True transparency and limited blocking in Slovenian palatalization consonant harmony

Peter Jurgec*, Rachel Evangeline Chiong*, Andrea Macanović*, and Peter Weiss†
(*University of Toronto and †Research Centre of the Slovenian Academy of Sciences and Arts)

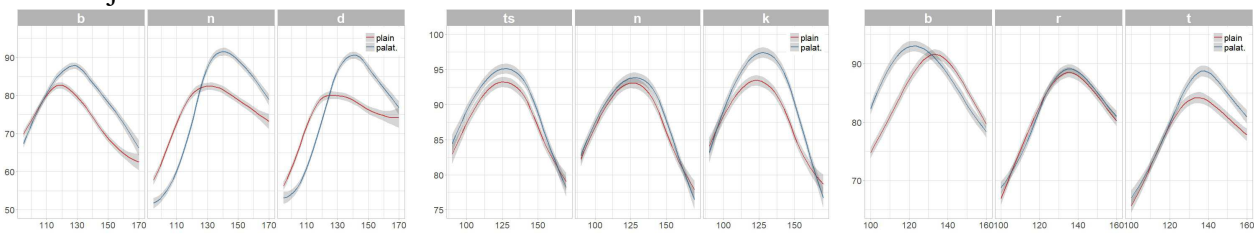
Introduction. Even though consonant harmony has been studied extensively, articulatory data have been scarce particularly with respect to two central issues: whether transparent segments are coarticulated (Walker et al. 2008) and whether segmental blockers exist (Hansson to appear). We present the first ultrasound study of consonant harmony to date. We find that Zadrečka Valley Slovenian (henceforth, Slovenian) does not display coarticulation on non-undergoers and has limited segmental blocking. We further demonstrate that the Slovenian pattern is wholly predicted by Agreement-by-Correspondence (ABC; Rose and Walker 2004, Hansson 2001).

Slovenian. Slovenian exhibits secondary palatalization triggered by specific suffixes and targeting consonants within the root (e.g. ˈzʊeːzd-a 'star' ∼ ˈz^{j}ʊ^{j}eːz^{j}d^{j}-ɛ 'stars'). All consonants but {ʃ, ʒ, ʧ, j, r} are reported to palatalize based on impressionistic transcriptions (Weiss 1998, 2001).

Method. Secondary palatalization is realized by raised and/or fronted tongue position (Kochetov 2002). To determine consonant articulation, we used the Articulate Instruments EchoB ultrasound system. We compiled 51 real-word minimal pairs with palatalizing v. non-palatalizing suffixes; [r] was chosen as a blocker. Using visual stimuli, 5 participants repeated each word 8 times.

Results. Figure 1 presents tongue shapes with confidence intervals for consonants (Cs) in palatalizing/blue v. non-palatalizing/red morphological contexts. To determine if there are statistically significant differences, we employed the Smoothing Spline ANOVA (Davidson 2006). If the confidence intervals of two mean splines are non-overlapping, then the Cs are statistically different.

bunda 'jacket' : b^{j}un^{j}d^{j}ɛ 'PL' tsen^{j}ika 'menu-DU' : ts^{j}en^{j}ik^{j}e 'PL' birta 'master-DU' : b^{j}irt^{j}e 'PL'



tsifra 'digit' : tsifrɛ 'PL'

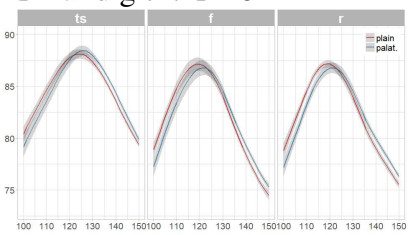


Figure 1: Tongue tracing SSANOVAs for minimal pairs. Each box represents one C; palatalizing environments are in blue and non-palatalizing are in red. The axes are spacial (in mm), with the right side corresponding to the front of the mouth. The software captured ultrasound data at 39.36 frames/second. We traced the second frame before the release for stops, and the frame closest to the midpoint of duration for all other Cs.

All Cs of 'jacket' (/bund-ɛ/ → [b^{j}un^{j}d^{j}-ɛ]) are statistically significantly different. Only the middle C does not differ in 'menu' (/tsen^{j}ik-e/ → [ts^{j}en^{j}ik^{j}-e]) and 'master' (/birt-e/ → [b^{j}irt^{j}-e]). The remaining 47 minimal pairs show that /n^{j}/ is underlyingly palatalized here, whereas /r/ never palatalizes nor is coarticulated. Finally, the root-final [r] blocks palatalization (/tsifr-ɛ/ → [tsifr-ɛ]).

