The Perception of a Vowel Contrast by Bilingual Children

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In this study I deal with the acquisition of a Dutch vowel contrast by children being raised bilingually in Dutch and Brazilian Portuguese (BP). The main question I address is the possible effect of simultaneous bilingualism in the phonetic detail of children’s categorization. By simultaneous bilingual children I mean children who have been exposed to both of their languages from birth. The contrast tested was the Dutch /aː/ - /ɑ/. Crucially, this Dutch contrast involves spectral and durational differences and is not found phonemically in BP.

One hundred and sixteen participants took part in this study.

1) 29 bilingual children in Dutch and Brazilian Portuguese (3;5 – 7;1 years old) raised in The Netherlands;
2) 19 bilingual children in Brazilian Portuguese and Dutch (4;7 – 7;1 years old) raised in Brazil;
3) 29 Dutch monolingual children (3;9 - 6;5 years old);
4) 14 Dutch monolingual adults (19 - 35 years old);
5) 14 Brazilian Portuguese monolingual children (4;6 - 6;7 years old);
6) 13 Brazilian Portuguese monolingual adults (23 - 27 years old.)

There are two groups of bilinguals involved in this research, namely one raised in The Netherlands (group 1) and one raised in Brazil (group 2). This separation allows us to control for language dominance.

The stimuli used were 12 synthesized vowels, manipulated in two dimensions, a spectral one (F1 and F2) and a durational one. Each dimension was manipulated in four steps, creating a 4 x 4 matrix. For this experiment only the edges were used as we were trying to reduce the length of the experiment. The vowels are synthesized in such a way as to range from the Dutch /aː/ to the Dutch /ɑ/ using some of the acoustic space reserved for the BP /a/, as shown in Figure 1.

All groups were tested in an XAB experiment where stimuli were presented through headphones. Participants heard three tokens in a row (X, A, and B) and had to decide whether the first token (X) matched the second (A) or the third sound (B). X was any of the 12 tokens synthesized vowels. A and B were each of the end points of the continuum, i.e. one of the two Dutch vowels, either /aː/ or /ɑ/. In order to make the experiment accessible for the children, it has been embedded into a computer game. Most children reported to find it easy and fun.

To calculate participants’ perceptual reliance of spectrum and duration, I followed the same procedure
used in Flege, Bohn & Jang (1997) and Escudero & Boersma (2004). We calculated the reliance of spectral differences to perceive the vowel contrast, i.e. *spectrum reliance*, by subtracting the number of \(/a/\) responses of the top horizontal edge of the continuum from the scores of the bottom horizontal edge (see figure 1 for reference). The value was then averaged across the number of tokens in each row (4 in this case). Similarly, the *duration reliance* was computed by subtracting the amount of \(/a/\) responses of the right vertical edge of the continuum from the scores of the left vertical edge. This value was also averaged across the number of tokens in each column (4).

Although data analysis is still in progress, our preliminary results (over 75% of the data) show no significant difference between monolingual and bilingual children’s perceptual responses. A regression analysis using the dummy variables “bilingualism”, “childhood” and “place where raised” reveals that “childhood” is the only significant factor. This indicates that bilingualism does not affect the categorization of sounds and that bilinguals are able to form native-like categories even in their non-dominant language. These results also show that up to the age tested, i.e. up to about 5 years of age, children, regardless if they are monolingual or bilingual, have not yet acquired the adult cue-weighting norm. Furthermore, spectrum reliance correlates significantly with age and vocabulary size. Bosch & Sebastián-Gallés (2003) have suggested that infants exposed to two languages have some delay in discriminating native sounds when compared to infants exposed to one language only. Sundara, Polka & Genesee (2006) found similar results with pre-school aged children. The results of the current study, however, are not in line with these conclusions, as we find bilingual children patterning with monolingual children.

Additional interesting results come from the cross-linguistic perception of the Dutch contrast by the BP monolingual listeners. These results suggest that two distinct categorizations strategies might be taking place (as previously claimed by Brasileiro & Escudero, 2006). Specifically, some BP monolingual listeners seem to be using the durational dimension to categorize the Dutch vowels (/aː/ and /ɑ/) whereas in BP duration is not used phonemically at the segmental level. I interpret these results suggesting that these listeners are categorizing both Dutch vowel onto the same BP category (/a/), and start using duration as an extra linguistic strategy in order to deal with the somewhat ambiguous input. On the other hand another group of BP monolingual listeners uses a lot of spectrum, more than the native Dutch listeners. I suggest that these listeners are categorizing the Dutch /aː/ onto BP /a/ and the Dutch /ɑ/ onto the BP /ɔ/. In this case, the contrast can be made purely on the basis of spectrum.

**References**


