THE INFLUENCE OF PROMINENCE ON THE PRODUCTION OF PLOSIVES IN ITALIAN

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ABSTRACT

This study explores prosodic strengthening in the production of fortis plosives in Italian as a function of four structural levels of prominence, reflecting differing focal conditions (in order of increasing prominence: postfocal, broad focus, narrow focus and contrastive narrow focus). The overall analysis indicated that for lingual consonants closure duration was the most important acoustic parameter, differing not only when comparing the most diverging levels, contrastive and postfocal, but also when comparing the broad focus and postfocal conditions. For the labial plosive, /p/, the parameter that was affected most by the level of prominence was burst energy. Unsurprisingly, given the lack of aspiration in the language, there was no consistent effect on VOT.

Keywords: prosodic strengthening, level of prominence, postfocal prominence, plosives, Italian.

1. INTRODUCTION

In the last two decades, a considerable body of research has been devoted to studying the influence of prosodic structure on the articulation of plosives in a range of different languages (e.g. [1], [2], [3] among others), including Italian ([4], [5]). However, this work has largely focused on effects of boundary strength at the beginning of domains. The effect of accentuation, by contrast, has received less attention, and has largely been restricted to the dichotomy accented-unaccented ([6], [7], [8], see [9] for Italian), where accented syllables are stronger than unaccented ones. The effects of these two types of strengthening have been argued to differ somewhat in terms of the domain of the effects [10], although in a language-specific way [11]. A number of studies on German have begun to look beyond the accented-unaccented dichotomy, by looking at the effect of different degrees of accentuation, comparing different focus types and domains. However, these studies are primarily concerned with the production of vowels ([12], [13], [14]).

The aim of this study is to explore the influence of different focal conditions – corresponding to different levels of prominence – in Italian. Specifically, we focus on the production of lingual and labial fortis plosives, /p/ and /t, k/ respectively. We hypothesise that a higher degree of prominence constitutes a higher degree of prosodic strength, involving sonority expansion ([15]), where consonants are more consonant-like (less sonorous) and vowels more vowel-like (more sonorous). The following acoustic parameters related to sonority reduction of fortis plosives are taken into consideration: closure duration, Voice Onset Time (VOT) and burst energy.

2. METHOD

We compared different realisations of syllable-initial plosives in target words with differing degrees of accentual prominence, resulting from the type and domain of focus. For the purposes of this study, we assume that a referent with Contrastive Narrow Focus (henceforth CNF) is more prominent than one with Narrow Focus (henceforth NF). A referent with NF will in turn be more prominent than one that is part of a larger focus domain, i.e. Broad Focus (henceforth BF). In the Post-Focal domain (henceforth PF), it is generally argued that Italian can also have an accent, albeit one with little F0 movement and low pitch although there is evidence that there may, in fact, be deaccentuation in some speakers' productions ([16]). In Bari Italian, the variety under investigation here, such information structural differences are generally reflected in the type of accent produced and in the F0 height on the accented syllable, either in absolute terms or in relation to an earlier accent in the phrase ([17], [18], [19]). However, here we investigate prominence resulting from focus conditions directly, without taking into account any speaker specific variation in the intonation patterns.

2.1. Elicited material

Target words were elicited in a sentence as an answer in Question/Answer pairs suitable for eliciting the intended CNF, NF, BF and PF focus structures. Target fortis plosives were syllable-initial, and either word-initial or word-medial, with the rest of the syllable as /ar/:

parto /'parto/ (*I leave*): reparto /re'parto/ (*section*)
tarlo /'tarlo/ (*woodworm*): citarlo /tʃi'tarlo/(*to cite it*)
Carlo /'karlo/ (*Carlo*): cecarlo /tʃe'karlo/(*to blind it*)

Examples for the four levels of accentual prominence are given below for the target word 'tarlo':

PF (example in Figure 1)
Ti dico tarlo lentamente
(*I'm telling you woodworm slowly*)
Si' [lo so]$_F$ che mi dici tarlo lentamente
(*Yes I know you're telling me woodworm slowly*)

BF (example in Figure 2)
Che cosa ti dico?
(*What am I telling you?*)
Mi dici [tarlo lentamente]$_F$
(*You're telling me woodworm slowly*)

NF (example in Figure 3)
Che cosa ti dico lentamente?
(*What am I telling you slowly?*)
Mi dici [tarlo]$_F$ lentamente
(*You're telling me woodworm slowly*)

CNF (example in Figure 4)
Ti dico verme lentamente?
(Am I telling you worm slowly?)
No, mi dici [<u>tarlo</u>]$_F$ lentamente, non verme
(*No, you're telling me <u>woodworm</u> slowly, not worm*)

Five repetitions of each Question/Answer pair were presented in randomised order.

