ON /l/ VELARIZATION IN EUROPEAN PORTUGUESE

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ABSTRACT

F2 and duration characteristics associated with onset and coda /l/ and its immediate phonetic environment, of speech material produced in the laboratory by European Portuguese (EP) speakers have been examined to bring some light into the empirical question whether lateral velarization has a categorical manifestation or not, in this language (Lisbon variety). The results are interpreted in terms of production, in accordance with a co-production model. The present findings have some implications with respect to the historical phonology of EP.

1. INTRODUCTION

There are conflicting positions in the literature with respect to the phonetic manifestation of the apical lateral in EP. The dominant position for the last two decades has been that /l/ is categorically associated with a non-velarized (‘clear’) allophone in syllable onset and a velarized (‘dark’) one in coda position [1, 2]. According to earlier phonetic descriptions, however, lateral velarization may also occur in syllable retraction, and its adjacent environment were carried out. Measurements of F2 as well of segmental durations associated with onset and coda /l/ and its immediate phonetic environment, of speech material produced in the laboratory by European Portuguese (EP) speakers have been examined to bring some light into the empirical question whether lateral velarization has a categorical manifestation or not, in this language (Lisbon variety). The results are interpreted in terms of production, in accordance with a co-production model. The present findings have some implications with respect to the historical phonology of EP.

2. METHOD

2.1. Speech material.

The material utilized includes laterals occurring in complex and simple onsets as well as in coda position and consists of the following sets: (a) the sequences /plɪ/ and /pe'li/ in the word ‘explicas’ preceded by the pronoun ‘a’ ([tə ˈplɪkB] - ‘you explain it’) and the word ‘pelicas’ preceded by the article ‘as’ ([tʰ ˈpi ˈlikB] - ‘the pieces of fine leather’) produced at the end of short declarative sentences; (b) LV sequences, in which V corresponds to (i, e, u); (c) and the words ‘cela’, ‘celta’, ‘seta’, ([ˈseln], [ˈseln], [ˈsetn] – ‘cell’, ‘celt’ and ‘arrow’, respectively) and the nonsense words ‘seli’ and ‘seli’ ([ˈseli], [ˈseli]) produced in isolation.

With respect to (a), the choice of a labial for the initial element of the complex onset had the purpose of minimizing gestural interaction in the production of the two onset elements (C and L). Although acoustically, C labiality might have some effect on the F2 of L, the the tongue body gesture for the latter would not be constrained by articulatory requirements of C. As for the sequence /pe'li/ (cf. note 2), a strong carryover effect of the lateral was expected, if the vowel were to be realized. The vowel contexts are dominantly front ones. This was motivated by the existence of empirical evidence that, generally, the tongue body gesture in the production of a clear /l/ is significantly less resistant to coarticulatory effects than in the production of a dark /l/ [6, 7, 8]: it was thought that if indeed, we were to find clear onset laterals the front vowel environment would enhance their “clear” nature and raise F2. A secondary criterion in the choice of vowel environments was the preference for words existing in the language (only two nonsense words were used).

The material was read at the rate individual speakers felt to be their normal one. Naturalness and clarity were further requirements of the reading task. All of the speech items in question were elements of larger lists which were read four times in different random orders: (a) pertains to a list of 120 sentences, (b) to a list of 52 of sequences and (c) to a 39 word list.

2.2. Vowel and lateral segmentation criteria.

As is well known, the acoustic manifestation of laterals is characterized by considerable variability, depending on a number of factors, namely the adjacent context, prosodic factors (stress and syllable position, in the present study) and speaker characteristics. From the acoustical point of view, in optimal conditions in syllable initial position, laterals are typically characterized by a vowel-like region with a clear formant
structure and a consonant-like dynamic region. Depending on the circumstances, one or the other may not be visible. In the present paper we identify the former as $L$ (cf. 3.3.) and the latter as $L'$ (cf. 3.3.); $L'$ stands for the interval between the stop burst and final transient associated with the lateral coronal release, in the C(V)L sequences (cf. 3.1.1.). Segmentation marks were made in the following “points” of the signal: onset of the stop burst and onset of voicing in the C(V)L sequences, onset and end of the lateral vowel-like region ($L_0$ and $L_e$, respectively), end of the consonant-like region ($L_r$), midpoints of the lateral ($L_m$) and the preceding vowel or the following one ($V_m$), and some fixed “points” in the lateral and vowels, namely $V_o+$15 ms, $L_r$-20 ms and $L_o+$25 ms. Establishment of the beginning and end “points” of the lateral was, in a number of cases, problematic.

