Whereas most of the early learners (21 out of 30) perceive category boundaries within the range of native-speaker categorization for all three places of articulation this applies to only two of the ten late learners (AO 13 and 16). In the group of early learners nine subjects show category boundaries within the range of native-speaker categorization for either one or two of the Swedish minimal pairs. At the same time no early learner was found who exhibits non-native-like category crossover points for all three places of stop articulation. Finally, the analysis of the group of late L2 learners shows that seven individuals change phoneme category within the range of native-speaker categorization for either one or two of the three places of articulation. In contrast, only one subject (AO 14) does not exhibit category boundaries within the range of native-speaker categorization for any of the stops.

4 Summary and conclusions

The present study has shown that age of onset has an effect on apparently nativelike L2 speakers' categorical perception of the voicing contrast in Swedish word initial stops. In addition to negative correlations between AO and perceived category boundaries, significant group differences were found. The late L2 learners change phoneme category at the shortest crossover points, thereby deviating the most from the Swedish controls. In short, the data confirm that there is a general age effect on categorical perception even among L2 speakers who seem to have attained a nativelike L2 proficiency (Research Question 1).

Among the late L2 learners only two subjects (AO 13 and 16) change stop category within the range of native-speaker categorization regarding all three places of articulation. Thus, only a small minority of late, apparently nativelike L2 speakers show actual nativelike behavior concerning the categorical perception of the voicing contrast (Research Question 2).

Most of the early L2 learners change category for the three stop continua at VOTs within the range of native-speaker categorization. On the contrary, no subject with an early AO was identified who showed non-native-like category boundaries for all three stop continua. Thus, most, but far from all, early learners show nativelike behavior when their perception of the L2 is analyzed in detail (Research Question 3).

References


fully counterbalanced. The word structures investigated were CV.CV.CV, CV.CVC.CV, CV.CCV.CV, CV.CV.CV.CV, CV.CV.CV.CV, CV.CV.CV.CV, CV.CV.CV.CV, CV.CV.CV.CV and CVV.CV.CV, each represented by 18 different words. The words were spoken in the frame sentence *xyz, MIKNUN mieletestiin xyz kirjoitetaan NAIN (xyz, in MY opinion xyz is written like THIS)*, where *xyz* represents the target word, the second occurrence of which was measured. The five speakers were instructed to emphasise the capitalised words. Suomi & Ylitalo only compared segment durations within the domain of the word’s first two morae with those outside the domain, but the data have now been reanalysed in more detail. It turned out that there are four statistically distinct, non-contrastive and complementary duration degrees for single vowels, denoted as V(1) - V(4) and as "short", "long", "very long", and "extra short". The distinction drawn by Ladd (1996, and elsewhere) between the association and the realisation of phonemic quantity opposition, and in particular the durational difference in the second-syllable vocalic segments in CV.CV and CV.CV word structures is less than optimal.

Table 1. The mean durations (in ms) of the four duration degrees (DD) of phonologically single vowels (V) and of three types of double vowels (VV) as observed in Suomi & Ylitalo (2004) and in Suomi (in preparation); columns S & Y and S, respectively. In the column *Moraic status* "Mi," means that the V is the word’s third or later mora, "M1" that the V is M1 that is followed by a syllable boundary, "M(C)" that the V is M1 that is followed by a consonant in the same syllable and "MiC*" that the V is Mi preceded by a consonant in the same syllable, "M1M2" that the VV constitutes the sequence M1M2, "M1M2" that the VV constitutes the sequence M1M2, and "M1M2" that the first segment in the VV sequence is M2, or a later mora. For further explanations see the text.

