

# Online processing of multilingual (code-switched) sentences



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## Introduction

Bilinguals combine words from different languages in a single sentence. Using eye-tracking and syntactic priming, we investigated whether these code-switched sentences are represented and processed similarly to unilingual sentences. We manipulated the relative order of adjective(A) and noun(N) in English-only and English-Spanish sentences. We asked whether AN/NA order in previous sentences influenced the processing of subsequent sentences.

Syntactic priming refers to facilitation in using a syntactic structure after recent exposure to the same structure. In studies of monolingual language processing, this technique has been used to shed light on the abstractness of syntactic representations, the ontogeny of such representations, and the possible architectural differences between language comprehension and production [1, 2, 3].

Parallel studies in bilingual language processing have shown that abstract syntactic representations can be shared between languages. Use of a syntactic structure in one language facilitates the use of a similar structure in the other language [4, 5].

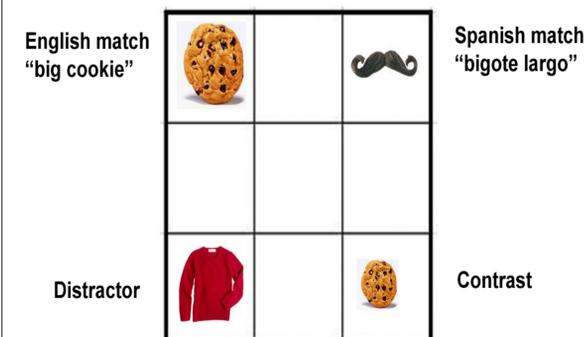
## Methods

Spanish-English bilingual participants were first familiarized with English and Spanish labels for picture stimuli. Then they followed auditory instructions and clicked on matching objects.

Instructions: “Click on the” + adjective-noun (AN) or noun-adjective (NA) phrase.

On critical trials, the word following the carrier phrase was roughly phonetically compatible with an English adjective and a Spanish noun (=> ambiguity).

“Click on the big cookie” or “Click on the bigote largo”



## Dependent Measure

We measured looking time to the four items on the computer screen. DV =  $\frac{\text{looking time to target}}{\text{looking time to target} + \text{competitor}}$  in 200-400 ms interval following ambiguous onset

## Experiment 1

Twenty four participants

### Prime (2 types)

Unambiguous

English AN: Click on the yellow box.

Code-switched NA: Click on the vaso pequeno.

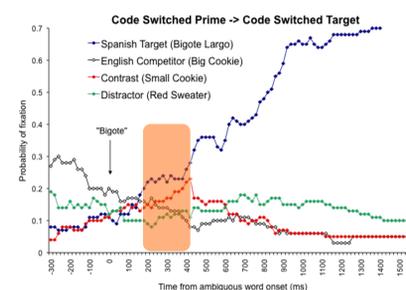
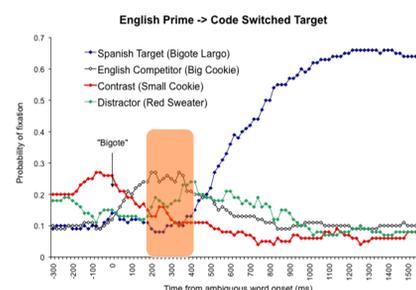
### Target (2 types)

Ambiguous

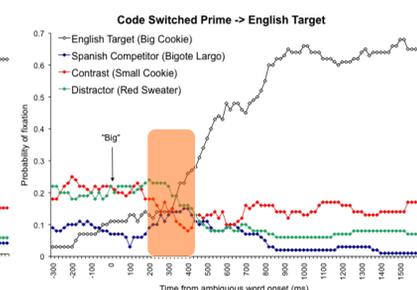
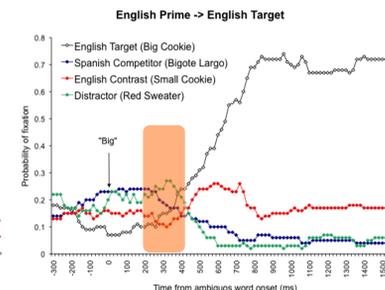
English AN: Click on the big cookie.

Code-switched NA: Click on the bigote largo.

### Significant priming effect for code-switched NA targets.



### No significant priming effect for English AN targets.



## Experiment 2

Motivation: Experiment 1 results could be due to priming of code-switching *per se* or structural priming of NA order. Fourteen new participants.

### Prime (2 types)

Unambiguous

Code-switched AN: Click on the bueno perro.

Code-switched NA: Click on the perro bueno.

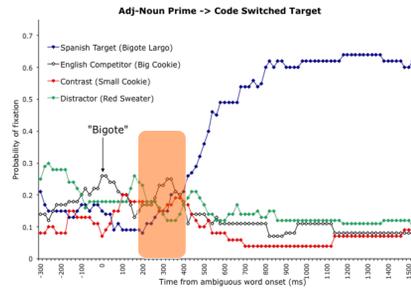
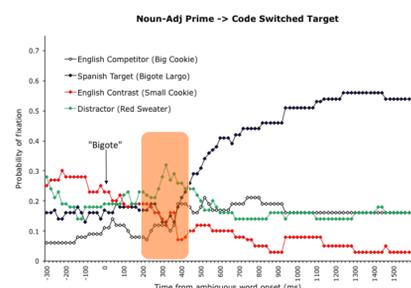
### Target (2 types)

Ambiguous

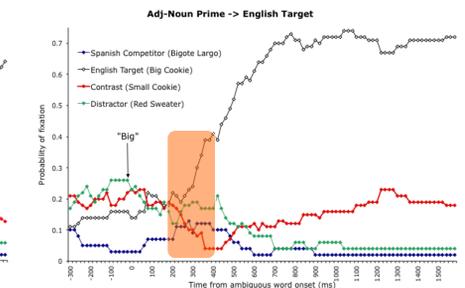
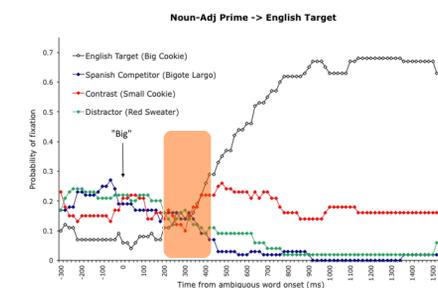
English AN: Click on the big cookie.

Code-switched NA: Click on the bigote largo.

### Code-switched NA targets: NA prime > AN prime



### English AN targets: AN prime > NA prime



## Conclusions / Future Directions and References

Results tentatively suggest priming independent of language-mixing => multilingual sentences are represented and processed similarly to unilingual sentences.

Need more subjects. Also, test using Spanish carrier phrases in a future experiment (*Haz click en el yellow apple*). Spanish-English bilinguals in the US are more likely to switch from Spanish to English rather than vice versa.

[1] Pickering, M.J. & Branigan, H.P. (1998). *Journal of Memory and Language*, 633-651. [2] Thothathiri, M. & Snedeker, J. (2008). *Journal of Memory and Language*, 188-213. [3] Pickering, M. J. & Ferreira, V. S. (2008). *Psychological Bulletin*, 427-459. [4] Weber, K. & Indefrey, P. (2009). *NeuroImaging*, 1164-1172. [5] Kootstra, et al. (2010). *Journal of Memory and Language*, 210-231.  
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