

## Gradient effects in the production of Spanish-English code-switching

In code-switching switches between languages are assumed to be categorical (Grosjean & Miller 1994). However, this conclusion is based on a small number of phonetic studies in which the location of code-switching was dictated by the investigators and known to speakers in advance (Grosjean & Miller 1994; Bullock et al. 2006). Research based on natural code-switching suggests that there may be gradient effects (Khattab 2007). Similarly, Roelofs & Verhoeof (2006) suggest that bilinguals' phonologies are merged, so they must actively suppress one language when encoding in the other.

The present study investigated the hypothesis that code-switching is not categorical but subject to gradient effects before and after the switch point using a corpus of spontaneous conversations between five pairs of Mexican-American Spanish-English bilinguals (three female-female and two female-male). Participants were given culturally appropriate conversation topics likely to induce code-switching (e.g. quinceañera) chosen in consultation with a different Mexican-American bilingual. Thirty minutes of conversation per pair was recorded. Code-switching utterances were defined as including both languages, having a pause of less than 300 ms between languages at switch points, and including no false starts or pauses during the utterance. Quality and duration differences of the discourse marker *like* and VOT durations of word-initial voiceless stops were examined. *Like* was chosen because it was found frequently both in English and Spanish monolingual contexts and directly at switch points. VOT was a good candidate for investigating gradient code-switching effects, as bilinguals are shown to maintain distinct categories for monolingual English and Spanish VOT (Flege & Eefting 1987).

VOT was longer in English than Spanish monolingual utterances [ $F(1,9)=697.1, p<0.05$ ] and displayed well-known differences of place of articulation (Cho & Ladefoged 1999). Both English and Spanish VOTs were significantly shorter at code-switching boundaries than in monolingual utterances of the same language [English:  $F(1,9)=6.5, p<0.05$ ; Spanish:  $F(1,9)=9.5, p<0.05$ ]. Due to the difficulty of separating the /l/ from the vowel in *like*, measurements treated them as one segment for duration. The [lar] in *like* was significantly shorter in English than Spanish monolingual utterances [ $F(1,9)=21.7, p<0.05$ ], and the English vowel was more monophthongal: it had a higher initial and lower final F2 compared to *like* in Spanish utterances [initial:  $F(1,9)=4.2, p<0.05$ ; final:  $F(1,9)=9.4, p<0.05$ ], i.e. English [læɪk] vs Spanish [lɪk]. At code-switching boundaries, *like* was significantly shorter than in Spanish monolingual utterances [English-*like*-Spanish:  $F(1,9)=7.5, p<0.05$ ; Spanish-*like*-English:  $F(1,9)=6.3, p<0.05$ ]. F1 was consistent in code-switching tokens, but F2 began similarly to the language preceding and ended similarly to the language following the token; e.g. in “Spanish-*like*-English” utterances initial F2 measurements were more Spanish-like but final measurements more English-like [e.g. English vs Spanish-*like*-English initial:  $F(1,9)=5.3, p<0.05$ ].

These results suggest code-switching boundaries are not categorical, but an area where the phonologies of both languages affect productions. This is possibly due to the difficulty of abruptly suppressing one language while beginning encoding in the other, which leads to the gradient productions uncovered here. These results thus support a theory of merged phonological systems regulated by actively suppressing one system at a time.

## References

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