contexts.

| **Sentence type** | **Sentence examples** |
|---|---|
| 1.Broad focus (BF) | O mama vinde mere. “A mother sells apples.” |
| 2.CF in word1 | O **MA**ma vinde mere. “A MOTHER sells apples.” |
| 3.CF in word2 | O mama VINde mere. “A mother SELLS apples.” |
| 4.CF in word3 | O mama vinde MERE. “A mother sells APPLES.” |

**Table 3:** Example of paroxytonic utterance '*O mama vinde mere'* in broad focus (BF) and contrastive focus conditions on each of its constituents (CF word1, CF word 2, CF word3); comparison of stressed vowel durations in BF vs CF conditions

Table 4 below compares the mean durations of the stressed vowels that receive a BF pitch accent with those that bear a CF pitch accent, for each word position and stress pattern. Although vowels were longer in CF than in BF, these differences were so small, i.e. they ranged from 1 to 7 ms. that became statistically non-significant. Thus, stressed vowels with CF pitch accents do not have larger durations than stressed vowels with BF pitch accents. Since CF pitch accents have larger pitch ranges than BF pitch accents, we can infer that larger pitch ranges did not increase vowel durations.

| **Stress** | **Word in sentence** | **Broad Focus (BF)** | **Contrastive Focus (CF)** |
|---|---|---|---|
| Paroxytone | Word 1 | 121msec | 125msec |
| | Word 2 | 85msec | 89msec |
| | Word 3 | 158msec | 159msec |
| Oxytone | Word 1 | 133msec | 136msec |
| | Word 2 | 141msec | 148msec |
| | Word 3 | 139msec | 144msec |

**Table 4:** comparison of mean vowel durations (msec) in broad focus (BF) and contrastive focus (CF) condition

In contrast, the durations of stressed syllables in pre- and post- focal positions in CF were much shorter than those in BF. As shown in Table 5, the pre- and post-focal vowels significantly compress their duration with respect to the instances when the same vowels are in the BF context, in both oxtyone and paroxytone utterances. For example, when word 1, like *mama* in *O mama vinde mere*, has a BF pitch accent, the stressed vowel has a mean duration of 121 ms. When this vowel is in pre-focal position, its mean duration decreases to 96 ms. When the second word in a sentence, like *vinde* in *O mama vinde mere*, is in BF, the mean duration of the stressed vowel is 85 ms. However, in pre-focal position, its mean duration is 68 ms and in post-focal position is 35 ms. Multiple comparisons with the Bonferroni adjustment yield significant results for all the comparisons ratifying that vowels in pre- and pot-focal contexts are shorter than those in BF.

| **Vowel compared & stress type** | **Mean duration (msec)** | | |
|---|---|---|---|
| **PAROXYTONE** | **BF** | **Pre-focal in CF** | **Post-focal in CF** |
| Word 1 | 121msec | 96msec | ------ |
| Word 2 | 85msec | 68msec | 35msec |
| Word 3 | 158msec | ------- | 138msec |
| **OXYTONE** | **BF** | **Pre-focal in CF** | **Post-focal in CF** |
| Word 1 | 133msec | 108msec | ------ |
| Word 2 | 141msec | 120msec | 102msec |
| Word 3 | 146msec | -------- | |

**Table 5: Pre- and post-focal vowel reduction**. Mean vowel durations (msec) in broad focus (BF) and in pre-/post-focal contexts; significance decrease independent of sentence stress (paroxytone and oxytone).

Finally, we compared the duration of stressed and unstressed vowels within each word. Since all words have two syllables and are either oxytone or paroxytone, the duration of the stressed vowel in a word was compared to that of their adjacent unstressed syllable. For example, in paroxytone words such as those in '*o mama vinde mere',* the duration of the stressed vowels was compared with the duration of their adjacent post-tonic vowels. These comparisons were calculated for words with CF, with BF and in de-accented contexts.

As shown in Figure 7, while stressed vowels are longer than their unstressed counterparts, this difference is larger in vowels with BF and CF than in vowels in pre- and post-focal contexts. For example, the mean difference between stressed and unstressed vowels for CF is 29ms and for BF is 17ms. Yet this difference scores only 8ms in pre- and post-focal contexts because the stressed vowel in this context is much shorter than in BF and CF contexts. Results from the ANOVA test confirm that in general, stressed vowels are significantly longer than unstressed vowels ($F(3, 296)=132$, $p=0.05$). Post-hoc tests ratify that this difference is significant only in BF and CF contexts. Thus, stressed vowels in Romanian are longer than their unstressed counterparts. However, this difference is larger in words with CF and BF pitch accents. In de-accented words, i.e. word in pre- and post-focal contexts, this difference reduces due to a significant shortening of the stressed vowel.

