Sergey KNYAZEV

AFFRICATED DENTAL PLOSIVES IN RUSSIAN: PHONOLOGICAL STATUS AND PERCEPTUAL CUES AS A TRIGGER OF SOUND CHANGES

Abstract

Standard Modern Russian has phonological contrast between palatalized and velarized consonants. One of the most prominent changes attributed recently to this part of its phonetic system is the dramatic affrication of palatalized dental stops which are now pronounced in most phonetic contexts as affricates [t͡sʲ], [d͡zʲ]. The paper proposes the hypothesis that a fast spread of palatalized dental stops' affrication in Standard Modern Russian is triggered by the need to more effectively distinguish palatalized plosives in situations that do not provide the primary acoustic cue (formant transition of adjacent vowel) for their differentiation to the listener. Palatalized dental plosives still should be treated phonologically as stops since in the context of homorganic nasal or stop they are not affricated (and often unreleased), while the fricative part of dental affricates in the same position still preserved in pronunciation of all the subjects studied.

Keywords: Russian, sound changes, perceptual cues, affricated palatalized stops

Abstract

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part of dental affricates in the same position still preserved in pronunciation of all the subjects studied.

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1. Many word languages have so called "soft" consonants as opposed to "hard" or plain ones. Thus, for instance, in Europe, one may find [j] and [ɲ] in French; [j], [ɲ], [ʎ] in Italian and Spanish; [j], [ɲ], [c] and [ɟ] in Czech; [j], [ɲ], [ʎ], [c], [ɟ] in Hungarian and Latvian. In all these cases soft consonants are palatal, which means that they differentiate from plain ones by place of articulation.

Usually listeners can easily distinguish among soft consonants in all such languages since all palatals differ in manner of articulation and voicing. Even the largest set, such as the Latvian one [j], [ɲ], [ʎ], [c], [ɟ] consists of approximant, nasal, lateral, voiced and voiceless stops. Russian is dramatically different in this regard: it has 15 pairs of hard and soft consonants which differ by means of secondary articulation (velarization for all "hard" consonants except velars and palatalization for all "soft" ones except palatals) preserving in general the same place of articulation (see Figures 1, 2).

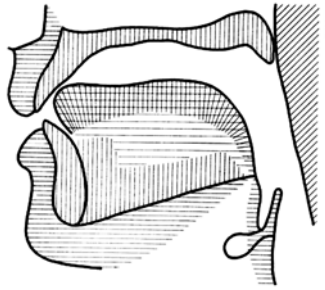

Figure 1. Velarized dental fricative [sˠ] in Russian (Bolla 1981)

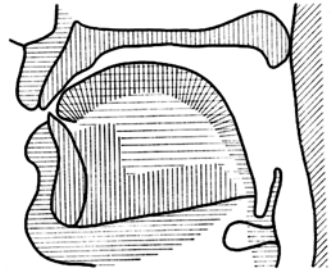

Figure 2. Palatalized dental fricative [sʲ] in Russian (Bolla 1981)

One of the most prominent changes attributed recently to this part of the phonetic system of Standard Modern Russian is the dramatic affrication of palatalized dental stops which are now pronounced in most phonetic contexts as affricates [t͡sʲ], [d͡zʲ] (see Figure 3). First mentioned in 1893 (Sievers 1893); in the middle of 20-th century it

was described as a relatively rare peculiarity of some Russian dialects (Kuznecova 1969, 1977); in the early 80-ies the most authoritative source on Russian orthoepy warns against such a pronunciation (Avanesov 1984: 143); in the beginning of XXI it becomes obligatory for Standard Russian (Knjazev, Požarickaja 2005)[11].

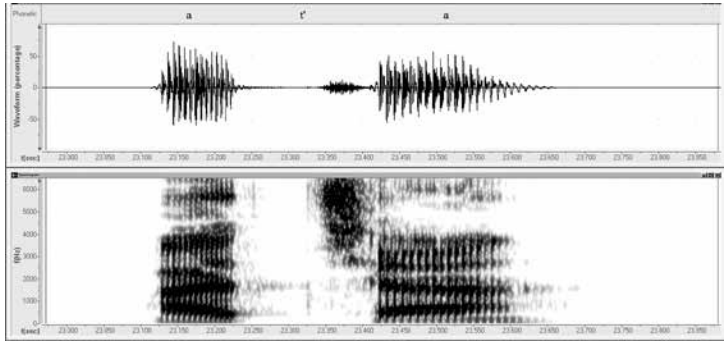

Figure 3. Waveform and spectrogram of affricated palatalized dental stop [t͡sʲ] in intervocalic position in Russian

The present paper thus examines two related problems:

1) what factor triggers the phonetic changes in question, and

2) if there are any phonetic factors which could help decide whether these consonants should be treated as stops or as affricates phonologically.

