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Research Article

Voice onset time in Spanish–English spontaneous code-switching

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ABSTRACT

Research on the phonetics of code-switching has focused on voice onset time (VOT) and has yielded mixed results regarding cross-language interaction, possibly due to differences in data used (scripted vs. spontaneous speech) and populations examined (L1 vs. L2 dominant, early vs. late bilinguals). Here VOT was measured in a corpus of spontaneous code-switching speech elicited from a homogeneous group of early bilinguals in conversation with and without distraction (completion of jigsaw puzzles). The distraction meant to increase cognitive load, a manipulation that could affect phonetic realization. Both English and Spanish VOT were shorter at code-switching points than in comparable monolingual utterances. English VOT lengthened overall under increased cognitive load (but remained shorter in code-switching as compared to the monolingual context). These results support previous findings of VOT shortening in code-switching for both English and Spanish, and confirm that the effect applies in the natural speech of early bilinguals.

1. Introduction

Code-switching is a practice common among bilinguals whereby speakers use both languages in a single utterance (Gumperz, 1977; Bullock & Toribio, 2009). Code-switching is particularly prevalent among fluent early or simultaneous bilinguals, defined as those who learned both languages before the age of six and continue to use them both in everyday life (McLaughlin, 1978; Poplack, 1980; Padilla & Lindholm, 1984; Flege, 1991; Flege, Munro, & MacKay, 1995; Hamers & Blanc, 2000; Genesee, Paradis & Crago, 2004; Gildersleeve-Neumann & Wright, 2010; Lee & Iverson, 2012). In bilingual research, code-switching has been well studied in regards to grammatical structure (Pfaff, 1979; Poplack, 1980, 1987; Woolford, 1983; Belazi, Rubin, & Toribio, 1994; Myers-Scotton, 2008). Relatively fewer studies, however, have examined the phonetics of code-switching (but see Grosjean & Miller, 1994; Bullock, Toribio, González, & Dalola, 2006; Antoniou, Best, Tyler, & Kroos, 2011; López, 2012; Olson, 2013; Balukas & Koops, 2014; Olson, to appear). Yet code-switching provides an interesting context in which to examine bilingual speech production, as it offers a window into bilingual processing in a natural context.

Past studies on the phonetics of code-switching have produced mixed results. Some found no difference between phonetic productions in monolingual vs. code-switching utterances (Grosjean & Miller, 1994; López, 2012). In others, differences were found for one of the languages. Antoniou et al. (2011) used Greek-English bilinguals whose L1 was Greek and found that these speakers' English VOT became shorter when produced in a code-switching context as compared to a monolingual context; in contrast, they did not find a similar effect of English on Greek VOT. Similar results are reported by Balukas and Koops (2014): the VOT of their Spanish–English bilingual speakers' English (their L2) was shorter when produced closer to a code-switch but there was no effect for Spanish. In yet a third set of studies, effects were found for both languages but of different types, depending on the population. Specifically, Bullock et al. (2006) found that the English VOT of L1 Spanish speakers in their study was shorter in code-switching, but the VOT of their Spanish was not affected; their L1 English speakers, on the other hand, showed a shortening of *both* English and Spanish VOT in code-switching contexts. The results of Olson (2013) indicate that effects may depend on language dominance: in his study the VOT of the speakers' dominant language (English or Spanish) shifted towards the non-dominant language under code-switching, while the non-dominant language was not affected; e.g., English VOT shortened in the speech of English-dominant

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speakers, but was unaffected by code-switching in the speech of Spanish-dominant speakers. These results are partially confirmed by Olson (to appear): with respect to English dominant speakers, this study replicated the effect found in Olson (2013): their English VOT shortened, but Spanish VOT was unaffected. On the other hand, Olson (to appear) found a bidirectional effect for Spanish-dominant speakers: their English VOT shortened and their Spanish VOT lengthened in code-switching.

There are several possible reasons for this lack of agreement among studies. First, not all studies tested the same populations: Grosjean and Miller (1994), Bullock et al. (2006), Olson (2013), and Olson (to appear) tested late bilinguals, while Antoniou et al. (2011) and Balukas and Koops (2014) tested early bilinguals. In Antoniou et al. (2011) and Olson (2013) speakers were L2 dominant, while in other studies they were L1 dominant (e.g. Bullock et al., 2006; Olson, to appear), or dominance was unclear (e.g. Balukas & Koops, 2014). In some studies the participant population was relatively uniform in age and other social characteristics (e.g. Grosjean & Miller, 1994; Bullock et al., 2006), but in others participants varied significantly in age (e.g. Balukas & Koops, 2014). This is important given that studies on VOT, such as Nagy and Kochetov (2013), have documented inter-generational changes in bilingual immigrant populations similar to the population in Balukas and Koops (2014). Olson (2013) tested both English and Spanish dominant bilinguals but it is arguable whether the participants in his study qualified as early bilinguals, having all learned their L2 after the age of 12. Furthermore, factors such as age and order of acquisition, language dominance, and language mode have all been found to affect bilingual production and processing indicating that these differences across studies may be responsible for the differences in the results (for age and order of acquisition, see, inter alia, Flege et al., 1995; Birdsong, 2001; Hakuta, Bialystok, & Wiley, 2003; for language dominance, see Cutler, Mehler, Norris, & Segui, 1992; Mok, 2011; Olson, 2013; Piccinini & Arvaniti, 2014; for language mode, see Dijkstra & Van Hell, 2003; Marian & Spivey, 2003; Soares & Grosjean, 1984).