2.3. Subjects.
The subjects are Lisbon EP native speakers and are relatively homogeneous in terms of age (30-24 yrs), and cultural background (they have all got a university degree). The number of subjects used in the present study was not the same for all sets of material. The data from seven subjects were analysed in the case of the /pli\~/pe\'li/ set: four women (S2, S3, S4 and S6) and three men (S1, S5 and S7). With respect to the other sets, the analysis was based on two men and three women, in the case of the LV sequences, and one man and two women (namely S1, S2 and S3) in the case of the remaining material.

3. RESULTS

3.1 Onset laterals.

3.1.1. The lateral in a complex onset.

Five of the seven subjects present significantly low F2 values for the lateral in /pli/ which are typical of a velarized variant (cf. table 1). The highest F2 values, correspond to two of the female subjects (S2 and S4). The F2 values obtained for the lateral and the following /i/ realizations of subjects S1, S2 and S3 are represented in figure 1.

<table>
<thead>
<tr>
<th>$L$</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2m</td>
<td>883</td>
<td>1377</td>
<td>950</td>
<td>1537</td>
<td>970</td>
<td>1024</td>
<td>829</td>
</tr>
<tr>
<td>F2msd</td>
<td>56.2</td>
<td>73.6</td>
<td>127.8</td>
<td>76.2</td>
<td>130.3</td>
<td>22.6</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Average F2 values obtained at $L_m$ in /pli/ realizations and the corresponding standard deviations, for 7 subjects. S2 is represented by a single token.

Upon examination of the F2 data for /l/ produced by male speakers of languages that distinguish velarized and non-velarized laterals (e.g. Russian, Bulgarian and Albanian [9, 10]) and languages that have either clear /l/ (e.g. Castillan Spanish, French, Italian, and German [7, 11]) or dark /l/ (e.g. Catalan and some varieties of English [7, 8, 12]), there is reason to think that S4, too, falls within the range of values associated with velarized laterals; however, while the F2 values of subjects S1, S3, S5, S6, S7 indicate their laterals are strongly velarized (or pharyngalized), those of S4 reflect weak velarization.

S4 is also the subject who displays the highest degree of dispersion with respect to the F2 values at $L_m$; for S1, S3, S5, S6 and S7 we find very little variation. This observation suggests that the articulatory constraints on the tongue body gesture for the lateral are weaker for S4 than for the other subjects and that, therefore, the lateral articulation is more resistant to the coarticulatory effect of the following /i/ in the case of S1, S3, S5, S6 and S7 than in the case of S4.

<table>
<thead>
<tr>
<th>$L'_{ve}$</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOT (ms)</td>
<td>56.3</td>
<td>38.6</td>
<td>57.5</td>
<td>61</td>
<td>74</td>
<td>77</td>
<td>55</td>
</tr>
<tr>
<td>VOT (ms)</td>
<td>17</td>
<td>30.4</td>
<td>18.5</td>
<td>31.6</td>
<td>18.7</td>
<td>26.2</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2. Average $p$-VOT and $L'$ durations in /pli/ realizations for 7 subjects.
lengthened lateral, for all speakers. This may be observed even for S2, as shown in figure 2. As for S4, her “lengthened laterals” in /pe/li/ are clearly velarized, unlike her short laterals in /pli/.

3.1.3. Intervocalic /l/: influence of the following vowel and stress. The results presented in this section and in 3.3 correspond to subjects S1, S2, S4, S5 and S6. Table 4 contains the average F2 values obtained at Lm for LV sequences in which /l/ is followed by [i], [e], [a] or [e]. The results in question require a revision of our interpretation of the /pli/ data, to some extent. In fact, while S2 reveals a remarkable constancy with respect to the F2 (average) values associated with the /pli/ and /li/ sequences (cf. table 1), S4 velarizes her /l/s quite markedly, in the “optimal” LV conditions. One possible explanation is that she is more prone to reduction in connected speech than when it pertains to the stressed syllable.

Table 4. Average F2 values obtained at Lm in LV sequences /V/ produced by 5 subjects (S1, S2, S4, S5 & S6).