2. The analysis of the production and perception of plain stops has been presented in various classical publications, among which Fant (1969), Halle et al. (1957), Delattre, Liberman & Cooper (1955), Liberman, Delattre & Cooper (1952), Schatz (1954), Fischer-Jørgensen (1954), Carlson, Granström & Pauli (1972), Diehl (1998) may be mentioned. Most typical acoustic cues for plain stops' place of articulation are as follows:

• closure duration (labials being longer than coronals and coronals being longer than velars),

• voice onset time, VOT (which is shorter for labials than for coronals and shorter for coronals than for velars),

• frequency of burst's noise,

[11] It's worth noticing that in Northern Russian dialects where voiceless non-palatalized dental affricate is neutralized with a palatalized postalveolar one in a soft dental [t͡sʲ] no such affrication of palatalized dental stops is attested, but speakers of Standard Russian regularly perceive dialectal [t͡sʲ] as [tʲ]).

• duration of preceding and following vowel (which is shorter near labials than near coronals and shorter next to coronals than next to velars),

• F_2 transitions of adjacent vowel.

The latter is probably a primary cue for the discrimination of plain stops' place of articulation. Thus, for instance, Čeirane, Indričāne and Taperte (2014) recently have shown for Latvian that "locus equations are efficient for distinguishing between place categories in certain conditions" (Čeirane et al. 2014: 38).

Spectrographic study of Russian shows that the main perceptual cue for differentiation of non-palatalized stops is the second formant's transition of preceding and following vowels with its movement to a value of 500–1000 Hz for labials, 1300–1600 Hz for dentals and no observable transition for velars (Bondarko 1977) (see Figure 4), while all the palatalized stops have second formant's locus in an area higher than 2000 Hz (see Figure 5).

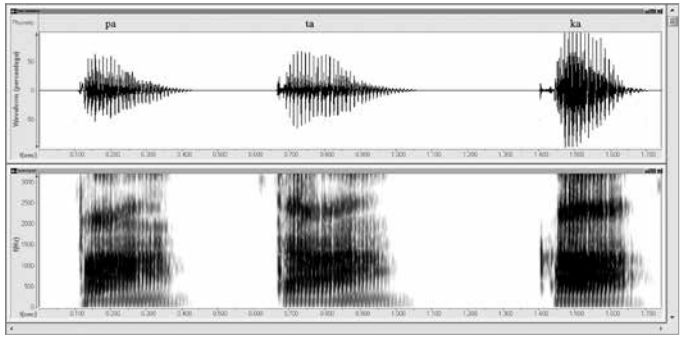

Figure 4. Waveform and spectrogram of Russian plain/velarized stops before [a]

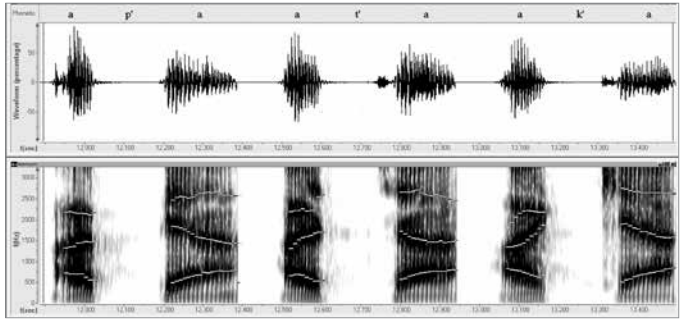

Figure 5. Waveform and spectrogram with formant tracks of intervocalic palatalized stops in Russian

3. As a part of the present study a perceptual experiment was conducted, in which we studied how Russian speakers can distinguish "hard" and "soft" stops of different places of articulation in a situation where only information about the F2 transition of the following vowel is available for this judgment.

Stimuli preparation. Clearly spoken words by one speaker were selected as original stimuli. They had earlier been recorded (44 100 Hz sampling rate) for another experiment and consisted of a voiceless stop ([pˠ], [tˠ], [k], [pʲ], [tʲ], [kʲ]) followed by a word-final stressed [a] vowel. Thus, in total 6 stimuli were included in the stimulus group type original. Then the CV sequence was cut out from the stimuli and a period of stop release was replaced by a silent interval. This set of stimuli was randomized and filled with 6 original stimuli with each stop's release.

