Effects of L2 use on the production of L1 vowels in early Spanish-Catalan bilinguals

Joan C. Mora, James L. Keidel, James E. Flege

Universitat de Barcelona, Bangor University, University of Alabama at Birmingham

mora@ub.edu, pssc08@bangor.ac.uk, flegejames@yahoo.com

A considerable amount of research on early bilingualism investigating the plasticity of the perceptual system in L2 learning has focused on the Catalan mid vowels /e/ and /ε/ [1,2,3]. This research has shown that even early Spanish-Catalan bilinguals who are highly proficient in Catalan exhibit an asymmetric behaviour in lexical decision tasks in which Catalan-dominant bilinguals obtain higher error rates in the identification of /e/-nonwords than /ε/-nonwords. The source of this asymmetry may be attributed to the co-existence of native and mispronounced Spanish-accented /ε/-words in the mental lexicon of Catalan-Spanish bilinguals (/gαlεdə/ vs.*/gαλεdə/) [4,5] or to the phonetic “weakness” of the mid-vowel contrasts due to various factors, including the pervasive influence of Spanish in a bilingual environment [6,7]. Evidence of this trend is provided by production data from children whose mid-vowels have been found to vary as a function of amount of exposure to Spanish in Barcelona [8]. In the present study we examined vowel production data from a group of 82 Spanish-Catalan (S-C) bilinguals born and raised in Barcelona (selected form a larger pool of 719 S-C bilinguals), first exposed to their L2 by school age (3-6 years), who had been found to perceive the mid-mid vowel contrasts /e/-/ε/ and /o/-/ɔ/ less categorically than the corresponding high-mid vowel contrasts /i/-/ε/ and /u/-/ɔ/ as a function of frequency of Catalan use (MostlyS=11%, S/C=40%, C/S=63%, MostlyC=86%) [6].

The participants read a passage in Catalan at normal speed containing target words with the 7 stressed vowels of Catalan. 5-8 words per vowel were selected according to consonantal place of articulation. Vowel frequency measurements (F0, F1, F2) were converted to Bark (B) and then normalized by computing the difference between Bark-converted F1 and F0 (B1-B0) and between Bark-converted F2 and F1 (B1-B0) for vowel height and frontness-backness, respectively [9]. Euclidean distances between B1-B0 and B2-B1 for the contrasting Catalan vowels /i/-/ε/, /u/-/ɔ/, /e/-/ε/ and /o/-/ɔ/ served as a measure of degree of overlap in production; greater spectral distances on a two-dimensional vowel space representing greater robustness of contrasting vowel pairs in production [10,11].

ANOVA with subject group (MostlyS, S/C, C/S, MostlyC) as the between subjects factor and vowel (/i/, /ε/, /ε/, /ɔ/, /o/, /u/) as the within-subjects factor yielded a significant main effect for vowel (F(3, 76)=71.3; p<.001) and a non-significant main effect for subject group (F(3, 78)=71.3; p=.457). However, a significant vowel x subject group interaction (p=.005) indicated that differences in vowel production across subject groups were dependent on vowel type, as /ε/ and /ɔ/ varied consistently as a function of subject group: the more frequently Catalan was used, the more open and less fronted (less Spanish-like) the mid vowels were. Similar analyses with spectral distance scores as the dependent measure revealed significant differences according to subject group for the /i/-/ε/ and /ε/-/ε/ contrasts (F(3, 78)=3.18; p=.028 and F(3, 78)=5.79; p=.001, respectively) but not for the /u/-/ɔ/ and /o/-/ɔ/ contrasts (F(3, 78)=0.10; p=.957 and F(3, 78)=1.98; p=.123, respectively). Tukey post-hoc tests revealed that MostlyC subjects produced the mid-mid vowel contrast /ε/-/ε/ with significantly greater spectral distances than the MostlyS (p=.001) and the S/C (p=.028) groups. This finding suggests that Catalan /ε/ and /ɔ/ are realized less distinctively by early bilingual speakers using Spanish more frequently, thus providing a source for the perceptual “weakening” of the mid vowel contrast for Catalan speakers through extensive life-long exposure to accented L1 input.
Mean B1-B0 and B2-B1 values for the 7 stressed vowels of Catalan (Fig. 1a) and spectral distances between the front-mid and the back-mid vowels (Fig. 1a and 2) as produced by the 4 subject groups in the study.

**Figure 1a**

**Figure 1b**

**Figure 2**

**References**


