Asymmetries in the acoustic enhancement of phonological contrasts

Olga Dmitrieva[1] and Chiara Celata[2]

[1]Purdue University (USA), [2]University of Urbino (Italy)

Lexical neighborhood density and the existance of minimal neighbors influence the way sounds are produced (e.g., [2,5,6]). For instance, English voiceless stops have longer voice onset time (VOT) when embedded in words which have a minimal neighbor for voicing (e.g. *teen* vs. *dean*) compared to words without minimal competitors (e.g. *table* vs. **dable*) [1]. This study investigates the acoustic realization of the voicing and gemination contrasts as implemented in Italian in order to expand the scope of previous research to typologically distinct languages and phonological contrasts. Italian, unlike English, is a 'true voicing' language and as such it provides a test case for the predictions of the laryngeal realism theory regarding the nature of phonological representations [3,7,9]. Standard Italian is known to contrast prevoiced stops with voiceless unaspirated stops [9], while gemination in stops is characterized by a longer closure duration and a shorter preceding vowel duration [4]. The goals of the study included verifying whether short-lag VOT (for voiceless stops) and prevoicing (for voiced stops) were equally manipulated by the speakers and whether both primary and secondary acoustic cues to gemination (closure duration and preceding vowel duration) were equally affected by the presence of a minimal neighbor.

Real and invented disyllabic paroxytones beginning with /p b t d k g/ and containing intervocalic /t t: n n:/ were read by 60 native speakers (4 repetitions). The stimuli were organized in quadruplets of minimal pairs for voicing or gemination (Table 1). In each quadruplet, stimuli were equally divided into those with and without real minimal competitor for voicing or gemination and into real and non-words, for a fully crossed factorial design. Stimuli were balanced for phonotactic probability and divided into two lists to be presented to two groups of participants, such that participants in each group were exposed to only one member of each minimal pair. Each experimental list contained 76 stimuli and 46 disyllabic fillers (half words and half non-words). For voicing, we measured VOT - the duration of prevoicing for voiced stimuli and the duration of the release for voiceless stimuli. For length, we measured the closure of the intervocalic consonant and the duration of preceding vowel. Linear mixed effects models were run with stepwise selection of explanatory variables (AIC criterion). Voiced and voiceless stops were analyzed in separate models.

We limit our summary to the competitor/non-competitor parameter. In word-initial voiceless stops, VOT was longer in items with a lexical competitor (both words and non-words); in contrast, prevoicing in voiced stops was not affected by the presence of a minimal neighbor. As for the gemination contrast, both consonant and preceding vowel durations varied systematically according to a main effect of competitor: consonants were longer and vowels were shorter in items with competitors. The interaction term showed that this effect was due to asymmetric lengthening of geminates and shorterning of the vowels preceding geminates in items with a competitor (Figure 1). Duration of singletons and vowels preceding them was not affected by the competitor condition. There was also no effect of the lexical status (word/non-word) on the stimuli.

In sum, the effect of the competitor was present in our data despite the fact that participants did not see both members of the minimal pairs and thus were not overtly encouraged to emphasize the acoustic difference between them. Results showed asymmetries in the way acoustic contrasts were modified in the words with competitors. Only positive VOT was lengthened for voicing contrasts, while geminates were lengthened and the pre-geminate vowels were shortened for gemination contrasts, which resulted in an enhanced voicing and gemination contrast. While these results suggest that the competitor effect is likely to be explained as a listener-oriented hyperarticulation, not all segmental parameters were subjected to manipulation for the purposes of contrast enhancement. Additionally, the findings for voicing contradict the predictions that in Italian, as in true voicing languages, positive VOT is not actively controlled, while negative VOT is (see, e.g., [10] for Catalan,

French, Spanish).

	/p/		/b/	
	real	*non-word*	*real*	*non-word*
pair 1	palla		balla	
pair 2		*paffa		*baffa
pair 3	paglia			*baglia
pair 4		*parra	barra	

	singleton		**geminate**	
	real	*non-word*	*real*	*non-word*
pair 1	fata		fatta	
pair 2		*sata		*satta
pair 3	tata			*tatta
pair 4		*gata	gatta	

Table 1. *Example of a quadruplet of minimal pairs used in the experiment for the voicing contrast (left) and the length contrast (right). '*' indicates nonwords.*

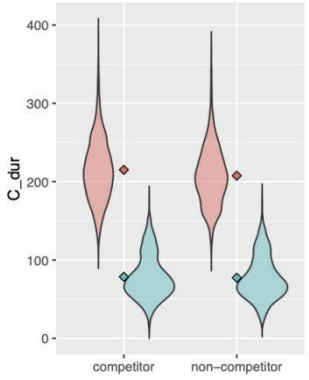

Figure 1. *Effect of competitor on C duration (left) and V duration (right) in the length contrast. Dots represent mean values.*

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