



Prosodic marking of information status in spoken digit sequences produced by speakers of Brazilian Portuguese and Dutch

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Abstract

Crosslinguistic analyses have shown that focus can be highlighted through syntactic, morphological and prosodic configurations, yet it also appears that languages may differ in the relative use of these features. Germanic languages have been argued to be more flexible in the use of prosodic cues to signal focus than Romance languages, for instance. However, research to support this claim has often been troubled by the fact that samples of languages that were used to compare their prosodic structures were not always comparable in terms of their lexico-syntactic structures (e.g. because of word order differences). The current study analyzed prosodic features of utterances in Brazilian Portuguese and Dutch, with basically identical surface structures, namely digit sequences of the type that also occur in credit card or telephone numbers. Twenty speakers of both Dutch and Brazilian Portuguese read out such sequences, in which target numbers were inserted that could either represent new (firstly mentioned) or given (repeated) information. Acoustic analyses showed that speakers of Dutch more consistently marked focused information than Brazilian speakers, albeit that this depended on the structural position of a number in a sequence.

Index Terms: focus, numbers, Brazilian Portuguese, Dutch

1. Introduction

Focus is a linguistic phenomenon that has been widely studied in many languages because it is an important communicative feature that is recurrently employed in different everyday interactions. Focus indicates specific semantic properties through prosodic, morphological and syntactic configurations that aim at highlighting an item.

According to [1], speakers of either Romance or Germanic languages use some kind of prosodic marking to indicate to their interlocutors the focused elements in their speech. Generally, variation in pitch is the most frequent of such markings. [2], however, observe that Romance languages, such as Italian, Catalan and French, seem to use more word order variation than variation in pitch for marking contextually relevant information, whereas Germanic languages, such as English and Dutch, use intonation for this same purpose, changing the prosodic pattern to fit the information structuring, since they do not have the same syntactic freedom to vary word order.

Focus is the part of an utterance that indicates a new information or some kind of pragmatic or semantic contrast. Previous researches have shown that prosodic features, such as intonation, duration and loudness, besides marking the focused element in the sentence, indicate the kind of focus of that element.

With regards to contrastive focus with exclusive value for Brazilian Portuguese (BP), [3] identified the following patterns: i) the stressed syllable of the focused lexical item presents a mid-melodic level (or mid-low); ii) the melodic level of the pre-tonic syllable is high (often extra-high); iii) there is no significant change in the melodic pattern on part of the utterance which precedes the focused lexical item; iv) the stressed syllable of the focused word presents loudness and duration greater than the same syllable in a neutral utterance. When the contrast is not exhaustive, it has been identified a rising modulation of melodic curve in the first stressed syllable to a high tone, which remains unchanged until the final pre-tonic, when there is a falling of the melodic curve, returning to a low level on the last stressed syllable of the utterance.

[4] investigated the characteristics of narrow focus in BP and found that, in sentence medial position, narrow focus is realized through the LH rising pattern, that is, by a high f0 peak positioned in the middle of the stressed syllable and preceded by a low tone. However, there are variations: HLH contour is also productive, wherein the second-high pitch is smaller in size than the first. Focus can also be represented by the HL pattern in final position, with the low tone aligned with the center of the stressed syllable when there is a more emphatic focus.

Researches that systematically approach the intonational structure of sentences with focused element in European Portuguese (EP) were developed by [5], [6], [7] and [8]. According to these studies, the identification of pitch accent pattern (H*+L) associated with the stressed syllable of the focused element seems to be a consensus, that is, there is a high pitch accent on the stressed syllable followed by a low tone. [7] also found that the stressed syllable of focused element presents longer duration and higher loudness.

In order to investigate whether Italian differs from Dutch in prosodic marking of the informational status within noun phrases, [9] conducted a comparative analysis of accentuation strategies in these two languages, comparing them through analysis of the melodic curve pattern for new, given and contrastive information. The results presented that in Dutch, new and contrastive information are accented, while given information is not; in Italian, distribution is not a significant factor in distinguishing information status, since within the elicited NPs both adjective and noun are always accented, irrespective of the status of the discourse context.