<table>
<thead>
<tr>
<th>DD</th>
<th>Duration label</th>
<th>S &amp; Y</th>
<th>S</th>
<th>Moraic status</th>
<th>Example structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>V(1)</td>
<td>&quot;extra short&quot;</td>
<td>48</td>
<td>75</td>
<td>M1</td>
<td>CV.CV.CV, CV.CCV</td>
</tr>
<tr>
<td>V(2)</td>
<td>&quot;short&quot;</td>
<td>58</td>
<td>104</td>
<td>M1</td>
<td>CV.CV(X)</td>
</tr>
<tr>
<td>V(3)</td>
<td>&quot;longish&quot;</td>
<td>73</td>
<td>126</td>
<td>M1</td>
<td>CV.CCV</td>
</tr>
<tr>
<td>V(4)</td>
<td>&quot;long&quot;</td>
<td>84</td>
<td>158</td>
<td>M1</td>
<td>CV.CV(C)</td>
</tr>
<tr>
<td>VV(1)</td>
<td>&quot;longish&quot; + &quot;longish&quot;</td>
<td>149</td>
<td>-</td>
<td>M1M2</td>
<td>CV.CV(X)</td>
</tr>
<tr>
<td>VV(2)</td>
<td>&quot;long&quot; + &quot;extra short&quot;</td>
<td>142</td>
<td>-</td>
<td>M1M2</td>
<td>CV.CV.VV</td>
</tr>
<tr>
<td>VV(3)</td>
<td>&quot;very long&quot;</td>
<td>135</td>
<td>-</td>
<td>M1M2</td>
<td>CV.CV.CV, CV.CV.CV</td>
</tr>
</tbody>
</table>

Suomi (in preparation) measured durations in segmentally fully controlled, accented CV.CV and CVC.CV nonsense words embedded in the frame sentence *Sanonko uudelleen?* (Shall I say again?) and spoken by seven speakers. Suomi found the same four statistically distinct duration degrees for phonologically single vowels, as reported in Table 1. Three of the four single vowel duration degrees have been well documented earlier, e.g. by Lehtonen (1970), but the existence of degree V(3) ("longish") has not been previously reported. Below are the distributional rules of the observed duration degrees. The rules are to be applied in the following manner: if a word contains a VV sequence, then an attempt to apply the rule for VV duration should be made first. If this rule is not applicable, then the rule for V should be applied to both members of the VV sequence (and of course to singleton V’s).

\[ \text{VV} \rightarrow \begin{array}{l} \text{[very long]} \quad \text{if the first V in the sequence constitutes M3s,} \\ \text{[extra short]} \quad \text{if it constitutes M1,} \\ \text{[short]} \quad \text{if it constitutes M1 that is not next to M2} \\ \text{[longish]} \quad \text{if it occurs in the sequence M3M2} \\ \text{[long]} \quad \text{if it constitutes M1 that is not next to M1} \end{array} \]

As the rule for VV duration is formulated, it is only applicable to VV(3) but not to VV(1) nor to VV(2). In these latter two cases, then, the rule for V duration has to be separately applied to both segments in the sequence, and the correct durations are assigned. Thus VV is "very long" in e.g. CV.CV.CV.CV and CVC.CV.CV, V is "extra short" in e.g. CV.CV.CV, CVC.CV and CV.CV.CV, "short" in CV.CV(C), "longish" in CV.CV.CV and CV.CV.CV (both segments in VV are "longish"), and "long" in CV.CV. In the structure CV.CV, the first segment in the second-syllable VV sequence (M2) is analysable as "long" and the second one (M1) as "extra short"; the sum of these duration degrees is (84 ms + 48 ms =) 132 ms which is 10 ms less than the observed duration for VV(3) (142 ms), but the difference was not significant. The duration alternations under discussion of course entail complications to the realisation of the phonemic quantity opposition, and in particular the durational difference in the second-syllable vocalic segments in CV.CV and CV.CV word structures is less than optimal.

Notice that the above rules explicitly refer to moraic structure only, and not e.g. to the syllable. Notice further that M3s is only referred to when the vowel is either "very long" or "extra short". These degrees represent the durations of double and single vowels in those unstressed syllables in which nothing interferes with the realisation of the quantity opposition; in these positions, the mean duration of double vowels is (135/48 =) 2.8 times that of single vowels. But when a vowel constitutes M1, it can be either "short" or "longish", and when it constitutes M2, it can be either "longish" or "long". This is because the durations of these segments also signal prominence.

3 On the phonetic realisation of prominence

The distinction drawn by Ladd (1996, and elsewhere) between the association and the alignment of prominence is very useful in Finnish. Primary word stress is unquestionably phonologically associated with the word’s initial syllable, but its phonetic alignment with the segmental material is more variable. Stress is signalled by greater segment duration, but not necessarily on the stressed syllable only. Broadly speaking, stress is manifested as greater duration of the segments that constitute M1 and M2, but exactly how the greater duration is distributed depends on the structure of the initial syllable. If the initial syllable is light, i.e. in (CV.CV.CV) words, the first-syllable vowel is “short” and the second-syllable vowel (M2) is “long” (but both are longer than the third-syllable “extra short” vowel in (CV.CV.CV(C)) words). But if the initial syllable is heavy, i.e. contains both M1 and M2, then both of these segments are “longish” as in CVV.CV.CV (words) and (the second-syllable V is “extra short”).