An additional reason for the discrepancies could well be that studies used widely different tasks. Several studies relied on scripted materials of varying degrees of naturalness. Grosjean and Miller (1994) instructed participants to read names in French and English sentences pronouncing the names in English or French respectively. Bullock et al. (2006) and Olson (to appear), on the other hand, used more realistic sentences that switched from one language to the other in various ways, while Antoniou et al. (2011) elicited nonce monosyllables (e.g. [pa]) in a typical phonetic frame indicating the language switch by a change in alphabet (Greek vs. Latin). Other researchers tested spontaneous code-switching (e.g. Khattab, 2009; Balukas & Koops, 2014), and yet others relied on the production of isolated words (Olson, 2013). These different experimental paradigms are likely to have consequences for the realization of phonetic categories. Scripted code-switching allows for ample preplanning; e.g. the participants of Antoniou et al. (2011) were familiarized with the switched materials before recordings began. Code-switching in spontaneous speech, meanwhile, is likely taking place with less preplanning, potentially resulting in a greater affect of one language on the other in phonetic productions. Such fundamental differences between tasks could well have affected the phonetics of VOT (see Khattab (2002) and Olson (2013) and references therein). The use of different tasks in combination with different populations of bilinguals is likely to have further compounded discrepancies among studies.

The current study addresses these concerns by examining the effects of code-switching on VOT (1) in spontaneous speech, and (2) with a homogeneous group of early Spanish–English bilinguals who are now English (L2) dominant. By using spontaneous speech we can determine whether previously reported effects of code-switching on phonetic parameters are task artifacts, or whether they are real and observable in ecologically valid studies that take into account the social, spontaneous and interactive nature of code-switching. By focusing on a homogeneous group of early bilinguals, we can further test if effects are present in this specific bilingual population. The combination of these two elements allows us also to shed light on the reasons for the discrepancies in the results of previous studies. Finally, here effects are examined in two conditions, (a) natural code-switching and (b) code-switching with increased cognitive load. This additional parameter allows us to observe possible effects of increased cognitive load on changes resulting from code-switching itself.

VOT was selected both because it has been used in many previous studies, as noted, and thus its study would facilitate comparisons with previous literature, but also because the phonetics of VOT in Spanish and English are well understood. It is well established that Spanish has significantly shorter VOT than English, especially word-initially (Lisker & Abramson, 1964). This distinction has been documented in the speech of Spanish–English bilinguals, demonstrating that they are capable of maintaining distinct VOT distributions for each language (Flege & Eefting, 1987). Nevertheless, recent studies have found that while bilinguals are often able to produce VOT durations appropriate for each of their languages, they still do not perform exactly like monolinguals. The differences are manifested either as longer or shorter durations for a specific VOT category, or as more variable productions of a specific category (see Khattab, 2002, for Arabic-English; Kehoe, Lleó, & Rakow, 2004, for German-Spanish; Sundara, Polka, & Baum, 2006, and Lev-Ari & Peperkamp, 2013, for French-English; Lee & Iverson, 2012, for Korean-English).

Our predictions for the current study are based on previous work according to which bilinguals operate in a continuum with many intermediate stages between a fully monolingual mode in one language and a fully monolingual mode in the other (Grosjean, 2001). In this continuum bilinguals do not fully deactivate either language (Green, 1998), while different contexts can induce different degrees of activation of each language. For example, bilinguals are slower at naming pictures in one of their languages when a distractor from the other language is present, as compared to when the distractor is from the same language as the picture to name (Ehri & Ryan, 1980; Bijeljac-Babic, Biardeau, & Grainger, 1997; Costa, Miozzo, & Caramazza, 1999; Perea, Duñabeitia, & Carreiras, 2008). Increasing cognitive load (e.g. in the form of auditory feedback) can also result in more heavily accented speech, as bilinguals have difficulty suppressing the inactive language (Howell & Dworzynski, 2001). Similar effects are reported when bilinguals are tested in different language modes. For example, Simonet (2014) found that the Catalan vowels of highly proficient Catalan–Spanish bilinguals were affected by whether Spanish words were included in a task; when Spanish words were present, the Catalan vowels /o, ɔ/ moved closer to Spanish /o/. Even when comparing within language, bilingual productions are affected by the inactive