AN AUDIO-VISUAL PERCEPTION STUDY OF BULGARIAN AND RUSSIAN PALATALIZED CONSONANTS

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1. INTRODUCTION

The existence of palatalized consonants in Standard Bulgarian has been a source of debate in Bulgarian linguistics. Horàlek (1950) hypothesized that the secondary palatal gesture /ʲ/ had decomposed into the palatal glide /j/. This argument has gained strength since Scatton (1984) and Maddieson & Ladefoged (1996) observed articulatory data from x-ray studies in Stojkov (1942, 1961) and noted that the height of the tongue body of the palatalized consonants /tʲ dʲ sʲ zʲ, lʲ rʲ nʲ/ was virtually indistinguishable from their plain counterparts. Furthermore, Tilkov (1983) conducted an experiment which tested the perception of Bulgarian palatalized and plain consonants. His results indicated that hard consonants could be identified from the duration and spectral shape of the burst alone. With the exception of the velars /kʲ gʲ xʲ/, the Bulgarian listeners needed the formant transitions to identify the remainder of the consonants as palatalized. The implication is that the secondary palatal gesture is not enough to cue the perception of these consonants.

Pritchard's (2009) recent acoustic study indicated that the acoustic attributes for Bulgarian and Russian palatalized consonants are very similar. This is important as the Russian subjects of Richey's (2000) experiment did not need the formant transitions to identify the secondary palatal gesture. The goal of the current study is to try to reconcile these potentially conflicting results. To this end, two variations of the gating task (Grosjean, 1980) were employed. In a gating task, a subject hears a stimulus over a number of gates, and at each gate an increased amount of information is available. Auditory-only and audio-visual gating tasks were performed in order to establish how much auditory and visual information a listener needs in order to identify a consonant as palatalized.

2. METHODS

The participants were 20 native Bulgarian and 22 native Russian speakers. They were all educated in their native countries and immigrated to Canada as adults.

The stimuli for both conditions (auditory and audio-visual), and for both languages, consisted of minimal or near-minimal pairs of the plain and palatalized consonants from Stojkov's (1942; 1961) x-ray studies (except for /v/) in which the tongue body gesture was identical for both types. The consonants occur word-initially in syllables with a primary stress. They precede the vowels /a/ and /u/ which, together with the vowel /ɔ/, are the only environments where palatalized consonants occur in Standard Bulgarian. The stimuli were produced by 2 male speakers of Russian and Bulgarian. They were recorded in a sound-proof booth. Noise was introduced to the sound file of the audio-visual condition to encourage the subjects to attend to the visual information. The stimuli for both conditions were gated at an interval of 30ms. They were presented randomly in a within-subject design, with a break between conditions.

The experimental procedure was as follows. A minimal pair appeared on a computer screen. Then, subjects heard a gated sound. Afterwards, in a forced-choice task, they selected one of the words which they associated with that sound. Next, they rated how confident they were in their choice, on a scale from 1 to 4 (1-very sure, 2-fairly sure, 3-fairly unsure, 4-very unsure). This cycle continued until they heard all gates of each stimulus.

3. RESULTS

At this stage of the project, only descriptive statistics have been performed. For each language, and for all stimuli, subjects' confidence ratings were graphed with boxplots. Figure 1, below, illustrates an increase of confidence ratings at the gate (5) where the secondary palatal gesture occurred, with a median of 1. As no information about the vowel is available, some subjects tend to be more conservative and select a rating of 2 (fairly sure). At gate 6, the confidence level increases to 1 (very sure) as a part of the vowel, including the transitions, is heard.

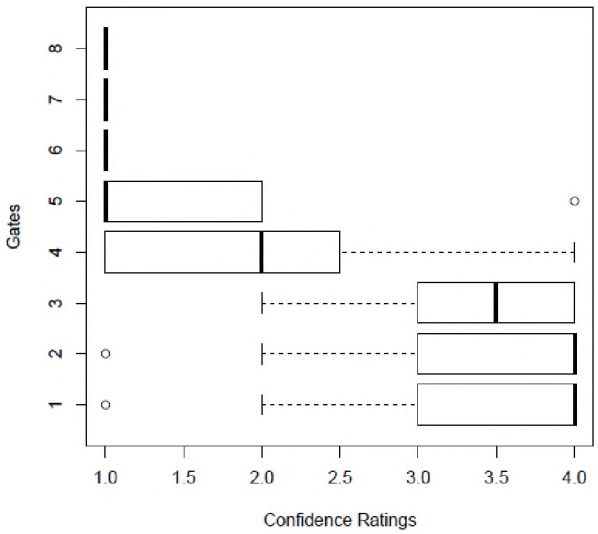

Figure 1. Boxplots of all gates of Bulgarian /dʲuna/, audio condition.

