Examining the relationship between comprehension and production processes in code-switched language

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ABSTRACT

We employ code-switching (the alternation of two languages in bilingual communication) to test the hypothesis, derived from experience-based models of processing (e.g., Boland, Tanenhaus, Carlson, & Garnsey, 1989; Gennari & MacDonald, 2009), that bilinguals are sensitive to the combinatorial distributional patterns derived from production and that they use this information to guide processing during the comprehension of code-switched sentences. An analysis of spontaneous bilingual speech confirmed the existence of production asymmetries involving two auxiliary + participle phrases in Spanish–English code-switches. A subsequent eye-tracking study with two groups of bilingual code-switchers examined the consequences of the differences in distributional patterns found in the corpus study for comprehension. Participants' comprehension costs mirrored the production patterns found in the corpus study. Findings are discussed in terms of the constraints that may be responsible for the distributional patterns in code-switching production and are situated within recent proposals of the links between production and comprehension.

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Introduction

A hallmark of proficiency in two languages is code-switching (the alternating use of two languages in bilingual speech). Proficient bilinguals often code-switch in the midst of speaking with or writing to other bilinguals. The following email illustrates the point clearly (code-switched material appears in bold and capital letters for ease of presentation; translation appears in square brackets).

On Mon, 9 Jul 2007 17:50:33-0400 (sender's name omitted) wrote:
Tuesdays at 6:30 pm SUENA BIEN. If there's enough people interested in playing, maybe PODEMOS EMPEZAR tomorrow MARTES. ¿QUé PIENSAN? We could play in the IM building. The place TIENE three volleyball courts QUE ESTáN available most of the time. COMO DIRíAN LOS commentators of the Puerto Rican Volleyball Federation...

[Tuesdays at 6:30 pm SOUNDS GOOD. If there's enough people interested in playing, maybe (WE) CAN START tomorrow TUESDAY. WHAT DO (YOU) THINK? We could play in the IM building. The place HAS three volleyball courts THAT ARE available most of the time. AS THE commentators of the Puerto Rican Volleyball Federation WOULD SAY...

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For several decades, code-switching was regarded as random interference of one language with the other (e.g., Lance, 1975). We now know that code-switching is rule-governed (e.g., Deuchar, Muysken, & Wang, 2007; MacSwan, 2000; Myers-Scotton, 2002; Toribio, 2001), although there is little agreement on the precise nature of the rules involved. There is consensus, however, as to the observation that code-switching is a remarkable feat of bilingual communication that gives language scientists the potential to understand how humans negotiate the boundaries of two languages (e.g., Kroll, Dussias, Bice, & Perrotti, 2015; Kroll, Dussias, Bogulski, & Valdés Kroff, 2012).

Code-switching presents a unique cognitive puzzle on the link between production and comprehension. In particular, the production of code-switched speech is putatively under the control of bilingual speakers, as evidenced by their ability to speak in one language when necessary (e.g., when speaking to a monolingual conversational partner). Yet bilingual comprehenders do not *a priori* know when a code-switch will occur in speech. In this sense, switches can be unexpected and, thus, potentially more difficult to process than within-language sentences. In support of this, several studies on the comprehension of code-switched language have documented costs associated with processing code-switches (e.g., Altarriba, Kroll, Sholl, & Rayner, 1996; Bultena, Dijkstra, & Van Hell, 2015; Proverbio, Leoni, & Zani, 2004). Given the presence of switch costs, it is on the surface surprising that bilinguals rarely report experiencing difficulties comprehending code-switched discourse. In fact, bilinguals often have difficulty remembering which language was used in any particular speech exchange (Gumperz, 1982) and are often not able to unequivocally indicate the precise locus of a recently produced code-switch (Toribio, 2001). These facts suggest the existence of factors that mitigate switch costs. This logic resonates with what has been proposed in many studies of monolingual syntactic ambiguity resolution: the observation that readers garden-path only occasionally, even though temporary ambiguities are common, indicates that they use cues from production to guide their initial choices (e.g., Garnsey, Pearlmutter, Myers, & Lotocky, 1997).

The main goal of the work presented here is to test the hypothesis, derived from experience-based models of processing (represented in the work of, e.g., Boland, Tanenhaus, Carlson, & Garnsey, 1989; Britt, 1994; Gennari & MacDonald, 2009; Holmes, Stowe, & Cupples, 1989; MacDonald, Pearlmutter, & Seidenberg, 1994; McRae, Hare, Elman, & Ferretti, 2005; Novick, Thompson-Schill, & Trueswell, 2008; Pickering & Garrod, 2013), that bilinguals are sensitive to the combinatorial distributional patterns derived from production and that they use this information to guide processing during the comprehension of code-switched sentences. As will be shown below, our approach exploits the power of the unique linguistic environment in which bilinguals find themselves to reveal the central influence of production and its relationship to the linguistic representations that speakers recruit during comprehension (e.g., Dell & Chang, 2014; Levy, 2008). A second aim is to add bilingualism to the discussion of

how language production affects language comprehension with the purpose of broadening the evidential base. The evidence in favor of experience-based models of processing has largely come from studies with monolingual speakers, and predominantly from studies on syntactic ambiguity resolution or the interpretation of subject/object relative clauses. Given the demographic reality that more speakers around the world are bilingual, bilingualism can and should be used as a tool to uncover important aspects of language function that may be obscured or difficult to study when examining the behavior of individuals who speak only one language (see Kroll, Bobb, & Hoshino, 2014). In the work reported here, we use the presence of code-switching in bilingual communities to test the correspondence between production patterns and comprehension difficulty proposed in experience-based models of language processing.

Switch costs

An important distinction in the code-switching literature is the division between inter-sentential and intra-sentential switches. Inter-sentential code-switches take place at sentence boundaries, as in example 1, and intra-sentential switches occur within sentence boundaries, as in example 2 (in both examples, Spanish words appear in italics; the underlined portion comprises the switch).

(1)	I need to go to the pharmacy.	*Tengo que comprar* *aspirina.* '...(I) have to buy aspirin.'
(2)	*Mi tía dijo que* <u>my uncle left.</u> 'My aunt said that...'	

Intra-sentential switches require greater simultaneous control of both languages, creating a unique opportunity to observe the interaction between two linguistic systems. Languages across the world differ in their statistical regularities even when surface structure is similar (e.g., Dussias, Marful, Gerfen, & Bajo Molina, 2010). An open question, then, is how bilingual speakers successfully navigate between two languages within the same sentence. Do bilinguals follow the specific distributional statistics of one language or the other when engaged in code-switching? Or do they develop knowledge of when code-switches are more likely to occur? If the interaction between linguistic systems and the constraints that guide their successful integration during code-switching can be systematically characterized, we propose that they provide a valuable means of investigating questions concerning the relationship between sentence production and comprehension.

Quantitative studies on intra-sentential switching involving a number of language pairs have revealed that certain types of syntactic junctures are more likely to serve as the loci of code-switching than others. If exposure-based models generalize to code-switched speech, then bilinguals presumably use this distributional information