Typical intonation patterns are shown for each focus condition in Figures 1-4.

2.2. Informants and elicitation method

Four Bari Italian speakers (3 females, 1 male, aged 24-40) participated in the recording sessions on a voluntary basis. They were students and staff of the two local universities, three of whom had no background in phonetics or prosody. During the recording sessions, informants sat in front of a computer, wearing a head-mounted professional microphone directly connected to another computer for signal acquisition (at 22.050 kHz sampling rate). Each Question/Answer pair was presented individually on the computer screen, and subjects were instructed to read both question and answer at their normal speech rate and in a natural way. They read silently before reading aloud. Speakers were allowed to repeat sentences if they felt they were unnatural, or when disfluencies occurred. All speakers were recorded in a quiet laboratory at the Polytechnic of Bari.

2.3. Acoustic measurements

In all target words, the following acoustic parameters were measures for /p/, /t/, /k/:
Closure duration: from the F2 offset of the preceding vowel to the first burst release of the consonant;
VOT: from the burst release to the F2 onset in the following vowel (i.e. voicing onset);
RMS Burst energy: calculated within a fixed 5 ms window from the burst release (by using the "GetEnergy" function in Praat).

All annotations and measurements were carried out with the Praat software tool [20].

Figure 1: PF condition. Waveform and F0 contour of target sentence containing the word "tarlo" (speaker LP)

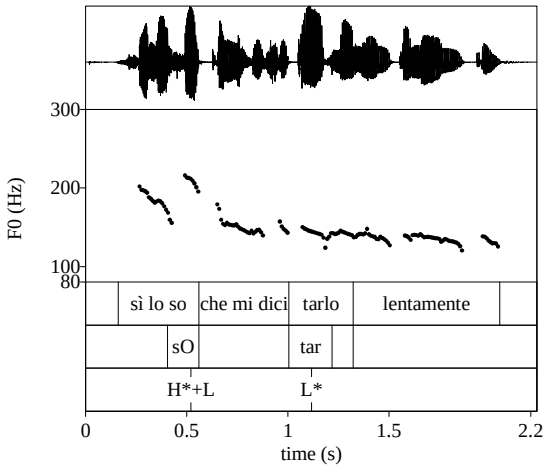


Figure 2: BF condition. Waveform and F0 contour of target sentence containing the word "tarlo" (speaker LP)

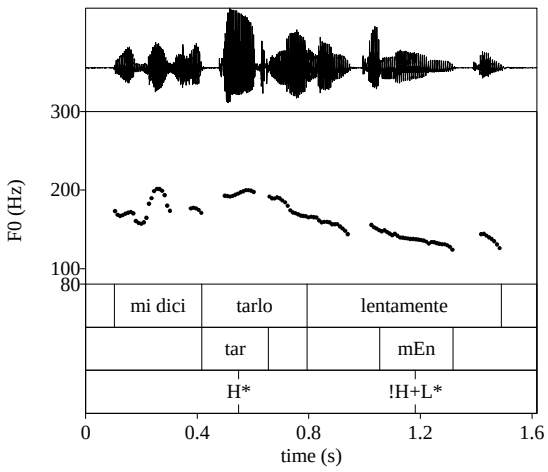


Figure 3: NF condition. Waveform and F0 contour of target sentence containing the word "tarlo" (speaker LP)