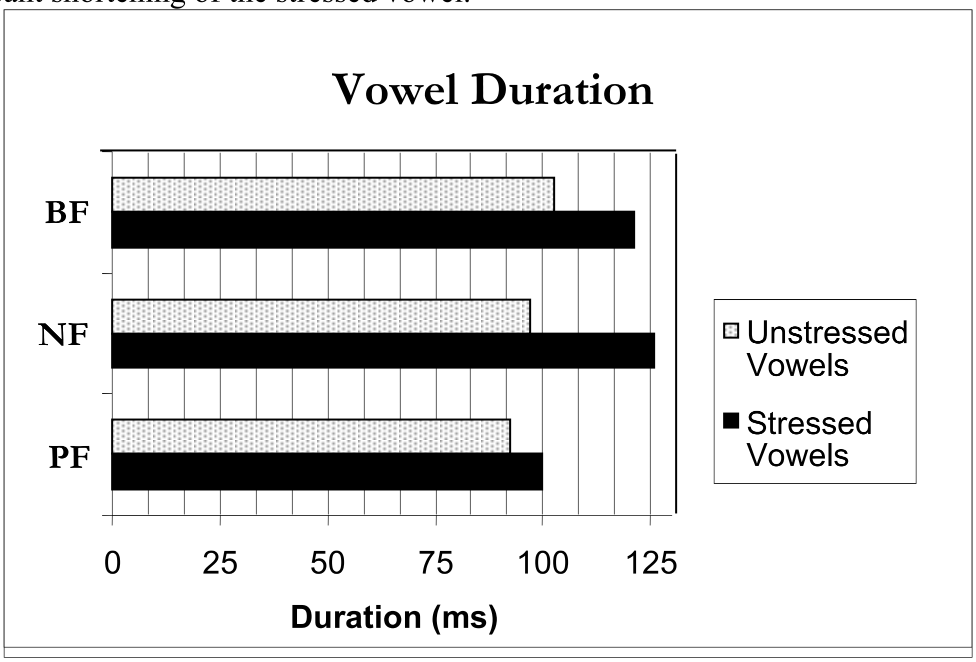


**Figure 7:** Duration (msec) for stressed and unstressed vowels, paroxytone/oxytone utterances in broad focus (BF), contrastive focus (CF), and pre-/post focal contexts (PF); stressed vowels have greater duration in all contexts as compared to unstressed vowels; no significant increase of stressed vowel duration in CF contexts; significant reduction of stressed vowels in PF contexts;

### 3.4 *Summary*

The preceding sections illustrated that there are several strategies in Romanian to cue contrastive focus: 1) through the F0 pitch range increase under CF and the pre- and post-focal pitch range reduction, 2) the tonal alignment within the rhyme bounds for CF constituents, closer to the vowel mid-point as compared to the constituents in BF. It was also shown that 3) vowel duration cues are an essential element of CF expression, signaling it through a significant compression of duration in pre- and post-focal contexts which mirrors the behavior of the pre- and post-focal accents. The shape of a CF contour is thus dependent on phonetic factors at both the level of the melodic curve as well as the segmental level, which conspire to create meaning by foregrounding the contrasted elements with an increased F0 pitch range, and surrounding it with the material in the background through de-accentuation and vowel duration compression.

## 4. *Discussion and conclusions*

This experiment describes the phonetic make up of broad focus and contrastive focus declarative sentences in Romanian. In broad focus sentences, speakers of Romanian consistently place a pitch accent on each syllable with lexical stress. The pitch range of these accents is progressively lower towards the end of the sentence and the peaks of the pre-nuclear accents align with the post-tonic syllable. Syllables with lexical stress are consistently longer than their unstressed counterparts.

In contrastive focus declarative sentences, speakers use several strategies based on pitch range, pitch alignment and duration to make the accented word more prominent than the rest. In CF the focalized word bears a pitch accent, which has an expanded pitch range whose peak aligns within the stressed vowel. However, this expanded pitch range did not have a lengthening effect on segmental duration since stressed syllables under CF pitch accents had similar durations to those under BF pitch accents, which have a smaller pitch range. In post-focal contexts, F0 has the lowest pitch values in the sentence and shows very little movement. In pre-focal positions, there is also a strong tendency to reduce F0 movement by either displaying a flat F0 or by reducing pitch accents. Although this reduced F0 movement was realized with a degree of variability, as seen in figures 5a-c, all tokens show an important reduction or de-accentuation of the pre-focal pitch accent. Moreover, segmental durations of words immediately adjacent to the word in CF are compressed especially in the stressed syllables.

Thus, Romanian speakers highlight the accented word in CF by contrasting the large pitch excursion of the CF pitch accent against the flat F0 trajectories of pre- and post-focal contexts, especially in those words that are adjacent to the CF. They also make the word under CF sound longer, not by lengthening the segmental durations of the word under focus, but by compressing the durations of the words adjacent to the CF.