As concerns sentence accent, it is normally realised as a tonal rise-fall that is also moraically aligned: the rise is realised during the first mora, and (most of) the fall during the second mora. Thus in (CV.CV.CV) words, the rise is realised during the first syllable and the fall during the second one, whereas in words with a heavy initial syllable both the rise and the fall are realised during the initial syllable. Strong (e.g. contrastive) accent involves a wider fall than moderate accent, and it is also realised durationally, as an increase in the durations of especially M1 and M2. But moderate accent is not realised durationally, i.e. the unaccented and moderately accented versions of a word have equal distribution of the total duration between the two syllables.

In many languages, details of the total duration of accent depend on the structure of the accented syllable. Thus e.g. Arvaniti, Ladd & Menmen (1998) report that in Greek, the slope and duration of the (prenuclear) accentual tonal movement vary as a function of the structure of the accented syllable. This is not so in Finnish. Instead, what has been observed repeatedly is that, given a constant speech tempo and a given degree of accentuation, the rise-fall tune is temporally and tonally uniform across different word and syllable structures (Suomi, Toivanen & Ylitalo, 2003; Suomi, 2005; in press).

**Table 1.** The mean durations (in ms) of the four duration degrees (DD) of phonologically single vowels (V) and of three types of double vowels (VV) as observed in Suomi & Ylitalo (2004) and in Suomi (in preparation); columns S & Y and S, respectively. In the column *Moraic status* "Mi," means that the V is the word’s third or later mora, "M1" that the V is M1 that is followed by a syllable boundary, "M(C)" that the V is M1 that is followed by a consonant in the same syllable and "MiC*" that the V is Mi preceded by a consonant in the same syllable, "M1M2" that the VV constitutes the sequence M1M2, "M1M2" that the VV constitutes the sequence M1M2, and "M1M2" that the first segment in the VV sequence is M2, or a later mora. For further explanations see the text.

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4 Motivating the durational alternations

Why are there so many non-contrastive vowel duration degrees in Finnish, alternations that partly interfere with the optimal realisation of the quantity opposition? The answer seems to be provided by the particular combination of prosodic properties in the language. Given the uniformity of the accentual tune across different word structures, and given the moraic alignment of the accentual tune, the durational alternations discussed above are necessary. If the durational alternations did not exist but accent nevertheless had the moraic alignment that it has, the uniformity of the accentual tune would not be possible. Why the tonal uniformity exists is not clear, but there it is. It is somewhat paradoxical that, in a full-fledged quantity language in which segment durations signal phonemic distinctions, segment durations nevertheless also vary extensively to serve tonal purposes, while in non-quantity languages like Greek the segmental composition of the accented syllable determines the tonal realisation.

The durational alternations are also observable in unaccented words. But this does not undermine the motivation just suggested, because unaccented and moderately accented words do not differ from each other durationally, and the alternations are directly motivated in moderately accented words. Thus unaccented words are as if prepared for being accented. A conceivable alternative would be that unaccented words would lack the alternations present in accented words, but this state of affairs would further complicate the durational system.

To summarise, beyond the loci in which stress and accent are realised, i.e. when vowels do not constitute M1 or M2, single vowels are “extra short” and double vowels “very long”, which results in their clear separation. In (C)V.CV(X) words, the tonal rise is realised during the initial syllable and it is sufficient that the vowel is “short”. The long fall is realised during the second syllable, and therefore the vowel must be “long”. In (C)V.V.CV(X) words, both the rise and most of the fall is realised during the initial syllable, and therefore both segments in the VV sequence must be “longish”. This paper is not about consonant durations but in (C)VC.CV(X) words, in which M2 is a consonant, it too has to be “longish”; if the consonant has relatively short intrinsic duration elsewhere, it is lengthened in this position. As a consequence of these alternations, the accentual rise-fall can be uniform across different word structures, and at the same time, the quantity oppositions are not jeopardised.

References


