

# 'I SAID MADE (MATE?):' CATALAN/SPANISH BILINGUALS' PRODUCTION OF ENGLISH WORD-FINAL OBSTRUENTS

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## 1. INTRODUCTION

The production of the voicing contrast in English word-final obstruents often poses difficulties for native speakers (NSs) of Romance languages [e.g., 1, 2, and 3], which have largely been attributed to the non-occurrence of voiced obstruents (and/or to the lower frequency of consonants) in word-final position in such languages as Spanish and Catalan. Thus in the implementation of the voicing contrast in English, Romance language speakers have been found to make use of first language (L1) production rules. Specifically, Spanish NSs have been observed to devoice, spirantize, or delete English /b d g/ in word-final position, as indicated by listener transcriptions [1; see also 4]. Besides, acoustic analyses in [5] showed that Spanish speakers further differed from English NSs (E-NSs) in the production of the /t/-/d/ contrast in word-final position in their failure to produce a significantly greater vowel duration difference in /d/ vs /t/ and to maintain voicing in the closure phase of /d/ longer. Spanish speakers were not successful, either, in producing a longer closure phase duration and higher F1 offset frequency for /t/. Similarly, Catalan NSs have been reported to resort to L1 production rules in the realization of the voicing contrast in final obstruents. For instance, [6] noted that English /b d g v ð z ʒ dz/ in absolute final position were produced as devoiced 94% – 100% of the time, hence illustrating Catalan NSs' use of the final obstruent devoicing (FOD) rule. As expected, the voiceless counterparts, /p t k f θ s ʃ tʃ/, were realized as intended in 100% of instances.

In addition to differences in the phonetic inventories between the second language (L2) and the L1, age of onset of L2 learning (AOL) and experience in the L2 might account for Romance language NSs' (non)native-like production of English final obstruents. The Speech Learning Model (SLM) [7] hypothesizes that an earlier AOL results in better discernment of phonetic differences between L1 and L2 sounds [e.g., 3]. It also suggests that learners might succeed in producing L2 sounds that do not exist in certain allophonic positions of their L1 sound inventory — or at least they approximate NS norms [5]. However, studies conducted in formal learning contexts [8] do not tend to uphold AOL and experience effects as put forward by the SLM.

The present study aimed to further explore the potential effects of age of onset of L2 learning and exposure to English on the production of the voicing contrast in English word-final obstruents /p b t d s z/ by Catalan/Spanish (Cat/Sp) bilingual learners of English in a formal learning context.

## 2. METHOD

### 2.1 Participants

Forty-seven Cat/Sp bilinguals (41 female, 6 male) participated. They were undergraduate students in English Teacher Education at the University of Barcelona (mean age

= 23.1 years). They differed in age of onset of English learning (before, at, or after age 8), and in exposure to English (school exposure only vs extra exposure through language courses). Four British E-NSs (1 female, 3 male) were included in the study as a control group.

### 2.2 Materials and procedure

English /p b t d s z/ were elicited in two different words each (*rope, tripe; robe, tribe; mate, sight, made, side; ice, pace; eyes, pays*) embedded in the carrier phrase "I said \_\_\_\_\_" of a delayed sentence repetition task. The mini-dialogues comprising the task (e.g., *What did you say? I said made*) were modeled by two taped British E-NS voices. Only after hearing the first question-answer exchange were participants asked to repeat the (answer) carrier phrase. Participants were recorded in a quiet room at the phonetics lab by means of a CASIO DA-7 DAT tape recorder and a YU-Brother EM-106 microphone. The resulting recordings were transferred in raw format onto a computer and later saved as 48 kHz, mono, 16-bit WAV files with CoolEdit2000.

### 2.3 Acoustic analysis

Acoustic measurements of vowel, closure phase and fricative duration were made using spectrographic and oscillographic displays in Praat [9]. The low-energy period during the closure phase of stops until the release burst defined the closure duration of stops (94% of stops were released). Fricative duration was measured from the beginning to the end of the typical high-energy profile. Vowel duration was measured from the first peak of periodic energy indicating the vowel onset to the last peak of periodic energy that coincided with a significant drop in energy. Vowel quality was also analyzed in a subset of productions by measuring F1 and F2 at two points: after consonant transitions (where applicable) preceding the vowel and before the start of final obstruent transitions.

## 3. RESULTS

Mean results for the acoustic measurements of stop closure phase, fricative, and preceding vowel durations are shown in Table 1. As expected, E-NSs produced vowels preceding voiced stops with longer mean duration (153.23 ms) than vowels preceding voiceless stops. Likewise, the average duration of vowels before /z/ was longer (203.95 ms) than before /s/. Accordingly, the closure phase duration of /p/ and /t/ was longer (27.75 ms) than that of /b/ and /d/. So was the mean duration of the voiceless fricative (108 ms) vs its voiced counterpart.

