VOWEL REDUCTION IN SPONTANEOUS BULGARIAN JUDEO-SPANISH

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ABSTRACT

This study compares spontaneous speech data from Judeo-Spanish as spoken in Bulgaria (BJS) and from Bulgarian (BG) with respect to spectral and durational reduction of unstressed vowels, as well as the ensuing height neutralizations. It is shown that BJS speakers, who are all bilingual with BG, largely follow Bulgarian reduction patterns, i.e., unstressed underlyingly non-high vowels raise considerably and tend to merge with their high counterparts. At the same time, however, the dialectal background of the speakers emerges as a relevant factor since neutralizing reduction of front vowels is only present in Eastern Bulgarian dialects. In contrast, raising is gradient in (close-to-standard) western dialects, where the raising of unstressed /ɛ/ to [i] is highly stigmatized.

Keywords: vowel reduction, vowel merger, incomplete neutralization, Judeo-Spanish, Bulgarian

1. INTRODUCTION

Judeo-Spanish (JS) refers to the varieties of Spanish spoken by the Sephardic Jews in their new areas of settlement (mostly in the former Ottoman Empire and North Africa) after their expulsion from the Iberian Peninsula at the end of the 15th century. From that point onwards, it developed independently from other Spanish varieties but in close contact with the respective surrounding languages, among them Greek, Turkish, and Bulgarian. The Bulgarian variety of JS addressed in this paper is still spoken today by a rather small group of probably less than 200 native speakers, the youngest of whom were born in the 1960s ([1]). All speakers are at least bilingual and dominant in Bulgarian (BG). The use of JS is nowadays restricted to informal communication within the community.

So far, the literature on JS phonology is rather sparse. However, recently both the segmental and the prosodic properties of the variety of JS spoken in Istanbul (Turkey) and in Sofia (Bulgaria) have been investigated ([2–11]).

As regards its vowel system, JS generally continues to exhibit the three-level system inherited from Spanish consisting of the five phonemes /i e u o a/ ([10]). In Bulgarian JS, /ɤ/ may be added to these as it can occur in loans from BG according to [4]. Furthermore, the quality of the mid-level vowels favours their classification as /ɛ/ and /ɔ/, making the BJS vowel system strongly resemble the Bulgarian one, which contains the six contrastive stressed vowels /i ɛ a ɤ ɔ u/. In opposition to Mainstream Spanish, however, where (spectral) reduction of unstressed vowels is virtually absent ([12–13]), it is generally accepted that in Bulgarian the six stressed vowels /i ɛ a, ɤ ɔ u/ are reduced to a subsystem of four (three in some dialects) /i (ɛ) ɤ u/ in unstressed positions. Opinions differ, however, as to the exact nature of the reduction process. [14] and [15] identify an intermediate quality for the reduced vowels, with /ɛ/ and /i/ neutralizing to [e], /ɔ/ and /u/ neutralizing to [o] and /a/ and /ɤ/ neutralizing to [ə], which implies additional defined targets for the unstressed vowels. Contrary to these claims, recent studies show evidence that the general pattern of the Bulgarian vowel reduction is one of low and mid vowel raising ([16–19], cf. also [20]). This results in the neutralization of /a/ and /ɤ/ to [ɤ], /ɔ/ and /u/ to [u], and in some (eastern) dialects /ɛ/ and /i/ to [i]. The latter merger is strongly stigmatized in the variety spoken in the capital Sofia.

As for BJS, recent studies suggest that, presumably as a consequence of its long-lasting and intense contact with Bulgarian, the phonological system has largely converged with the one of the contact language (cf. [5] for rhythm, [6–7] for intonation). Regarding its vowel system, [5] have analysed read data to show that in JS as spoken in Sofia unstressed /a/ and /ɔ/ tend to raise following the BG pattern, although to a somewhat lesser extent ($n = 420$). Regarding unstressed /ɛ/, an auditory analysis by [21] revealed that speakers stemming from Eastern Bulgaria present raising to [i] when spontaneously speaking BJS (to an extent of roughly 24 to 50%, $n = 647$) but clearly avoid this in their reading pronunciation as well as in (spontaneous and read) BG.

The present study is concerned with the analysis of spectral and durational unstressed vowel reduction (UVR) in the spontaneous speech of bilingual female speakers of BJS and BG and monolingual speakers of BG and addresses the following research questions (RQ):

RQ 1: How do the vowel spaces shrink in unstressed positions?
RQ 2: Which is the relative weight or importance of the acoustic parameters F1, F2, and duration in distinguishing stressed from unstressed vowels?
RQ 3: What is the extent of contrast loss between low and high vowels in unstressed positions?

