Do Punjabi geminates show looooooong-distance anticipatory effects?

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Phonetic studies of singletons and geminates have shown that the duration of C_1 in a $C_1V_1C_2V_2$ structure is longer when C_2 is a geminate (Hindi: Ohala, 2007; Japanese: Han, 1994). This suggests that geminates can have long-distance anticipatory effects (Italian: Turco & Braun, 2014). The aim of the current study is therefore to investigate whether Punjabi singleton and geminate stops show the same anticipatory effects. Given previous findings from Hindi (Ohala, 2007) and Italian (Turco & Braun, 2014) singletons and geminates, we predicted that the duration of C_1 in a $C_1V_1C_2V_2$ structure would differ significantly, depending on the durational properties of C_2 (singleton or geminate).

Five male Punjabi speakers (21-29 years, M=23.8) participated in the experiment. The stimuli (Table 1) were consisted of five pairs of voiceless singleton and geminate stops, with $C_1V_1C_2V_2$ structure (C_1: /p b ʈ k/, V_1: /ə/, C_2: singleton /p t ʈ tʃ k/ or geminate /pp tt ʈʈ tʃtʃ kk/, V_2: /aː/). The target words were elicited in an utterance-medial position, /kɛ ____ɛnu/ which can be literally translated as *say___ it*. Each target word was repeated five times, resulted in a 250 items. Four items were excluded due to the noise in the acoustic signal. The C_1 and C_2 durations (including the VOTs) of the singleton and geminate stops were measured in Praat, by using the broad-band spectrograms and visual inspection of the waveforms (Rachid, 2007).

Two repeated-measures ANOVA were conducted separately by using consonant durations (C_1 and C_2) as dependent variables, place (labial, dental, retroflex, palatal, velar) and consonant type (singleton and geminate) as within-subject factors. Table 2 presents the mean C_1 and C_2 durations of the Punjabi singleton and geminate stops across different places of articulation. The results of C_1 indicated that there was a significant effect of place (F (4, 16) = 10.322, p<.001) on the C_1 duration, but unexpectedly, there was no significant effect of consonant type (F (1, 4) = 4.203, p=.110) and no significant interaction between the place and consonant type (F (4, 16) = .170, p=.950). This suggests that the duration of C_1 varied significantly across different places of articulation but C_1 duration did not differ significantly when the C_2 was one of the singleton or geminate stops. The results of C_2 duration showed a significant effect of place (F (4, 16) = 13.359, p<.001) and consonant type (F (1, 4) = 44.346, p=.003) on the C_2 duration but no significant interaction between the place and consonant type (F (4, 16) = 1.357, p=.292). This indicates that C_2 duration was significant across different places of articulation and C_2 duration was significantly longer for the geminate stops, compared to the singleton stops.

The findings of the current study suggest that, unlike previous studies of Italian singletons and geminates (Truco & Braun, 2014), there are no anticipatory effects of C_2 on C_1 in Punjabi geminates. Furthermore, the durational cues of C_2 do not affect the duration of C_1, opposite to what Ohala (2007) and Han (1994) reported for the Hindi and Japanese singletons and geminates. Hindi and Punjabi are closely related to each other and share the same language family (Indo-Aryan). The results of our study also show that languages belonging to the same language family might behave differently in terms of the durational cues of singleton and geminate stops.

References:

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Table 1. Punjabi stimulus words (voiceless singleton and geminate stops) used in the current study.

	Singleton		**Geminate**	
	IPA	**Gloss**	**IPA**	**Gloss**
Labial	/t̪əpaː/	*jump*	/t̪əppaː/	*song*
Dental	/pətaː/	*address*	/pəttaː/	*leaf*
Retroflex	/kəʈaː/	*cut*	/kəʈʈaː/	*calf*
Palatal	/bətʃaː/	*save*	/bətʃtʃaː/	*child*
Velar	/pəkaː/	*cook*	/pəkkaː/	*strong*

Table 2: Mean C_1 and C_2 durations (ms) of the singleton and geminate stops. SD is presented in parentheses.

Consonant	**C_1**	**C_2**
/p/	100 (10)	111 (19)
/pp/	113 (16)	143 (10)
/t/	111 (19)	101 (10)
/tt/	116 (22)	149 (10)
/ʈ/	110 (34)	87 (14)
/ʈʈ/	117 (23)	125 (17)
/tʃ/	81 (27)	102 (18)
/tʃtʃ/	85 (24)	140 (16)
/k/	109 (17)	102 (12)
/kk/	118 (11)	142 (15)