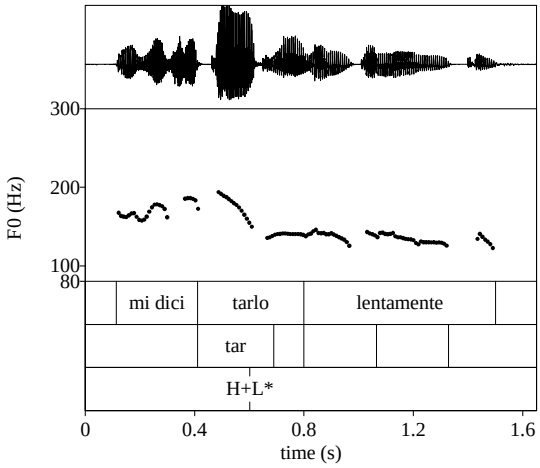
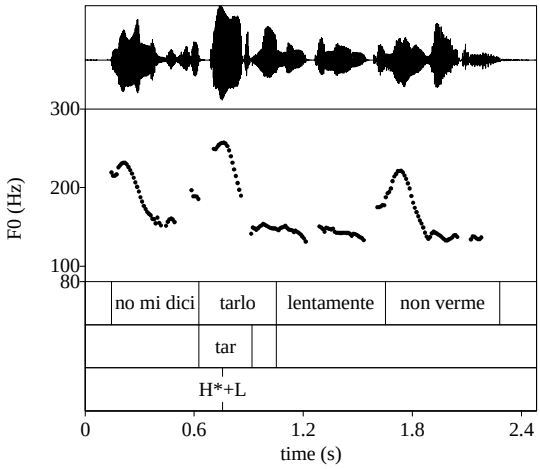


Figure 4: CNF condition. Waveform and F0 contour of target sentence containing the word "tarlo" (speaker LP)



3. RESULTS

We performed a series of mixed factor ANOVAs with Place of Articulation (PoA, 3 levels: /p/, /t/, /k/), Level of Prominence (LoP, 4 levels: PF, BF, NF, CNF), and Position in the word (Pos, 2 levels: word-initial, word-medial) as within-subjects independent variables, and Speaker as between-subject factor. Results are described for each variable below (all posthoc tests are HSD Tukey with Bonferroni correction). Since in this paper we focussed on the influence of level of accentual prominence, positional effects are not presented and discussed here.

Closure duration. For this parameter, results show an interaction effect between PoA (place) and LoP (prominence) ($F(6,96)=9.22$, $p<.001$, Figure 5). For /k/, closure duration is significantly longer in CNF than in BF and PF, but not longer than in NF (i.e. **CNF=NF>BF=PF**); for /t/, closure duration is not significantly longer in CNF than in NF, but it decreases significantly in BF and even more in PF conditions (i.e. **CNF=NF>BF>PF**). The situation for /p/ is different, as posthoc tests show no effect of LoP for /p/.

Voice Onset Time. Analysis reveals an interaction effect between PoA and LoP ($F=6,96)=4.8995$, $p<.001$, Figure 6). This was possibly due to a strong main effect of PoA ($p<.001$) and a weaker main effect of LoP ($p<.05$), as posthoc tests did not reach significance.

RMS burst energy. Results show an interaction effect between PoA and LoP ($F(6,96)=3.8116$), $p<.01$, see Figure 7), even though posthoc tests indicate that the effect is significant only for /p/, which is characterised by higher RMS burst energy values in CNF than in each of the other conditions, and values in NF are higher than in PF. However, differences between BF and NF and between BF and PF do no reach significance (i.e.**CNF>[NF,BF,PF]**, **NF>PF**, **BF=NF, BF=PF**).

The overall results are presented in Table 1.

Figure 5: Closure Duration: Mean values and standard errors for the three Italian plosives as a function of different Levels of Prominence.

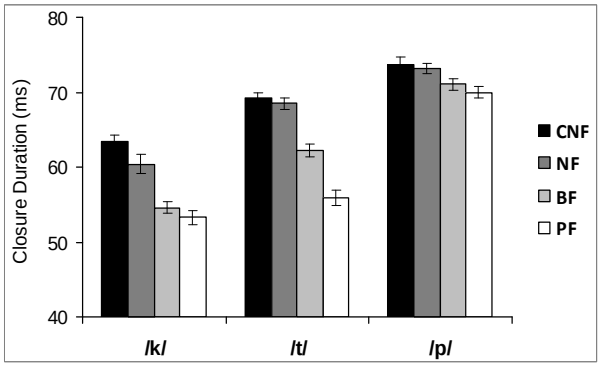


Figure 6: Voice Onset Time: Mean values and standard errors for the three Italian plosives as a function of different Levels of Prominence.

