

## Durational effects of boundaries in Italian fricatives

Ioana Chitoran<sup>1,3</sup>, Hiyon Yoo<sup>1,2</sup>, Giuseppina Turco<sup>1,2</sup>

<sup>1</sup> Université de Paris – Paris Diderot, <sup>2</sup> CNRS Laboratoire de linguistique formelle, <sup>3</sup> Clillac-ARP

**INTRODUCTION.** In this study we examine durational effects in Italian consonants as a function of two positional factors: position with respect to stress and with respect to an Intonational phrase (IP) boundary. In Italian, consonant duration is used in implementing *raddoppiamento sintattico* (RS), a well-studied phonological process in Southern and Central Italian varieties [1][2][3][4][5][6], whereby a word-initial consonant is geminated after a final stressed vowel. RS occurs when two stressed syllables are adjacent within a phonological phrase ([ˈtre ˈk:a:se] ‘three houses’), or when they are separated by at most one unstressed syllable ([parˈlo l:aˈti:no] ‘spoke Latin’). It has also been suggested, on the basis of articulatory data [7], that consonant duration may signal stronger (IP) prosodic boundaries in Italian.

We ask to what degree native speakers of RS varieties of Italian show durational differences in their speech patterns both in relation to RS as a function of proximity to stress, and to signal the presence of an IP boundary. In the presence of an IP boundary RS is blocked. Evidence for IP as a major prosodic boundary in Italian is based on [8][9].

**HYPOTHESES.** H1: Consonant duration varies with respect to both stress and IP position. In RS varieties of Italian, we expect, under H1, longer consonant duration in stress-adjacent positions relative to non-stress-adjacent, based on [4][6]. We also expect longer duration in IP-initial position relative to non-IP-initial, based on [7] for Italian, and on evidence from other languages [10].

H2: Consonant duration varies only as a function of stress. In RS varieties of Italian, we expect, under H2, longer consonant duration in stress-adjacent positions relative to non-stress-adjacent, but no differences in duration between IP-initial and non-IP-initial positions. We tested the hypotheses through a systematic comparison of consonant duration as a function of position with respect to stress and with respect to IP boundary. The consonants we examined are the singleton onset fricatives [f], [s] and the fricatives in the onset clusters [fr], [sp], [sk].

**METHOD.** The experimental material includes sentences where the same consonant occurs in four different conditions (Table 1). We paired sentences in stress-adjacent and non-stress-adjacent contexts with IP-initial and non-IP-initial positions. In the stress-adjacent condition (AS), the consonant is both preceded and followed by a stressed syllable: [porˈtɔ ˈfɛ:ta] ‘s/he brought feta’. The sentence contains a simple past verb with final stress ([porˈtɔ]) followed by a consonant-initial word with initial stress ([ˈfɛ:ta]). In the non-stress-adjacent condition (nonAS), the consonant is only followed by a stressed syllable. The same sentence contains a past tense verb with penultimate stress ([a porˈtato]) followed by the same stress-initial word: [a porˈtato ˈfɛ:ta] ‘s/he has brought feta’. Within each of these two stress conditions, the verb+noun combination was further manipulated to contrast the presence vs. absence of IP. We thus have a sentence with one verb phrase (non-IP-initial position: [porˈtɔ / a porˈtato ˈfɛ:ta ε oˈli:ve]) or two separate clauses (IP-initial position: [ne porˈtɔ / a porˈtato] [ˈfɛ:ta ε oˈli:ve]).

Eight Italian native speakers (7 female), four from Rome, one from Florence, two from Naples, one from Marsala, Sicily, participated in the recordings. The material was presented in two blocked lists. The first list contained all the non-IP-initial sentences in both AS and nonAS conditions. The second list contained all the IP-initial sentences (again, AS and nonAS). In both lists, the sentences were pseudo-randomized. Automatic annotations with SPPAS [11] were checked for alignment errors. Fricative duration was determined by frication noise.

**RESULTS.** We found an effect of proximity to stress (Fig. 1 left), confirming that consonant duration is longer in the expected AS condition compared to nonAS, supported by a linear mixed effects model ( $\beta_{AS}=38.06$ ,  $SE=5.60$ ,  $t=6.79$ ,  $p<.0001$ ). The difference in fricative duration between the AS condition (Table 1, upper row) and the nonAS condition (Table 1, lower row) is significantly larger for singleton [f], [s] and for the [fr] cluster than for [sC]

