Bilingual experience shapes language processing: Evidence from codeswitching

Anne L. Beatty-Martínez *, Paola E. Dussias

Center for Language Science, Department of Spanish, Italian, and Portuguese, Pennsylvania State University, PA 16802, USA

ABSTRACT

We report three experiments on two groups of Spanish–English bilinguals who differed in codeswitching experience (codeswitchers and non-codeswitchers) to examine how different production choices predict comprehension difficulty. Experiment 1 examined the processing of gender congruent and gender incongruent determiner-noun switches in sentential contexts using event-related potentials. While codeswitchers demonstrated N400 sensitivity to congruency manipulations, non-codeswitchers showed a modulation of early frontal EEG activity to switching, regardless of switch type. Experiment 2 validated the translation-equivalent target words compared in Experiment 1. In Experiment 3, the bilinguals who participated in Experiment 1 completed a task that elicited naturally-produced codeswitched speech. Codeswitchers switched more often than non-codeswitchers, and their switches robustly reflected the conditions that were more easily processed in Experiment 1. Together, the results indicate the comprehension system becomes optimally attuned to variation in the input, and demonstrate that switching costs depend on the type of codeswitch and bilinguals' language experience.

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Introduction

A unique feature of bilingual communication is that many bilinguals sometimes alternate between languages when speaking to other bilinguals. While not all bilinguals engage in *codeswitching*, those who do are able to do so without any apparent disruptions to production or comprehension (Myers-Scotton & Jake, 2015; Poplack, 1980). The following conversational exchange between two Spanish-English bilingual speakers illustrates such linguistic behavior.[1]

(1) I was like, <u>si me hacen una pregunta de</u> how would I say this. I wouldn't be able to say it <u>si me están haciendo</u> consciously say it.
      'I was like, <u>if they ask me a question on</u> how I would say this. I wouldn't be able to say it <u>if they are making me</u> consciously say it.'

From a psycholinguistic perspective, codeswitching bears the hallmark of cross-language activation and represents a research tool to examine how bilinguals systematically (dis)engage two languages (Green & Abutalebi, 2013; Kroll, Dussias, Bice, & Perrotti, 2015; Kroll, Dussias, Bogulski, & Valdés Kroff, 2012). It has been well established in the psycholinguistic literature that a bilingual's two languages are active even when speakers intend to produce or comprehend one language alone (Kroll, Bobb, & Hoshino, 2014; Kroll & De Groot, 2005). Despite this interactivity, errors in which bilinguals select the unintended language are strikingly rare in unilingual contexts (Bobb & Wodniecka, 2013; Kroll et al., 2012; Poulisse & Bongaerts, 1994). At the same time, we know that bilinguals who habitually engage in codeswitching do not haphazardly switch between languages, even in the face of heightened co-activation (Deuchar, 2005; Lipski, 1978; Pfaff, 1979; Poplack, 1980). This leaves open the question of how bilinguals successfully integrate both languages in the production and comprehension of codeswitched discourse. Although research on codeswitching is increasingly growing, the processes that mediate the production and comprehension of codeswitching are not well understood (Green & Wei, 2014). One possibility explored in this paper is that production and comprehension processes may be differentially tuned by language experience. Crucially, codeswitching provides a unique opportunity to examine how bilinguals regulate the use of

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* Corresponding author at: Department of Spanish, Italian, and Portuguese, Pennsylvania State University, 466 Burrowes Building, University Park, PA 16802, USA.

   E-mail address: alb507@psu.edu (A.L. Beatty-Martínez).

[1] The example is reproduced verbatim from the Codeswitching Map Task corpus (Beatty-Martínez, Navarro-Torres, Parafita Couto, & Dussias, 2017). Spanish is underlined; the non-codeswitched English translation is given below the original transcript in italics.

their languages throughout their daily lives. Because codeswitching emerges in some bilingual communities but not in others, it is possible to examine more readily how the production and comprehension systems become optimally attuned to variation in the input, and how the comprehension system uses this information during language comprehension. The current study seeks to exploit this relationship by examining the extent to which individuals' production choices can predict comprehension difficulty in codeswitching and non-codeswitching bilingual populations.

The remainder of this paper is structured as follows. First, we describe documented production asymmetries in codeswitching corpora. Then, we review previous findings on the production and the comprehension of codeswitched language both in experimental and naturalistic settings. Next, we present the goals and design of the current study. We report the findings of two event-related potential (ERP) studies conducted to examine the processing of different types of codeswitches, and present the results of a codeswitching elicitation task to confirm the production asymmetries discussed below by assessing the codeswitching preferences among two bilingual groups. We end with a general discussion of the results.

Production asymmetries in the production of mixed noun phrases

In unilingual contexts, production preferences emerge as choices among structures. Subcategorization biases (Dussias & Cramer Scaltz, 2008; Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Trueswell, Tanenhaus, & Kello, 1993) are an example of such preferences. For verbs with alternative complementation patterns (e.g., 'believe' vs. 'confirm'), it has been found that preferences for associating verbs with a particular argument structure can influence speech production (Gahl & Garnsey, 2004) and speech comprehension (Wilson & Garnsey, 2009). In a codeswitching context, production preferences emerge as choices between languages. Identification of distributional patterns is achieved by the quantification and extraction of structural alternations from naturalistic corpora (Poplack, 1980, 2015). Most relevant for purposes of the current study are switches within the noun phrase in Spanish-English codeswitching (henceforth mixed NPs; Clegg, 2006; Jake, Myers-Scotton, & Gross, 2002; Otheguy & Lapidus, 2003).