Similar to what happen in Dutch, [10] found that German speakers usually mark new referents with a phrasal accent (H*), whereas given referents tend to be deaccented, and accessible referents tend to present an intermediate phrasal accent (H+L*).

In Castilian Spanish, there are peculiarities relative to the marking of focus, as noticed in [11] whose results showed that the falling f0, typical of downstep, is one of the intonational cues of focus in that language. In this sense, [12] developed an experiment involving Dutch and Spanish and found that there is a prosodic transfer, even partially, from pattern used in the native language (L1) of the speaker to the second language (L2). Furthermore, they confirmed that the intonation marked by a rising pitch is used by Dutch to mark informational status whereas Spanish does not make the same for this purpose.

Another comparative analysis among Romance and Germanic languages was conducted by [13] that examined prominence patterns in Dutch and Romanian, investigating which different types of contrasts have impact on the distribution of the accent and whether there are differences in the relationship between contrast and accent in these languages. The findings of this study revealed that Dutch and Romanian are markedly different in the way they encode contrastive information in prominence patterns. While the Dutch data showed a rather complicated pattern of interactions between contrastive factors and accent distribution, the Romanian data instead did not yield any evidence of a relation between contrast and accent.

In declarative sentences of English, [14] assert that the focused constituents receive the nuclear accent of the sentence, and are marked by higher pitch, longer duration and higher loudness, whereas the given constituents, especially when located after the focus, are deaccentuated. However, the authors emphasize that we should not generalize since it is a language that is spoken in several countries, as with Spanish.

[15], for instance, studied the use of prosody for information structuring in Nigerian English and found that the main difference between this language and British English is that in Nigerian English nearly all sentence-final words receive an accent even if they represent given information. That is, Nigerian English does not seem to deaccentuate given information as it happens in British English.

Another variety of English, the South African, was studied by [16]. They realized that speakers of English as L1 use intonation in order to mark focused words, as it happens in other varieties of English. However, speakers of the English resulting from contact with the Bantu language, called Zulu, did not use prosody to signal the focus, similarly to what is typical of their native language.

Given the above, we can see that the studies on focus often use, in their experiments, words organized syntactically in sentences. To the best of our knowledge, there isn't any research about prosodic focus using numeric groupings conducted for neither BP nor Dutch. The present paper aims to describe the prosodic pattern of focus marking on numbers in both Brazilian Portuguese and Dutch.

2. Methods

The data used in this study consist of numeric groupings extracted from speech recordings of twenty Dutch native speakers and twenty Brazilian Portuguese native speakers in a monolingual environment. Recording were made in a quiet room. Participants were informed that they would be presented to a series of slides with numeric groupings containing three blocks of three numbers each. They were instructed to read aloud the numeric groupings, digit by digit, in a normal speech

rate. They were informed that the approximate time for the entire experiment was eight minutes.

Participants were asked to repeat each numeric grouping as often as they wished or if there was any mistake in the reading. Then, they were presented to a total of 48 numerical groupings. The strings of numbers were created using the numbers from zero to nine in a random way. For the study, only the numbers "one", "two", "three" and "six" were analyzed, because they are monosyllabic words in both Dutch and Brazilian Portuguese. This was done in order to control for utterance duration.

The target number could be either a given (G) or a new (N) information in the grouping. It appeared either on the second (non-final, NF) or on the third (final, F) block in the grouping. Inside the block, it could appear in three possible positions: initial (I), middle (M) and final (E). See Figure 1 below for an example of a numeric grouping.

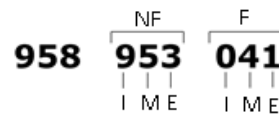


Figure 1: Example of a numeric grouping.