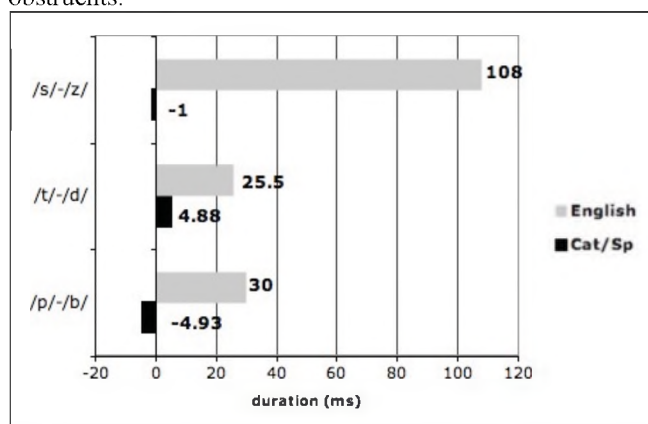
Cat/Sp bilinguals implemented duration differences in their production of vowels before voiced vs voiceless obstruents. However, the extent of those differences was much smaller than E-NSs' (mean range = 43.17–88.16 ms). As for consonant (closure phase or frication) duration, there was barely a length difference in voiced vs voiceless

obstruents (mean range = 1.47–7.24ms). Moreover, contrary to E-NSs, Cat/Sp bilinguals produced a longer duration of closure phase of /b/ than /p/ in *rope-robe* (11.33 ms) and of /z/ vs /s/ in *pace-pays* (3.76 ms). Mann-Whitney *U* tests revealed that vowel duration differences between E-NSs and Cat/Sp bilinguals before voiced vs voiceless segments were significant ( $U$  0–16,  $p < .05$ ). Differences in consonant duration also turned out to be significant in fricatives and in the closure phase of /p/-/b/ in *rope-robe* ( $U$  0,  $p < .05$ ).

**Table 1. Acoustic measurements of vowel, closure phase and fricative durations (in ms).**

Obstruent	Preceding vowel duration		Consonant duration	
	Cat/Sp	English	Cat/Sp	English
/p/	153.11	152.87	119.12	87.12
/b/	199.85	289.12	129.95	57.54
/t/	198.04	181.62	113.20	67.87
/d/	262.75	311.75	104.26	42.50
/s/	235.05	181.66	204.81	259.87
/z/	313.37	380.50	203.44	152

Cat/Sp bilinguals' production of English word-final obstruents as a function of age of onset of L2 learning and exposure did not yield any significant differences according to Kruskal-Wallis and Mann-Whitney *U* tests. Significant differences occurred only between the various age or exposure groups and the English control group. In all cases, the differences had to do with voiced segments, specifically with closure phase and fricative durations. Although Cat/Sp bilinguals produced vowels before voiceless obstruents with a similar duration to that of E-NSs, they tended to lengthen both closure phase and fricative (as well as vowels before voiced obstruents) in the same way for voiceless as for voiced consonants (see Figure 1). Further evidence of Cat/Sp bilinguals' nonnative-like production was found in the preliminary analyses of vowel quality, wherein, unlike E-NSs' typical pattern, the diphthongs were not consistently different between those preceding voiced versus voiceless obstruents.



**Figure 1. Mean closure phase and fricative duration differences (in ms).**

## 4. DISCUSSION

This study looked at Catalan/Spanish bilinguals' production of the voicing contrast in English obstruents /p b t d s z/ in word-final position. The results obtained further supported previous findings of Romance language speakers' difficulties in producing the voicing contrast in English accurately [1, 3, 6]. In particular, Cat/Sp NSs failed to produce voiced segments at native-like levels. Instead, they

appeared to resort to L1 production rules such as FOD, as in [6]. To a certain extent, the finding of Cat/Sp speakers' production of longer vowel duration before voiced obstruents than voiceless consonants is in line with [5] and [10] and might be taken as learners' resembling E-NSs. However, Cat/Sp bilinguals exhibited non-English production patterns in making not only /p t s/ duration longer, but also in realizing the closure phase of /b d/ and the frication of /z/ with considerably longer durations than E-NSs.

The lack of significant differences or a clear pattern in the production of English word-final obstruents as the result of varying ages of onset of L2 learning and degrees of exposure to English corroborated previous findings of formal learning contexts [8], while failing to conform to SLM's predictions.

Further analyses on vowel quality and closure voicing, in addition to native English listeners' perceptions, might provide a greater insight into Catalan/Spanish bilinguals' overgeneralized use of longer and undistinguished duration in their implementation of voiced and voiceless English obstruents in word-final position.

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