These results contribute to the discussion on the distribution and nature of pitch accents in Romance languages (Hualde 2002). Concerning the distribution of pitch accents in the sentence, Hualde shows that Romance languages either exhibit a high density of accents by placing one pitch accent in each syllable with lexical stress, like Spanish and Italian. Or, like European Portuguese, only the first and last word of a declarative statement bear a pitch accent while syllables in between these two words show no prominence marking. Winkler-Gobbel's (2000) analysis of Romanian showed that in declarative statements, some words, especially verbs, tend to be de-accented suggesting that Romanian, an SVO language, could pattern more like European Portuguese than like Spanish or Italian. However, our data showed that such de-accentuation does not exist, but that each lexical stress of the utterance was linked to a pitch accent. Thus, our results indicate that Romanian patterns more like Spanish and Italian than like European Portuguese.

These contradictory results could be explained, in part, by the effect of lexical items on prominence. There seems to be reasonable evidence that properties of the segmental string, such as lexical items, have an independent effect on prominence marking (Calhoun, 2006). For example, certain types of words are much likely to be prominent than others. Function words like articles, determiners, prepositions and pronouns are often unstressed at sentence level (for Spanish see Hualde, to appear). Moreover, some classes of content words, .i.e. nouns, are more likely to be accented than others, i.e. verbs. Face's (2003) study of spontaneous speech in Spanish, a language that like Romanian exhibits high pitch density, seems to corroborate these patterns. He finds that verbs, especially those with high frequencies, tend to be de-accented. Thus, it is possible that in Winkler-Gobbel's (2000) database, this effect of word class de-accentuation was more apparent than in ours since our data is based on a question-answer elicitation method and Face's results are based on spontaneous speech.

With regards to the nature of pitch accents, Hualde (2002) explains that some Ibero- and Italo-Romance languages use pitch accent shapes in a pragmatically contrastive manner. Thus, speakers can choose among different pitch contours on stressed syllables to express different pragmatic meanings. More specifically, CF pitch accents have a different shape than pitch accents that do not have this contrastive meaning. For example, in Spanish, the peaks of pre-nuclear accents align with the post-tonic syllable. However, when pitch accents have a contrastive meaning, the peak aligns within the stressed syllable. These alignment differences determine two distinct pitch shapes, which in AM notation are transcribed as L*H and LH*. In Italian and Portuguese, contrastive pitch accents on the last word of the sentence align its peak within the stressed syllable while neutral or non-contrastive accents in the same position show a falling pattern (D'Imperio 2003, Frota 2000).

Similarly, our results indicate that CF pitch accents in Romanian have a different shape than neutral pitch accents in pre-nuclear position: the peaks of CF accents align with the stressed vowel and peaks of neutral accents align closer to the syllable boundary or with the post-tonic syllable. These alignment differences within neutral pitch accents seem to be related to word boundaries since words with paroxytone stress exhibit the post-tonic alignment while oxytone words align closer to the end of the syllable showing that these alignment differences are more related to phonetic factors rather than to meaning itself. In contrast, the peak of CF pitch accents consistently aligns with the center of the stressed vowel. Therefore, the feature that differentiates pitch shapes in Romanian is to align the peak with the center of stressed vowel, as in CF pitch accents, or closer to the syllable boundary, as in neutral pitch accents.

However, some researchers question the definition of pitch accents types solely in terms of tonal alignment and propose that meaning differences attributed to different pitch accents types are in fact signaled by multiple phonetic cues, potentially at different levels of the prosodic structure (Calhoun 2006: 67 and references therein). As Face points out for Spanish, pitch alignment is one amongst several strategies to mark CF. Similarly, our results indicate that Romanian speakers not only use pitch alignment, but also pitch range and segmental duration to express CF. They highlight the accented word in CF by contrasting the large pitch excursion of the CF pitch accent against the flat F0 trajectories of pre- and post-focal contexts, and make the word under CF sound longer, not by lengthening the segmental durations of the word under focus, but by compressing the durations of the words adjacent to the CF. Thus, in addition of pitch shape, a word in CF is marked by contrasts in pitch range and segmental duration. It would be interesting to examine the perceptual salience of pitch alignment, pitch range and segmental duration in relation to CF in order to elucidate which phonetic factors are most important in conveying phonological meaning of CF in Romanian.

In conclusion, this study contributes to description of the intonation in Romance languages by examining the phonetic characteristics of broad focus and contrastive focus declarative sentences in Romanian. Broad focus sentences in Romanian are very similar to those of Spanish and Italian in that they have a high density of pitch accents: each lexical stress in the sentence bears a pitch accent. CF pitch accents in Romanian, like in Italian, European Portuguese and Spanish, exhibit a different shape than neutral pitch accents. However, since Romanian speakers also use strategies based on pitch range and segmental duration to highlight the word in CF, it is necessary to test the perceptual salience of these cues in order to understand fully how CF works in Romanian. Perceptual testing will both highlight the interaction of various phonetic cues, as well as support a phonological assessment of these cues.

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