In this case, the number 3 (three) appears in the last position (E) of the second block (NF) as a new information (N), so it was classified as NF-E-N. The stimuli resulted in 48 counterbalanced possibilities, 12 per target number, as described in Table 1. The groupings were presented to the participants in a random order. Moreover, ten distracting sequences have been prepared and presented to the participants, five at the start of the experiment and five at the end.

Table 1. Combinations for analysis per target number.

Column	Position	Status
NF	I	G
		N
	M	G
		N
	E	G
		N
F	I	G
		N
	M	G
		N
	E	G
		N

Recordings were done directly into a laptop, using Audacity 2.0.5 software (16bit/44.1 kHz WAV format) [17] and analyzed with Praat [18], version 5.4.12. A script was used to extract the following acoustic measurements of the target numbers: duration (in milliseconds), mean pitch (in St) and mean intensity (in dB). The statistical analysis was carried out using IBM SPSS Statistics v24 [19], and a significance level of 0.05 was used.

3. Results and discussion

3.1. Duration

Mean duration of the target numbers did not differ significantly with respect to information status. It was observed a tendency for numbers associated to new information to be longer than those associated to given information, in both languages. However, Analysis of Variance (ANOVA) with repeated measures showed no significant interaction between information status and language, $F(1,38)=1.27$, $p=0.26$.

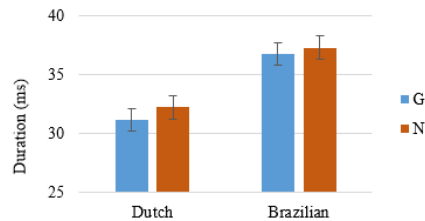


Figure 2: Duration in given and new information.

With regards to the location of the target number in NF block or F block of the grouping, no significant interaction in terms of duration was found either: $F(1,38)=1.65$, $p=0.20$.

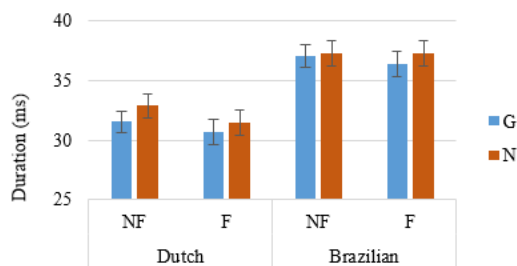


Figure 3: Duration in block position.

The duration of the target number varied as a function position of the number in the block (I, M, E) was another condition which showed the same pattern of behavior regarding the duration, for both languages. Brazilian and Dutch participants spoke the numbers more slowly when they appeared in end position and the duration has been shorter in middle position (Figure 4). However, only in the middle position (M) the difference between given and new information was significant: $F(1,318)=10.06$, $p<0.05$.

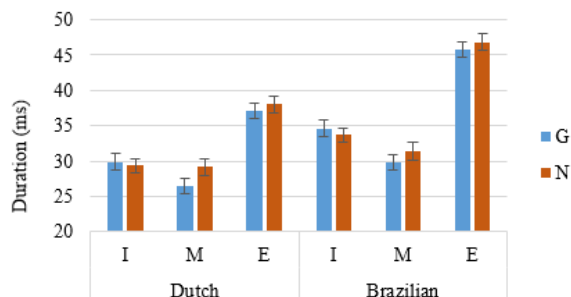


Figure 4: Duration in position within the block.

Figures 2, 3 and 4 revealed that in both Dutch and Portuguese new information items are regularly associated to

longer duration, regardless of the position of the item in a numeric grouping. Although this difference is in most cases not significant, it is possible to observe a trend in this direction. It should be pointed out that the duration of new information in middle position within a numeric block is significantly longer than the duration of given information in both languages.

3.2. Mean pitch

A significant difference was observed in mean pitch between given and new information in both Dutch, $F(1,958)=26.92$, $p<0.05$ and Brazilian Portuguese, $F(1,958)=18.25$, $p<0.05$. Figure 5 shows that higher values of mean pitch is associated to new information in both languages.