Previous studies examining the distributional patterns of mixed NPs have reported two robust asymmetries (Clegg, 2006; Jake et al., 2002; Pfaff, 1979; Poplack, 1980). The first concerns the direction of the switch: switches between the Spanish determiner and the English noun (e.g., 'el dog', "the_SPAN dog_ENG") have been found to occur more frequently than switched in the opposite direction (e.g., 'the perro', "the_ENG dog_SPAN"). The second asymmetry involves grammatical gender assignment: Spanish-English bilinguals in some codeswitching communities exhibit an overall preference for the masculine-marked determiners (e.g., el, "the_MASC") regardless of the English noun's Spanish translation equivalent (e.g., 'el_MASC fork_MASC' and 'el_MASC spoon_FEM'). In contrast, switches with the feminine-marked determiners (e.g., la, "the_FEM") occur less frequently and are restrictively used with feminine translation equivalents ('la_FEM spoon_FEM' but not 'la_FEM fork_MASC').

In Valdés Kroff's (2016) analysis of the Bangor Miami corpus (Deuchar, Davies, Herring, Parafita Couto, & Carter, 2014), quantification of the distribution of mixed NPs revealed 322 total instances, of which 5% were composed of an English determiner followed by a Spanish noun, and 95% of a Spanish determiner followed by an English noun. Further decomposition of this distribution revealed that 92% of Spanish-to-English codeswitches were preceded by a masculine determiner while only 3% were preceded by a feminine determiner. This production asymmetry differs from that in unilingual Spanish contexts, where masculine and feminine nouns are evenly distributed (Eddington, 2002; Otheguy & Lapidus, 2003). The fact that grammatical gender is absent in English suggests the use of a codeswitching strategy that results from the interaction between the two grammars.

A point worth emphasizing is that, while previously proposed linguistically-based constraints (e.g., Lipski, 1978; Pfaff, 1979; Poplack, 1980) have predicted mixed NPs as a feasible switch point because Spanish and English share the same surface order, these constraints do not predict asymmetric distributions in mixed NPs with respect to grammatical gender assignment of the determiner, nor do they predict asymmetries in the direction of the switch. The purpose of this paper is not to explain why these asymmetries might arise (although we touch upon this in the discussion section). Instead, it tests whether bilingual speakers are sensitive to this variation in ways that constrain the comprehension system.

Switch costs during the production of codeswitches

The language-switching task (e.g., Meuter & Allport, 1999) has been the benchmark method to investigate the processes underlying bilingual language production (Bobb & Wodniecka, 2013; Tarlowski, Wodniecka, & Marzecová, 2013). In this paradigm, bilinguals name items out of context (e.g., numeric digits or pictures) in one of their two languages as indicated by external cues (e.g., color font or frame). On non-switch trials, participants name the target item in the same language as the preceding trial. On switch trials, participants name the target item in the opposite language than on the preceding trial. Switching costs are determined by calculating latency differences between switch and non-switch trials. The canonical finding in this paradigm is a switch cost: switch trials elicit longer reaction times than non-switch trials (see Meuter (2009), for a review). Switch costs are typically asymmetric, such that participants take longer to name a target in their first language (L1) following a trial in their second language (e.g., Meuter & Allport, 1999).

Another finding is that linguistic proficiency in the second language (L2) can modulate the magnitude of this effect (e.g., Costa & Santesteban, 2004). Studies investigating the presence of switch costs in sentence level contexts have reported mixed findings. Bultena, Dijkstra, and van Hell (2014) found that switching to the L2 was more costly than switching to the L1, and Tarlowski et al. (2013) found asymmetrical switching costs that differed depending on the grammatical structure produced. Gullifer, Kroll, and Dussias (2013), on the other hand, found that bilinguals did not differ in naming times for target words embedded in mixed and blocked sentence contexts. Studies examining codeswitching in naturalistic contexts have asked whether there is a cost associated with spontaneously-produced codeswitches. In an analysis of the Bangor Miami Corpus (Deuchar et al., 2014), Fricke, Kroll, and Dussias (2016) found that even when highly proficient codeswitchers retain full control over when to switch languages, switching resulted in slowed speech rate and a modulation of cross-language phonological overlap; this suggests that language regulation has consequences for processes occurring during speech planning. Overall, these findings pose an interesting paradox: if bilingual speakers exhibit larger processing costs when switching languages, why do they customarily codeswitch?

Although this question has not been addressed in depth, recent work looking at codeswitching from a conceptual point of view capitalizes on the role of opportunistic planning in the production of codeswitches (Green & Abutalebi, 2013; Green & Wei, 2014, 2016). According to this account, codeswitching plays an important role in mitigating utterance planning difficulties in bilinguals. For example, if speakers intend to use a specific word in the language not currently in use, they may deliberately switch to more