Analysis. We found that there is no coarticulation on root-medial [r] which supports a view of consonant harmony as a non-local agreement among Cs, as it is within ABC. The remaining patterns can also be analyzed using ABC. As we have seen, palatalization is triggered morphologically, which we attribute to PAL (≡ The root-final C is palatalized iff the word contains a palatalizing affix; after Rubach 2003, Itô and Mester 2003, Rose 2004; Pater 2007). In ABC, CORR constraints enforce correspondence (marked as '$_{x}$' in tableaux) among consonants: CORR-T↔K requires correspondence among all rhotic/all non-rhotic Cs, whereas CORR-R↔K requires correspondence among all Cs. Finally, IDENT-CC prefers that all Cs in correspondence agree in palatalization.

The rankings are shown in (1–4). In a nutshell, Cs will generally correspond and agree (1). Depalatalization in a word with /C^{j}/ is protected by top ranked IDENT-IO (≡ No depalatalization),

but the remaining Cs will correspond, not agree/palatalize (2). A middle /r/ will not palatalize (due to top-ranked *r^{j}) nor agree. In the same word, the final C palatalizes under the pressure of PAL, as well as further palatalizes, corresponds and agrees with all non-r Cs (3). Finally, a root-final [r] cannot palatalize and blocks palatalization of other Cs because of correspondence and agreement (4). Hansson (2007) predicts a similar blocking pattern, which Slovenian now confirms.

(1) Palatalization harmony: agreement and correspondence in most cases

/tsen^{j}ik-e$_{Pal}$/	CORR-T↔K	PAL	IDENT-CC	IDENT-OI
☞ ts$^{j}{}_{x}$en$^{j}{}_{x}$ik$^{j}{}_{x}$e				2
a. ∼ ts$_{x}$en$^{j}{}_{x}$ik$^{j}{}_{x}$e			W 2	L
b. ∼ ts$_{x}$en$_{x}$ik$_{x}$e		W 1		L
c. ∼ tsen$^{j}{}_{x}$ik$^{j}{}_{x}$e	W 2			L 1
d. ∼ ts$^{j}{}_{x}$en^{j}ik$^{j}{}_{x}$e	W 2			2

(2) Correspondence, no agreement: /n^{j}/ → [n^{j}] but no harmony

/tsen^{j}ik-a/	IDENT-IO	CORR-T↔K	PAL	IDENT-CC	IDENT-OI
☞ ts$_{x}$en$^{j}{}_{x}$ik$_{x}$a				2	
a. ∼ ts$^{j}{}_{x}$en$^{j}{}_{x}$ik$^{j}{}_{x}$a			W 1	L	W 2
b. ∼ ts$_{x}$en^{j}ik$_{x}$a		W 2		L	
c. ∼ ts$_{x}$en$_{x}$ik$_{x}$a	W 1			L	

(3) Partial correspondence: non-final /r/ → [r] does not correspond or agree; other Cs do both

/birt-e$_{Pal}$/	*r^{j}	CORR-T↔K	PAL	IDENT-CC	IDENT-OI	CORR-R↔K
☞ b$^{j}{}_{x}$irt$^{j}{}_{x}$e					2	2
a. ∼ b$_{x}$irt$^{j}{}_{x}$e				W 1	L 1	2
b. ∼ b$^{j}{}_{x}$ir$_{x}$t$^{j}{}_{x}$e				W 2	2	L
c. ∼ b$_{x}$ir$_{x}$t$_{x}$e			W 1		L	L
d. ∼ birt$^{j}{}_{x}$e		W 1			L 1	2
e. ∼ b$^{j}{}_{x}$ir$^{j}{}_{x}$t$^{j}{}_{x}$e	W 1					

(4) Correspondence and agreement: root-final /r/ → [r] blocks palatalization of other Cs

/tsifr-ɛ$_{Pal}$/	*r^{j}	CORR-T↔K	PAL	IDENT-CC	IDENT-OI	CORR-R↔K
☞ ts$_{x}$if$_{x}$r$_{x}$ɛ			1			
a. ∼ ts$_{x}$if$_{x}$rɛ			1			W 2
b. ∼ ts$^{j}{}_{x}$if$^{j}{}_{x}$rɛ			1		W 2	W 2
c. ∼ ts$^{j}{}_{x}$if$^{j}{}_{x}$r$_{x}$ɛ			1	W 2	W 2	
d. ∼ tsifrɛ		W 1	1			W 3
e. ∼ ts$^{j}{}_{x}$if$^{j}{}_{x}$r$^{j}{}_{x}$ɛ	W 1		L		W 3	

Conclusions. The ultrasound data reveal that Slovenian has palatalization consonant harmony, which can ignore intervening non-palatalized consonants as well as palatalized non-triggers. This study presents one of the most convincing arguments for ABC to date and serves as a model how to use articulatory data obtained in the field to support a phonological analysis.