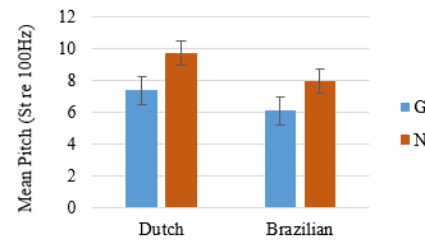


Figure 5: Mean pitch in given and new information.

When the data are broken down by block position, pitch values are only significantly different for blocks in non-final position, as Figure 6 below demonstrates.

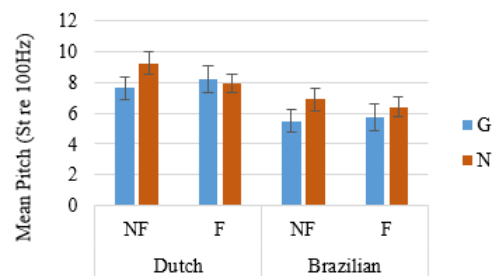


Figure 6: Mean pitch in block position.

Results of statistical tests revealed significantly higher mean pitch values when the target number was new information as compared to the same number when it was delivered as given information in both Dutch, $F(1,478)=14.72$, $p<0.05$, and BP, $F(1,478)=9.03$, $p<0.05$.

With regards to the position of the item in the block (I, M, E), Figure 7 shows that new information is associated to higher value of mean pitch in all positions.

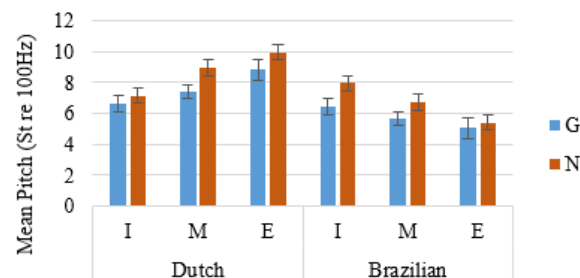


Figure 7: Mean pitch in position within the block.

However, the results of ANOVAs revealed no significant difference in relation to informational status at the initial position (I) in Dutch, $F(1,318)=2.32$, $p>0.05$, and nor at the end position (E) in BP, $F(1,318)=0.94$, $p>0.05$.

There were significant differences in mean pitch between new and given information at the middle (M), $F(1,318)=38.26$, $p<0.05$, and final (E), $F(1,318)=24.57$, $p<0.05$, positions in Dutch. In Brazilian Portuguese, mean pitch was significantly higher for new information at initial (I), $F(1,318)=29.85$, $p<0.05$, and at middle (M), $F(1,318)=11.29$, $p<0.05$ positions.

It is noteworthy to point out the different intonation pattern associated to numeric groupings in Dutch and Brazilian Portuguese. As Figure 7 shows, Dutch presents a rising intonation pattern in the uttering of numbers in a block. The opposite pattern is observed in Brazilian Portuguese.

3.3. Mean intensity

Mean intensity has been also analyzed and the results showed that this acoustic measure seems to be relevant as a mark of informational status in Dutch.

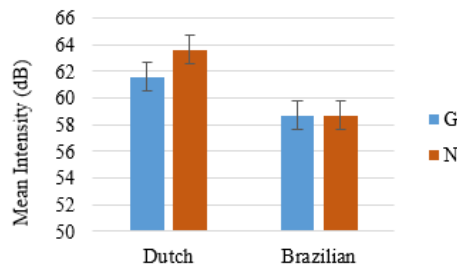


Figure 8: Mean intensity in given and new information.

ANOVA test revealed significantly higher mean intensity values when the target number was new information, as compared to when it was given information in Dutch, $F(1,958)=24.86$, $p<0.05$. On the other hand, in BP, this difference was not significant, $F(1,958)=0.006$, $p>0.05$.