Subjects and experiment procedure. Seventy eight subjects, students of philological faculty of the Moscow State University from 16 to 27 years of age participated in the experiment. Not aware of the hypothesis and motivations for the experiment, they were instructed to simply report which unvoiced stop ([pˠ], [tˠ], [k], [pʲ], [tʲ], [kʲ]) they heard in the beginning of the respective nonsense syllable. If needed, it was possible for the subject to repeat a stimulus. The experiment was typically carried out within ten minutes for each subject.

The **results** grouped according to stimulus type are presented in Table 1.

Table 1. The number of correct answers for [pˠ], [tˠ], [k], [pʲ], [tʲ], [kʲ] place articulation with no release information (%)

[pˠ]	[tˠ]	[k]	[pʲ]	[tʲ]	[kʲ]
87	84	71	53	57	58

The results presented in Table 1 show that native speakers of Russian easily distinguish between plain stops only by the second formant's transition of vowels after the consonant in question when no information about the quality of burst or its duration is available, while the palatalized ones in the same situation are not distinguished by subjects (almost all being reported as soft labials since bilabial stops have the shortest release period). This brings us to the conclusion that such a fast spread of palatalized dental stops' affrication in Standard Modern Russian is triggered by the need to more effectively distinguish palatalized plosives in situations that do not provide the primary acoustic cue

for their differentiation to the listener. As a result, palatalized plosives of different places of articulation may be discriminated on the basis of release duration which is the longest for dentals, relatively long but significantly shorter for velars and quite short for labials.

4. The second experiment was aimed at the release duration measurement of "hard" and "soft" voiceless plosives.

Stimuli preparation. Test words, comprising [pˠ], [tˠ], [k], [pʲ], [tʲ], [kʲ] were selected according to the following restrictions: 1) same number of syllables, 2) same total number of segments, 3) same stress position, 4) similar stressed vowel's quality, 5) same position of tested word in phonological phrase (under phrase accent). The only parameter that varied was the place of articulation of voiceless stops.

Subjects and experiment procedure. The same seventy eight subjects, students of philological faculty of the Moscow State University, participated in the experiment. Not aware of the hypotheses and motivations for the experiment, they were instructed to simply read test phrases.

Test words were recorded (44 100 Hz sampling rate) in phrases repeated 3 times each, then the release duration was measured for each stimulus using the *Praat* software (Boersma, Weenink 2012).

The **results** are presented in Table 2.

Table 2. Mean release duration for [pˠ], [tˠ], [k], [pʲ], [tʲ], [kʲ] in Standard Modern Russian (ms)

[pˠ]	[tˠ]	[k]	[pʲ]	[tʲ]	[kʲ]
19,1	25,3	59,4	24,8	104,1	62,3

The results presented in Table 2 show that mean release duration for [tʲ] is approximately two times larger than for [kʲ] and four times larger than for [pʲ] in Standard Modern Russian, which means that this acoustic cue presently may serve as a reliable perceptual correlate for discriminating palatalized stops' place of articulation.

Not surprisingly the worst score for velars' discriminating corresponds with their longest release duration and "the difficulty in identifying a particular F_2 transition or locus with /g, k, ŋ/" (Borden et al. 1994: 193): one may conclude that this parameter can be utilized for differentiating plain velar stops from velarized coronals and labials in Russian.

5. Since palatalized dental stops are pronounced in most phonetic contexts as affricates, the question may arise whether they should be treated phonologically as affricates or as plain stops.

As a part of the present study, a third experiment was conducted in which we studied the ratio of noise and closure periods for [tʸ], [t͡sʲ] and [t͡sʸ] (/t͡s/) in various phonetic contexts for seventy eight native speakers of Standard Modern Russian.

Stimuli preparation. Test words, comprising [tʸ], [t͡sʲ] and [t͡sʸ] (spelled т, т and ц) in each group were selected according the following restrictions: 1) same number of syllables, 2) same total number of segments, 3) same stress position, 4) similar stressed vowel's quality, 5) same position of tested word in phonological phrase (under phrase accent / not under phrase accent). The only parameter varied was the right phonetic context: 1) stressed vowel, 2) unstressed (post-tonic) vowel, 3) end of phonological word, 4) nonpalatalized velar stop ([k]),[12] 5) homorganic nasal or stop – [nʸ] or [tʸ].

Subjects and experiment procedure. The same seventy eight students of philological faculty of the Moscow State University participated in the experiment. Not aware of the hypotheses and motivations for the experiment, they were instructed to simply read test phrases.