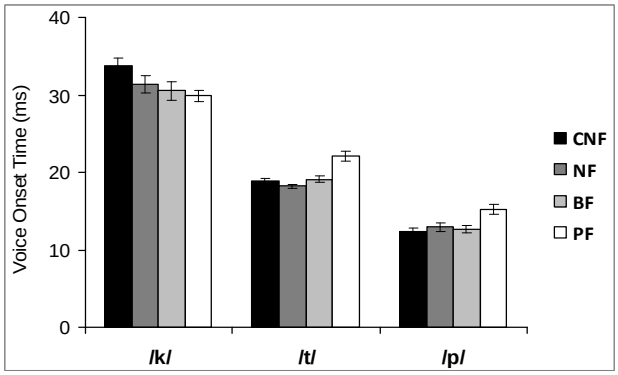


Figure 7: RMS Burst Energy: Mean values and standard errors for the three Italian plosives as a function of different Levels of Prominence.

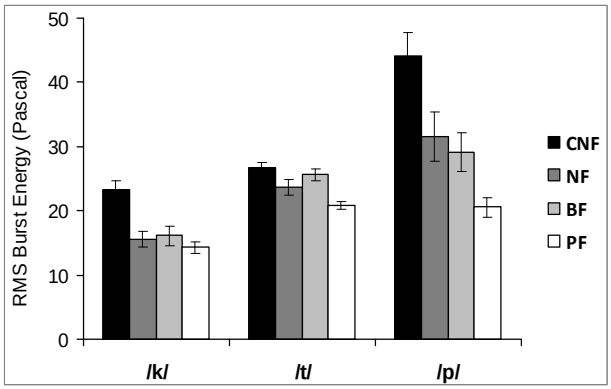


Table1: Overall results for Place of Articulation x Level of Prominence interactions for the three acoustic parameters

param	PoA x LoP
Closure dur	/k/ CNF=NF>BF=PF /t/ CNF=NF>BF>PF /p/ *n.s.*
VOT	*n.s.*
Burst energy	/k/ *n.s.* /t/ *n.s.* /p/ CNF>[NF,BF,PF], NF>PF, BF=NF, BF=PF

Since, as expected, we found a significant main effect for Speaker, we also performed a series of factorial ANOVAs, one for each speaker, in order to explore speaker-specific differences across the four degrees of accentuation. Although space restrictions prevent us from showing individual results in detail, a summary of main trend is provided here,

For closure duration, speakers ES and TA show similar patterns to those in the overall results, whereas the other two speakers are less consistent.

For burst energy, ES shows the same effects described for /p/ as in the overall analysis, whereas for RF /t/ is affected instead.

VOT shows inconsistent effects across the levels. However, in the production of two of the four speakers (ES and TA) there are lower values, corresponding to shorter VOT, for CNF compared to the other levels (for ES: /t/, for TA: /t/ and /p/).

4. DISCUSSION AND CONCLUSIONS

Our overall results provide evidence that the production of fortis plosives in Italian can be conditioned by prominence as a reflection of focus type. Moreover, we draw the preliminary conclusion that in Italian focal prominence induces sonority expansion. This means that this type of prosodic strengthening enhances the syntagmatic constrast between consonants and vowels.

The effect of prominence was not the same for all three plosives investigated. For the lingual ones, /k/ and /t/, closure duration appeared to be the crucial parameter affected. This was not only the case when comparing the two most diverging degrees of prominence (contrastive narrow focus and postfocal), but also when comparing broad focus and contrastive narrow focus. Interestingly, there was no apparent difference between the values for closure duration when comparing broad focus with the postfocal condition. For the labial plosive, /p/, the relevant acoustic parameter was burst energy, rather than closure duration.

Our results are consistent with the above mentioned studies on German ([12, [13], [14]), where systematic differences in supralaryngeal articulation were found, not only when comparing accented and unaccented words, but also when comparing accented words with different levels of focal prominence. Moreover, our findings are in line with the German studies when comparing the production of words that were postfocal with those in the broad focus condition. This is interesting, as the two languages differ in the postfocal case. Whereas in the German case postfocal words were consistently deaccented, in Italian they were occasionally deaccented but typically had a L* accent. Thus we provide evidence from another language indicating that it might not be accentuation *per se* that triggers prosodic strengthening, but rather the level of prominence.

Inconsistent results for VOT were unsurprising, given that plosives in Bari Italian are unaspirated. The fact that two individual speakers reduced VOT in the most prominent position is also consistent with general results on another language with unaspirated fortis plosives (cf. [21] for Dutch). Thus, individual results suggest a possible tendency towards feature enhancement, although further exploration is needed to corroborate this.

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