ACOUSTIC CORRELATES OF VOWEL QUANTITY CONTRASTS IN AN ITALIAN DIALECT

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INTRODUCTION

It is a widespread belief that Italo-Romance languages lack vowel quantity contrasts. Our previous studies, though limited to the northern Italian dialects of Emilia, led us to a different opinion. A preliminary phonological interpretation of the large vowel inventory found in a dialect of the Friulan area was proposed. In stressed syllables thirteen vowels are used: /i, y, u, e, o, e, o, a, i, y, o, a, a/. This analysis received later some instrumental support. A first research was focused on the duration of the vowel differences between the long segments /e, o, a, a/ and the short segments /e, o, a, a/. In a following research the spectral properties of all the thirteen phonemes of the system were examined, but the paper discussed only the formant frequency patterns of the nine long phonemes [2].

These early studies raised several questions which require further experimental investigation and discussion. Firstly, it seems important to establish whether and to what extent quantity contrasts exist in an Italo-Romance variety. Another issue concerns the position of this northern Italian dialect within a typology of so-called quantity languages. A further problem is to propose a hierarchy among the multiple factors serving as cues for the Frignanese speaker-listener.

DATA AND METHODS

The speech material presented here includes both monosyllabic and disyllabic meaningful words stressing on the first syllable, the target vowels are /i, y, u, e, o, e, o, a, o/ and occur in the context of different prevocalic consonant and postvocalic consonant, i.e., an alveolar lateral /l/ of the common voiced approximant type.

RESULTS

Durations

The measurements on vowel durations indicate that the speakers of the Frignanese make a very clear distinction between the long vowels /e, o, a, a/ and the short vowels /e, o, a, a/.

As can be seen from Table 1, the mean short vowel durations are less than half the mean long vowel durations in both CVCV and CVC structures. Vowels have shorter durations in disyllabic than in monosyllabic words, conforming to a common tendency in world languages [3].

Note that this shortening occurs to a similar extent for both short and long vowels, and therefore the V/V: ratio is unaffected.

Table 1. Mean durations in ms and V/V: ratio of the short and long vowel pairs.

<table>
<thead>
<tr>
<th>Vowel Pairs</th>
<th>Short</th>
<th>Long</th>
<th>V/V: Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVVC/VCVC</td>
<td></td>
<td></td>
<td>46.15</td>
</tr>
<tr>
<td>CVVC/CVC</td>
<td></td>
<td></td>
<td>46.33</td>
</tr>
</tbody>
</table>

Differences in the mean values of the V/V: ratio by vowel type and word structure were found. These are reported in Table 2. In general, the V/V: ratios vary with degree of vowel height. It can be observed that in CVVC words the ratios are smaller for the mid high than for the mid low and low vowels.

Table 2. Mean values of V/V: ratio by vowel type and word structure.

<table>
<thead>
<tr>
<th>Vowel Type</th>
<th>CVVC</th>
<th>CVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>/e/</td>
<td>36.56</td>
<td>44.79</td>
</tr>
<tr>
<td>/o/</td>
<td>40.00</td>
<td>43.39</td>
</tr>
<tr>
<td>/a/</td>
<td>55.17</td>
<td>64.47</td>
</tr>
<tr>
<td>/i/</td>
<td>36.56</td>
<td>44.79</td>
</tr>
<tr>
<td>/u/</td>
<td>40.00</td>
<td>43.39</td>
</tr>
<tr>
<td>/y/</td>
<td>55.17</td>
<td>64.47</td>
</tr>
</tbody>
</table>

The data of the single subjects show some interspeaker variability in the absolute vowel duration values. In short, there are greater temporal differences between our three subjects in the production of long than of short vowels. Though limited, these data seem to suggest that the short vowels display a relative stability with respect to the long vowels.