2. METHODS AND PROCEDURE

We collected data from four female bilingual BJS-BG speakers, aged 80 to 88 (recordings Sofia, September 2012). They were born and raised in different places in Bulgaria (Kyustendil, Pazardzhik, Kazanlăk, and Karnobat) and had used BJS on a regular basis in family situations along with BG during their childhood. Nevertheless, BG became their dominant language when they moved to Sofia for study purposes between 1947 and 1950. Having lived there for more than 70 years at the time of recording, they spoke the BG variety of the capital. The bilingual subjects were recorded in both of their languages (BJS and BG_B(ilingual)). Four same-aged monolingual BG (BG_M) speakers born and raised in Sofia (all females, aged 79–86) served as control group (recordings Sofia, September/October 2016). All participants held an academic degree.

The material gathered for the analysis of UVR consisted of extracts from narrative interviews conducted in both BJS and BG (net amount of speaking time, excluding all pauses, ca 3 min per speaker and variety). The interviews were semi-focused in that all speakers were asked to retell their life story and family history and to speak freely about their daily lives and, only in the case of the bilinguals, about their language use. The data were recorded with a Marantz hard disk recorder (PMD671) and a Sennheiser microphone (ME64).

Variety	Speakers	Vowel tokens
BJS	4	2438
BG_B	4	2842
BG_M	4	2290

Table 1: Speakers and vowel tokens per variety.

The vowels were manually segmented in Praat [22], on the basis of the synchronized spectrogram, waveform, and audio signal. Vowel boundaries were determined by the presence of clear formant structure and sharp changes in intensity. Material produced with creaky voice or disfluencies was excluded from the acoustic analysis. Since unstressed vowels preceding pauses are prone to be lengthened cross-linguistically [23], we decided to analyse tokens in phrase-final position as a separate category. A Praat script was used to extract vowel duration and midpoint F1 and F2 frequencies. Formant values were normalized using Lobanov (*z*-transform) as implemented in the R package phonR [24]. Next, outliers, defined as values 1.5 times beyond the interquartile range, were removed (F1 = 2.5%, F2 = 4.3%, duration = 3.5%).

A series of MANOVAs were performed to measure UVR, on the one hand, and height contrast, on the other. In the former set, we examined the effect of stress and location (i.e., phrase-final vs non-final) on F1, F2, and duration, while vowel height was the input variable in the latter set. Pillai's trace (Λ), which is part of the output of the MANOVAs, was used as a measure of separation, values approaching $\Lambda = 1$ indicating no overlap and values approaching $\Lambda = 0$ indicating complete overlap. The strength of contrast between high and low vowels was studied in stressed and unstressed position, and a measure of contrast loss was computed as the difference in contrast between stressed and unstressed position relative to contrast in stressed position (i.e., $\Lambda_{stressed}–\Lambda_{unstressed})/\Lambda_{stressed}$) [18]. MANOVA, and in particular Pillai's trace, have been used increasingly in phonetic and phonological research to measure the extent of vowel mergers (including mergers resulting from vowel reduction) [18, 19, 25–31].

Finally, the parallel discriminant ratio coefficient derived from Discriminant Function Analysis (DFA) was used as an estimate of the relative importance, or weight, of each acoustic parameter (i.e., F1, F2, and duration) in discriminating between stressed and unstressed, or high and non-high vowels, respectively. The role of a parameter was considered to be negligible if its coefficient was lower than half the mean of the absolute coefficient values for all three parameters. For a detailed discussion of this measure, cf. [18, 32].

3. RESULTS

Table 2, below, shows the means for F1, F2, and duration of stressed and unstressed vowels in different positions in the three varieties under concern in this paper. Means for phrase-final unstressed /u/ are only given for BG_M due to an insufficient number of tokens in the bilingual varieties. Note, in this respect, that there are no native words ending in unstressed /u/ in BJS.

The lower means of the F1 values indicate that the non-high unstressed vowels /a ɛ ɔ/ are clearly raised as compared to their stressed counterparts in all varieties. The high vowels /i u/, and in BG /ɤ/, on the contrary, largely remain in place. This is illustrated in Figure 1, below, where the unstressed vowel spaces are noticeably reduced as compared to the stressed ones. Final unstressed vowels, however, are somewhat less reduced than non-final unstressed vowels, which present the smallest vowel spaces across varieties.

Regarding duration, non-final unstressed vowels present markedly shorter means than stressed vowels. Again, this difference is more prominent in non-high vowels. Final unstressed vowels, as expected, showed the longest duration, which in some cases doubled the duration of stressed vowels.