<table>
<thead>
<tr>
<th>F2</th>
<th>S1</th>
<th>S2</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
</tr>
</thead>
<tbody>
<tr>
<td>[li]</td>
<td>906,2</td>
<td>1374,9</td>
<td>1074,7</td>
<td>941</td>
<td>1019,5</td>
</tr>
<tr>
<td>[le]</td>
<td>874,9</td>
<td>1296,8</td>
<td>1052</td>
<td>915,7</td>
<td>1027</td>
</tr>
<tr>
<td>[la]</td>
<td>871,1</td>
<td>1161,4</td>
<td>982,4</td>
<td>845</td>
<td>937,5</td>
</tr>
<tr>
<td>[le]</td>
<td>835,9</td>
<td>1249,9</td>
<td>1101,6</td>
<td>914,7</td>
<td>767,1</td>
</tr>
</tbody>
</table>

The five subjects under analysis converge with respect to one further aspect: they all evidence an effect of the following vowel in the front-back dimension; moreover, all but S6 have their highest and lowest F2 values in the context of /l/ and /al/, respectively, as expected [4].

3.1.4. Intervocalic /l/: influence of the following vowel and stress. The results presented in this section and in 3.3 correspond to subjects S1, S2 and S3. The F2 values sampled at Lo, Lo+25 and Lm in ‘sela’- ['sɛlɛ] and ‘séli’ - ['sɛli] realizations of the three subjects in question reflect the occurrence of an effect of the following vowel on the lateral at Lm (cf. figure 3): F2 is higher in the context of /l/ than in the context of /l/. In accordance with what was observed previously, it’s S2 who presents the largest effect. Analysis of the F2 values associated with the preceding vowel (i.e.) shows that the influence of the following vowel extends beyond the lateral region, though in differing degrees from speaker to speaker.

As may be seen in figure 3, shifting stress from the initial syllable to the final syllable, in [se’li], results in a further rise of /l/ F2 relative to the corresponding F2 value in [’sɛli]. Again, the degree of this effect is speaker dependent: it is more marked for S3 and S2 (though not as much) than for S1. It is notable that the lateral is shorter when it pertains to the stressed syllable than when it fills the onset of the post-stress syllable.

Figure 3. Average F2 values for /l/ taken at Lo, Lo+25 and Lm for [’sɛli] and [’sɛli] produced by S1, S2 and S3.

3.2 Coda vs onset position. Analysis of the segmental durations associated with the [ɛl] realizations F2 of ‘sela’- ['sɛlɛ] and ‘celta’- ['sɛltɛ] of S1, S2 and S3 shows there is a marked, systematic vowel shortening as well as a strong tendency for shortening the lateral sonorant region (L) in ['sɛlɛ] relative to ['sɛltɛ]. The VL sequence is shorter in the coda case than in the onset one even when the consonant-like region of the lateral (Lc) is taken into consideration, as well. These observations are illustrated with figure 4, which contains the segmental duration results for S1. Comparison of the F2 average values for the front vowel in ‘sela’- ['sɛlɛ], ‘celta’- ['sɛltɛ] and ‘seta’- ['sɛtɛ] indicates, in turn, that F2 lowering towards the velarized lateral values takes place earlier in the coda context than in the onset one. This may be observed for S1 and S2 in figure 5. It may be inferred from figure 5 that the exact timing of F2 lowering relative to vowel onset varies across speakers: of the three subjects, it is S1 who exhibits lowering of F2 earliest. With respect to the lateral itself, S1 produces a clearly lower F2 for ['sɛlɛ] than for ['sɛltɛ], which is in accordance with what has just been observed for this subject’s [ɛl] and S3 produces the opposite pattern; as for S2, the F2 difference found is not
significant. Such observations lead us to hypothesize that S1’s tongue body lateral gesture is more resistant to the influence of the preceding vowel than that of S2 and particularly S3.

The present findings indicate that the tongue body retraction and lowering gesture associated with the lateral together with the strong co-production between this consonant and the preceding vowel gestures when it occurs in the syllable coda converge towards the blocking of stress-dependent vowel rising. Phonological facts indicate this process is stronger with the lateral than with other consonants, namely /l/ and /ʃ/. We may therefore, hypothesize that the two factors in question were active historically, when unstressed vowel reduction got structured in EP.

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NOTES

1. In order to account for vowel nasality, the set also includes an underlying /u/ or an underspecified N, for some authors; we prefer to postulate a nasal autosegment which anchors on the preceding vowel when followed by a C or at word boundary.

2. The vowels /u, ʋ/ can be said to alternate with a high schwa: a high vowel that is highly context dependent which may be produced in a very reduced manner, devoice or even have no phonetic manifestation [3].

3. Analysis of other parameters, namely F1 and F2-F1, is under way.

4. Analysis of further data is being carried out.

5. Portuguese does not have aspirated stop.

REFERENCES