Test words were recorded (44 100 Hz sampling rate) in phrases repeated 3 times each, then the ratio of noise and closure periods for [tʸ], [t͡sʲ] and [t͡sʸ] was measured using the *Praat* software (Boersma, Weenink 2012).

The **results** grouped according to stimulus type are presented in Table 3.

Table 3. Mean duration of closure – release periods for [tʸ], [t͡sʲ] and [t͡sʸ] (%)

right phonetic context:	[tʸ]	[t͡sʲ]	[t͡sʸ]
stressed vowel	81-19	46-54	39-61
unstressed vowel	79-21	43-57	36-64
end of phonological word	72-28	41-59	32-68
[k]	83-17	44-56	35-65
[nʸ] or [tʸ]	100-0	100-0	37-63

[12] This context was chosen due to the fact that palatalized and velarized coronal consonants are opposed before velars in Standard Modern Russian.

Based on the results presented in table 3, we can see that phonetic realizations of /tʲ/ before homorganic consonants (nasals and stops) are not affricated and even unreleased consonants, as well as realizations of /tʸ/. On the contrary, the fricative part of the dental affricate in the same position is still preserved in the pronunciation of all the subjects studied (see Figure 6).

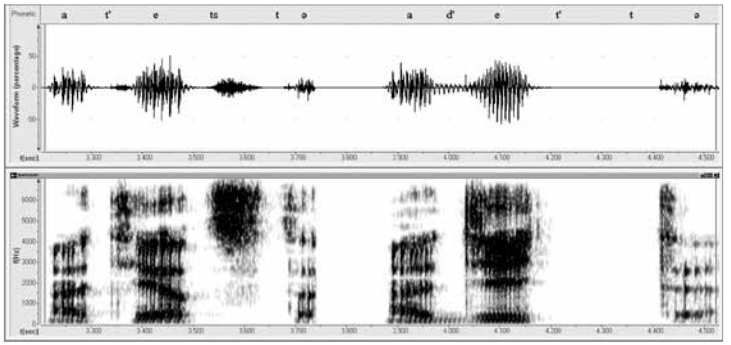

Figure 6. Different realizations of /t͡s/ and /tʲ/ before homorganic plain stop / tʸ/ in Russian in phonological words *otec-to* and *odet'-to*.

6. **Final conclusions**. Based on the data obtained during the experiments discussed above we can conclude that

• a fast spread of palatalized dental stops' affrication in Russian is triggered by the need to distinguish palatalized plosives on the basis of release duration;

• mean release duration for [tʲ] now is approximately two times larger than for [kʲ] and four times larger than for [pʲ] in Standard Modern Russian, thus phonetically [tʲ] is an affricate, but

• palatalized dental plosives still should be treated phonologically as stops in Standard Modern Russian since their phonetic realizations are partly different from those of underlying affricates.

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Denitsa DIMITROVA

GERMAN ROUNDED VOWELS PERCEIVED AND PRODUCED BY BULGARIAN CHILDREN

Abstract

The aim of this paper is to present the results of my recently defended doctoral thesis which conducts an extensive study of the strategies for perceptual acquisition of speech sounds in the L2 that are not present in the L1 phoneme set, and of the relationship between perceptual and production mechanisms in this process. Subject of the study is the perception and production of the German vowels in 7–9-years-old Bulgarian children, on one hand because the studies of the specifics in the acquisition of the German language in Bulgarian learners have focused so far on learners above the age of 13, and on the other hand because at that particular age these children have already been exposed to the L2 since the age of 4, so that the development of the categorical perception in the L2 and the impact of the L1 phonological system on the acquisition of the L2 phonological structures can be traced.

The methodological approach applied in the dissertation includes a comparison between the articulatory and the acoustic characteristics of the German and the Bulgarian vowels considering the detection of the potential difficulties in the discrimination of the German vowels. Two theoretical models of L2 perception build the theoretical frame of the study and three experiments provide the empirical basis for the examination and verification of the hypotheses and the postulates of those two models. The results of the experiments support the working assumptions and can be used to develop a new system for the teaching of German phonetics to this age groups.

Keywords: vowel perception and production, foreign language acquisition, PAM, SLM

Abstract

The aim of this paper is to present the results of my recently defended doctoral thesis which conducts an extensive study of the strategies for perceptual acquisition of speech sounds in the L2 that are not present in the L1 phoneme set, and of the relationship between perceptual and production mechanisms in this process. Subject of the study is the perception and pro-