Vowel	Position	F1			F2			duration		
		BSJ	BG_B	BG_M	BSJ	BG_B	BG_M	BSJ	BG_B	BG_M
a	stressed	816	802	717	1599	1626	1663	147	127	110
	unstr. final	637	584	546	1688	1601	1608	144	189	173
	unstr. non-final	628	517	488	1701	1775	1651	81	61	66
ɛ	stressed	596	591	548	2182	2123	1923	135	109	104
	unstr. final	450	482	490	2223	2179	1971	197	164	178
	unstr. non-final	438	428	455	2167	2155	1868	78	63	64
ɤ	stressed		498	483		1646	1608		99	81
	unstr. final		544	438		1589	1396		85	79
	unstr. non-final		479	482		1634	1524		59	69
i	stressed	377	364	407	2525	2450	2133	126	90	83
	unstr. final	349	398	396	2563	2491	2182	263	173	175
	unstr. non-final	344	372	406	2354	2330	2079	83	67	67
ɔ	stressed	589	611	597	1058	1086	1237	137	124	106
	unstr. final	426	413	459	1071	983	1140	158	193	181
	unstr. non-final	440	391	429	1203	1156	1262	87	65	63
u	stressed	389	383	434	1024	1078	1291	111	87	78
	unstr. final	-	-	423	-	-	1127	-	-	134
	unstr. non-final	381	342	394	1263	1065	1231	83	72	68

Table 2: Means of F1, F2 (in Hz) and duration (in ms) across varieties and positions.

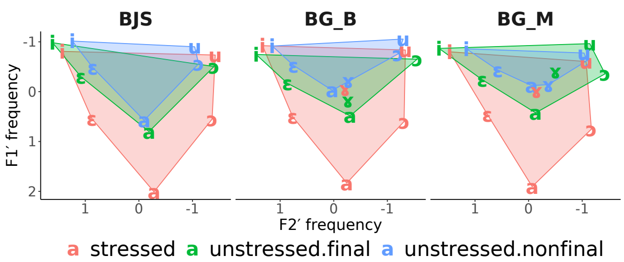

Figure 1: Mean F1/F2 vowel spaces across varieties.

The MANOVAs computed for each vowel phoneme confirmed the significant effect ($p < 0.05$) of stress on the three acoustic parameters taken together, except for BG_M /u/ ($p = 0.2745$). Pillai scores for UVR are given in Figure 2.

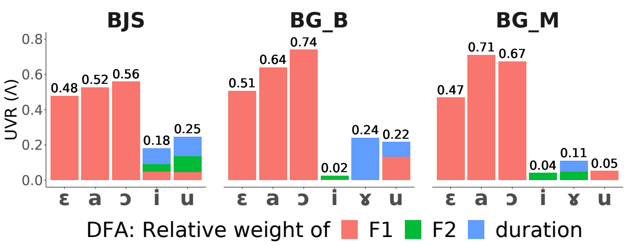

Figure 2: Extent of UVR (stressed/unstressed difference).

As can be seen, the non-high vowels are reduced only with regard to the F1 dimension, while in the high vowels, which undergo very little UVR, reduction results mainly from duration and/or F2 frequency.

MANOVAs comparing phrase-final and non-final unstressed vowels produced significant results, except for BG_M /ɤ/ (p = 0.1519). As can be seen in Figure 3, the main difference was in duration, with the formant frequencies playing practically no role.

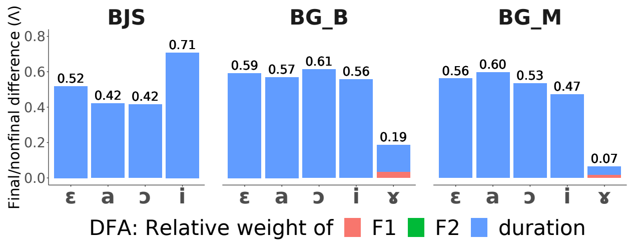

Figure 3: Extent of (unstressed) final–non-final difference (Λ) with parameter weight.

The vowel /u/ was excluded from this comparison because of the insufficient number of tokens in final position.

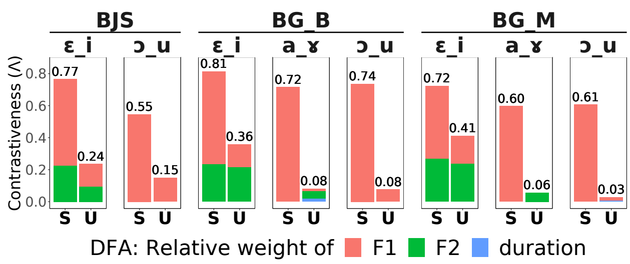

Figure 4: Height contrast with parameter weight in stressed (S) and unstressed (U) position ($p < 0.05$).