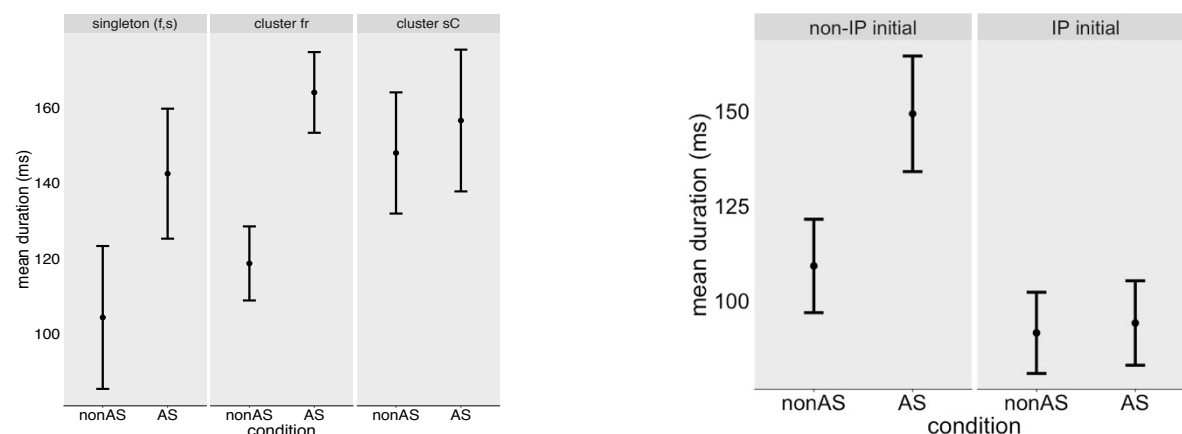
( $\beta_{\text{singleton}*\text{AS}}=29.83$ ,  $SE=5.02$ ,  $t=5.93$ ,  $p<.0001$ ;  $\beta_{\text{[fr]cluster}*\text{AS}}=36.83$ ,  $SE=5.82$ ,  $t=6.32$ ,  $p<.0001$ ). Preliminary comparisons of the stop duration in [sC] showed that C is longer in AS (mean = 91.25 ms) compared to the non-AS condition (mean = 59.5 ms).

We found no effect of IP condition (Fig. 1 right). The duration of singleton fricatives was comparable in IP-initial position and in the non-IP-initial position, non-adjacent to stress. The difference in fricative duration is larger for the non-IP-initial context (Table 1, left) than for the IP-initial context (Table 1, right) ( $\beta_{\text{AS}*non-IP-initial}=-36.33$ ,  $SE=4.09$ ,  $t=-8.86$ ,  $p<.0001$ ). In the IP-initial context, fricative duration is comparable across the two stress positions ( $p=.6$ ).

DISCUSSION. The results support H2, confirming that duration signals proximity to stress (cf. [4][6]) for all onset types except the so called ‘impure’ [s] in [sC] clusters (cf. [5]). Contrary to expectations for strong domain positions, we did not find IP-initial fricative lengthening. In RS varieties of Italian, prosodic strengthening is not realized through increased fricative duration. Rather, duration marks morphological word boundaries via RS (cf. [5]).

	C in non-IP-initial position	C in IP-initial position
<b>Adjacent stress (AS)</b>	<i>Alla festa Nicolò <b>portò feta</b> e olive con cinque bottiglie di vino.</i>	<i>Di specialità Nicolò ne <b>portò. Feta</b> e olive furono divorate rapidamente.</i>
<b>Non-adjacent stress (nonAS)</b>	<i>Alla festa Nicolò ha <b>portato feta</b> e olive con cinque bottiglie di vino.</i>	<i>Di specialità Nicolò ne ha <b>portate. Feta</b> e olive sono state divorate rapidamente.</i>

**Table 1.** Example of experimental material in the four test conditions.



**Figure 1.** Left: mean duration of the fricative consonants as a function of adjacent-stress and of non-adjacent stress condition split by type of consonant (singleton [f, s], cluster [fr] and cluster [sC]) in non-IP initial position. Right: mean duration of the fricative consonants as a function of adjacent and non-adjacent stress condition split by position (non-IP initial vs. IP initial).

**References:** [1] Chierchia (1986) Length, syllabification and the phonological cycle in Italian. *Journal of Italian Linguistics* 8. 5-33 / [2] Repetti (1991) A moraic analysis of *raddoppiamento fonosintattico*. *Rivista di Linguistica* 3. 307-330 / [3] Bertinetto, Loporcaro (2005) The sound pattern of standard Italian, as compared with the varieties spoken in Florence, Milan and Rome. *JIPA* 35. 131-151 / [4] Marotta (1986) Rhythmical constraints on syntactic doubling. *Journal of Italian Linguistics* 8. 35-52 / [5] McCrary (2004) *Reassessing the role of the syllable in Italian phonology: An experimental study of consonant cluster syllabification, definite article allomorphy and segment duration*. PhD dissertation, UCLA / [6] Payne (2005) *Phonetic variation in Italian consonant gemination*. *JIPA* 35/2. 153-181 / [7] Gili-Favela, d’Apolito, Stella, Sigona (2008) Domain initial strengthening in sentences and paragraphs. *ISSP* 8 / [8] Grice, D’Imperio, Savino, Avesani (2005) Strategies of intonation labelling across varieties of Italian. In Sun-Ah Jun (Ed.) *Prosodic typology I*. Oxford UP. 362-389 / [9] D’Imperio, Gili-Favela (2003) How many levels of phrasing? Evidence from two varieties of Italian. In Local, Ogden, Temple (Eds.) *Papers in Laboratory Phonology VI*. Cambridge UP. 130-144 / [10] Cho, Keating (2001) Articulatory and acoustic studies on domain-initial strengthening in Korean. *Journal of Phonetics* 29. 155-190 / [11] Bigi (2015) SPPAS - Multi-lingual Approaches to the Automatic Annotation of Speech. *The Phonetician – International Society of Phonetic Sciences* 111-112. 54-69