The frequency of confidence rankings of 1 and 2 is shown in

the histogram below, Figure 2. The 1 and 2 confidence rankings are associated with correct responses only. From a sample of 20 subjects, 65% selected a correct response, with a confidence of 1; 35% of them also selected the right answer with a confidence of 2.

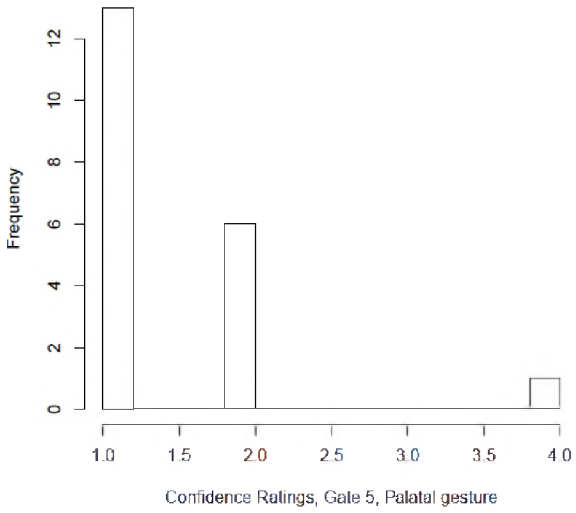

Figure 2. Histogram of Bulgarian /dʲuna/.

Tables 1 and 2, below, contain the combined percentage of the confidence rankings of 1 and 2 at the gate of the palatal gesture for each palatalized consonant in the environments of the vowels /a/ (Cʲa) and /u/ (Cʲu). Again, only the correct answers associated with those rankings were included. Overall, the palatal gesture is perceived better in the auditory condition (Aud) compared to the audio-visual condition (AV), for both languages and vowel environments. The palatal gesture of the sonorant consonants (rʲ lʲ nʲ) seems to be perceived better than that of the others in both conditions.

Table 1. Confidence Ratings (%) – Cʲa .

Language and Condition	Palatalized Consonants							
	tʲ	dʲ	vʲ	sʲ	zʲ	rʲ	lʲ	nʲ
Bul – Aud	75	75	90	85	95	85	95	100
Bul – AV	50	50	45	50	75	60	65	100
Rus – Aud	67	69	86	100	91	96	81	96
Rus – AV	32	77	0	47	0	91	56	35

In terms of the Bulgarian audio-visual data, the palatal gesture of the consonants /tʲ dʲ vʲ sʲ/ is perceived at chance, or worse. Only the gesture of /zʲ/ in the context of /a/ appears to be perceived better by the subjects. In some instances, the percentages for the Russian audio-visual data are higher than the Bulgarian ones(/dʲ/ next to /a/, / tʲ/ & /dʲ/ next to /u/), although half, or fewer, of the Russians chose the wrong answer in some instances (shown as 0 in Table 2).

Table 2. Confidence Ratings (%) – Cʲu .

Language and Condition	Palatalized Consonants							
	tʲ	dʲ	vʲ	sʲ	zʲ	rʲ	lʲ	nʲ
Bul – Aud	60	95	NA	80	NA	95	85	80
Bul – AV	35	60	NA	30	NA	72	60	80
Rus – Aud	91	91	NA	86	NA	67	87	86
Rus – AV	74	94	NA	0	NA	74	90	61

4. DISCUSSION AND CONCLUSIONS

This study aims to compare the perception of palatalized consonants in Standard Bulgarian and Standard Russian. According to the current results, in the auditory gating task subjects from both language samples are able to perceive a consonant as palatalized at the gate at which the palatal gesture becomes available. The transitions with the following vowel are not essential. These findings are not in line with those of the Tilkov's (1983) study of the perception of Bulgarian palatalized consonants. The results from the audio-visual task indicate that visual cues by themselves may not be sufficient for the identification of the secondary palatal gesture, particularly in noisy environments.

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