With regard to the duration of the consonant following the four pairs of long/short stressed vowels, our previous study [1], based on one subject, showed different duration values for the target consonant in the CVVC vs. the CVC structure. The CVC ratio resulted negligible in disyllables while it was
The present data confirm the observation for the consonants occurring in the CVC structure, where the C/C ratio is around .100. For the consonants in the CVC structure the C/C ratios for the three subjects are very different: for one subject it is 81.29, while the other two subjects have larger ratios. In this case no generalization can be made.

Vowel quality

The analysis of the spectral properties of the Frignanoan vowels has revealed a certain amount of variation in formant frequencies between the long and short vowels. The data relating to the mean differences in F1 and F2 are visualized in Fig. 1. It can be observed that, for F1 of all the vowels, the three subjects exhibit, though to a different extent, the same tendencies. For F2, subjects SG and RI show a similar pattern, while subject GB behaves in a very different way for the vowel pair /e, o/, as can be seen from the direction of the bars in Fig. 1. The figure also illustrates how the spectral characteristics differ systematically from vowel to vowel. For F1, the subtraction value is positive for /a, a/ and negative for the other pairs. This indicates that the duration distinction affects the F1 values of short vowels so that they are smaller in /a/ and larger in /e, o, a/ than in the corresponding long vowels. For F2, the variation from long to short is more remarkable in /e, o, a/ than in /a/. With the mentioned exception of GB there is a decrease in frequency for the front vowels /e, o/. The effects of duration on the quality of the four vowel pairs can be seen also in Fig. 2.

For representing the data in the formant chart, the F1 and F2 values were converted into Mel using the formula given by Fant [5]. Fig. 2 shows the location of the four vowel pairs in the thirteen-vowel system of the dialect for two of the subjects. The quality variation due to duration is found on both the F1 and F2 axes. For the high-low dimension, a comparison of the short and long members of the pairs shows a lowering of the vowels /e, o, a/ and a raising of /a/. It is interesting to note that short /e/ lowers to such an extent that it approaches the quality area of long /e/. As concerns the front-back dimension, the short vowels /e, o/ centralize with respect to their long counterparts, the shift in F2 for the pair /a, a/ is minimal. Subject GB’s divergent behavior regarding the vowel pair /e, o/ can be observed also in the formant chart. While for SG short /a/ has a smaller F2 value than long /o/, for GB the formants shift in the opposite direction.

Figure 2. Mean F1 and F2 formant frequencies for the thirteen-vowel system (two subjects). Values of the vowels in CVC and CVC structures are averaged and expressed in Mel.

On the basis of our production data, a tentative conclusion can be drawn as to which acoustic correlate is most important for the quantity contrast. It seems unquestionable that the crucial factor is the vowel duration distinction, the other two factors being additional. Qualitative vowel variation is dependent on the long/short distinction, like in many languages [4]. As for consonant duration, the fact that two different patterns were found for the two word structures poses a problem of interpretation. Of course we are aware that, to determine the actual hierarchy of importance among the phonetic factors serving as cues for the Frignanoan speaker-listener, perceptual experiments are needed.

Finally, at a more general level of discussion, it is worth adding some concise remarks. As far as the data analyzed are representative of this dialect of the Frignano area, the results of the present study support our early hypothesis that this Italo-Romance variety is a quantity language. We attempt a brief definition of the Frignano-specific characteristics in the framework of the languages which make contrastive use of durational differences. Our analysis seems to suggest that the domain of the quantity contrast in the dialect is the vowel segment. There is a two-way quantity contrast which is found only between vowels occurring in stressed syllables. The durational distinction applies only to some phonemes of the thirteen-vowel system, that is, the four pairs /e, o; e, o; e, o; a, a/ and /e, o, a, a/. So, the qualities of the four short vowels are a subset of the qualities of the nine long vowels [6]. The short-to-long ratio is about .46 (i.e., 1.2:1) in both CVCV and CVC structures, which classifies this dialect among the languages having strong vowel quantity contrast.

REFERENCES