As pertains the contrast between high and non-high vowels, as expected, it was considerably stronger in stressed position (Figure 4). The respective vowel pairs were primarily distinguished by F1, while in the front vowels F2 played a secondary role. Contrast is practically lost in unstressed /a–ɤ/ and /ɔ–u/ for all varieties. In /ɛ–i/, also as expected, there is considerably less contrast loss in unstressed positions, since this pair does not neutralize in Western Bulgarian. Interestingly, BJS shows somewhat less contrast loss in the back pair /ɔ–u/, but considerably more in /ɛ–i/ than either Bulgarian variety. Ratios of contrast loss between unstressed high and low vowels are shown in Table 3.

Variety	ɛ–i	a–ɤ	ɔ–u
BJS	69	-	73
BG_B	56	89	89
BG_M	43	90	95

Table 3: Contrast loss in per cent.

Figure 5, finally, shows the distribution of vowels across stressed and unstressed positions and hence illustrates the loss of contrast between high and low vowel pairs. As can be seen, there is almost no overlap between the distributions of the realizations corresponding the different vowel phonemes in stressed position (uppermost panel), but the overlap is substantial in unstressed positions (lower panels).

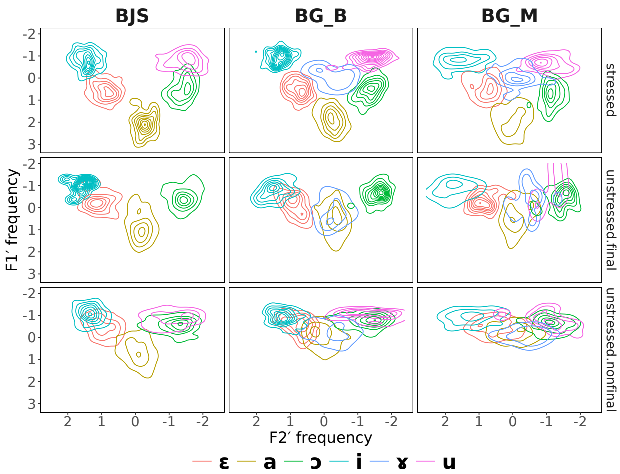

Figure 5: F1 and F2 distributions of stressed and unstressed vowels based on kernel density estimation.

4. DISCUSSION AND CONCLUSIONS

The results of the analyses show that vowel spaces were thus considerably smaller in unstressed positions across varieties (RQ 1). In this sense, BJS largely follows BG patterns with regard to UVR, i.e., the non-high vowels /ɛ a ɔ/ are considerably raised when unstressed, while other dimensions (i.e., duration and F2) do not play much of a role (RQ 2). As regards high vowels, UVR affects all dimensions, but its extent is nominal. In BG, bilingual speakers behave roughly like BG monolinguals. However, the spectral reduction in terms of F1 was found to be overall somewhat less strong in BJS than in BG. While this implies less loss of the contrasts between high and low vowels (cf. below), it could possibly be a side effect of the bilinguals' lower speech rate in their non-dominant language BJS. Findings made regarding the durational properties of vowels in different positions support this hypothesis. More particularly, unstressed vowels were generally much shorter than stressed vowels, as was expected. In phrase-final position, however, they were considerably lengthened. A secondary effect of this lengthening seems to be that that these vowels were somewhat less spectrally reduced than unstressed vowels in non-final positions. This very observation, in turn, suggests that speech rate could also have an effect on spectral UVR. As pertains the extent of contrast loss between high and low vowels (RQ 3), the raising of the latter entails that the back vowel pair /ɔ–u/ is virtually neutralized in unstressed position across varieties. The same holds true for the central pair /a–ɤ/ in BG. Both is expected in Western and Standard BG. Regarding the front pair /ɛ–i/, the situation is somewhat more complex. While unstressed /ɛ/ is clearly raised in all varieties, there is some overlap but certainly no merger of the categories in BG_M, i.e., the reduction presents itself as gradient and the quality of raised unstressed /ɛ/ rather corresponds to [e] than to [i]. As opposed to this, the extent of reduction of /ɛ/ is similar to the back vowels in BJS, with substantial overlap of the categories /ɛ/ and /i/. BG_B, finally, is in an intermediate position. A possible explanation for this finding could be that three out of the four analysed bilinguals originally stem from Eastern Bulgaria, where a loss of the contrast between unstressed /ɛ–i/ is expected. Yet, as they have been living in Sofia for most of their lives, where raising of /ɛ/ to [i] is severely stigmatized, it is likely that they try to avoid it when speaking BG ([19]).

In sum, UVR is a systematic process in BJS that clearly reflects patterns known from the BG dialects. This feature thus not only set this variety apart from present-day Spanish and other JS varieties, but also suggests strong influence from the contact language. The present results are thus in line with the observation that vowel systems of non-dominant languages tend to converge with the system of the environmental or dominant language (cf. [33] for Spanish as a heritage language in the US, [18, 29] for Turkish in Bulgaria).

5. ACKNOWLEDGEMENTS

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