A similar behavior was observed when the data was broken down by block position (NF and F), as Figure 9 below demonstrates.

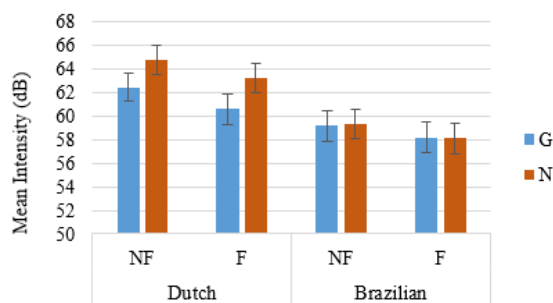


Figure 9: Mean intensity in block position.

Mean intensity values were significantly different at non-final block position (NF), $F(1,478)=6.904$, $p<0.05$, and at final block position (F), $F(1,478)=20.4$, $p<0.05$ in Dutch. In BP, no effect was found: $F(1,478)=0.054$, $p>0.05$ at NF block, and $F(1,478)=0.013$, $p>0.05$ at F block.

Figure 10 also shows that the mean intensity is relevant in focus marking only in Dutch.

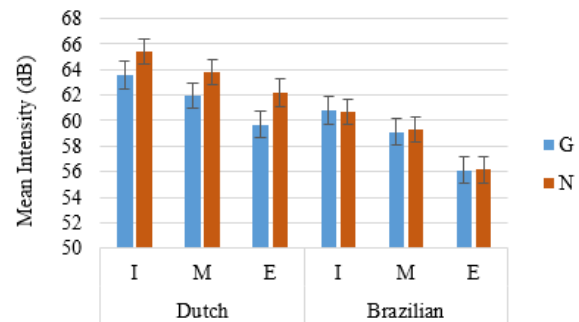


Figure 10: Mean intensity in position within the block.

Higher mean intensity values were always associated to new information in Dutch, regardless of the position of that information in a string of numbers: at initial position, $F(1,318)=5.122$, $p<0.05$, middle position, $F(1,318)=8.71$, $p<0.05$, and end position, $F(1,318)=14.06$, $p<0.05$. In Brazilian, these differences were not significant: $F(1,318)=0.023$, $p>0.05$ at the I position; $F(1,318)=0.05$, $p>0.05$ at the M position; and $F(1,318)=0.003$, $p>0.05$ at the E position.

4. Conclusions

This study aimed at analyzing prosodic features of utterances in Brazilian Portuguese and Dutch, with identical surface structures: digit sequences of the type that occur in telephone numbers. These numbers differed only by one digit, that could either represent new (firstly mentioned) or given (repeated) information. Acoustic analyses showed that Brazilian speakers use predominantly pitch to indicate whether the information is given or new, whereas Dutch speakers use intensity and pitch for the same purpose. The duration do not seem to be a relevant prosodic feature in the marking of informational status neither in BP nor in Dutch.

In both languages, when a number was shown as new information, it was uttered with a significantly higher mean pitch than when it was displayed as given information. The same pattern was found in the analyses of mean intensity, but only in Dutch. The final block of a numeric grouping (F) was characterized by a shorter duration and lower mean intensity as compared to the penultimate block (NF). However, mean pitch was higher in the final block position than at the non-final block in Dutch whereas in BP the opposite pattern was observed.

Our findings are in line with previous findings for BP ([3], [4], [20], [21], [22]) and for Dutch ([2], [9], [12], [13]) concerning the use of prosody as a marker of focus marking on syntactically organized sentences. However, we observed in our data that Brazilian speakers use pitch for marking new information, as opposed to what has been reported for other Romance languages, such as Italian [9] and Spanish [12]. Dutch speakers apparently employ a combination of prosodic features for marking informational status, while Brazilian speakers use only pitch for the same purpose. In both language, pitch is a highly relevant cue for marking informational status.

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